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OPERATIONS AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST--ETC(U)
JAN 80 D R BOGARD, T H HSU, R KIRKPATRICK F30602-78-C-0150

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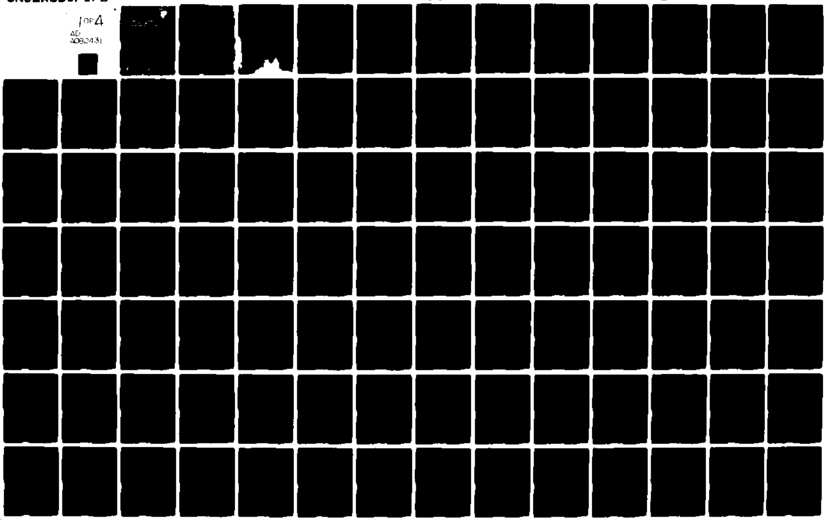

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Fifty-nine operations and support cost estimating relationships (CERs) and 20 guidelines have been developed for use early in the d[illegible]ment phase of Air Force electronic equipment pro[illegible] to estimate th[illegible] and support costs and ramifications associated [illegible]ous types [illegible] test subsystems. These CERs were developed th[illegible]cation o[illegible]t estimating and regression analysis techniqu[illegible] a lar[illegible]torical and experience data.

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The CERs require little knowledge of the testers or test subsystems in their application. Eighteen CERs require knowledge or estimating/predicting capability of only one independent variable; the remaining 41 require knowledge of only two independent variables. The 95% prediction confidence interval can also be calculated for each CER application.

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EVALUATION

1. The objective of this effort was to investigate and develop guidelines and relationships for use early in the development phase of Air Force electronic equipment programs to estimate the operation and support costs and ramifications associated with various types of testers and test subsystems.

2. The objectives have been satisfactorily achieved. Cost estimating relationships (CERs) and guidelines have been developed for use early in the development phase of Air Force electronic equipment programs to estimate the operation and support costs and ramifications associated with various types of testers and test subsystems. These CERs were developed utilizing a large sample of historical and experience data and require little knowledge of the testers or test subsystems in their application. The 95% prediction confidence interval can also be calculated for each CER application.

3. These CERs and guidelines when used early in the development of a weapon system can aid in determining the optimum cost mix of internal testing versus external testing for ground based electronic equipments.

JERRY F. LIPA, Jr
Project Engineer

0.0 SUMMARY

Introduction

In today's environment, the designs of major U.S. weapon systems are becoming ever more complex technologically. The real budget for U.S. weaponry has been decreasing in recent years while weapon system acquisition and ownership costs continue to escalate. Since ownership (operations and support) costs are increasing more rapidly than acquisition costs, various attempts are being made to identify operations and support (O&S) cost drivers in order to control and/or reduce these costs. One of the largest single cost elements is people costs. With more and more sophisticated, complex technology being introduced, higher skilled operators and maintainers are required. This, of course, introduces highly scarce resource requirements (skilled personnel) at commensurate higher costs.

One way to reduce/control costs, is by introducing more automation within the weapon itself by incorporating a built-in-test (BIT) and/or built-in-test equipment (BITE) capability. However, too much automation may not be cost effective, therefore, a designer must perform early tradeoffs to achieve the optimum combination and balance of automation versus manual testing and internal testing versus external testing.

In order to accomplish these tradeoffs, proper cost estimating tools must be developed and made available to the engineering designer. This study has addressed such a challenge by developing cost estimating relationships (CERs) and guidelines related to the annual recurring O&S cost characteristics of testers (external testing) and test subsystems (internal testing).

Approach

The general approach used for this study was to identify pertinent O&S cost parameters, to collect this data on appropriate existing and developing systems and to develop the annual recurring O&S costs for various typical testers and ground weapon test subsystems. Then, through the application of statistical techniques (regression analysis), CERs and guidelines were developed. These CERs and guidelines can be used, with very little known data, early in the development of a weapon system. With these tools the design engineer can determine the optimum-cost mix of internal testing versus external testing for ground based electronic equipments.

Results & Conclusions

There were 64 CERs developed for 6 tester categories. Each tester category represents a particular maintenance concept such as fault isolation to the module/circuit card assembly with an analog tester. There were also 9 CERs developed for estimating the O&S costs of ground systems test subsystems and 8 guidelines provided for the application of these CERs. In addition, 9 general guidelines were formulated for use during tester and test subsystem O&S cost estimating.

In developing the CERs and guidelines, the distribution of the O&S costs by the support element were identified. These cost findings are summarized in the table below.

TABLE 0. TESTER AND TEST SUBSYSTEM COST ELEMENT PERCENTAGE DISTRIBUTION

	% Cost Distribution					
	Testers			Test Subsystems		
		Hardware/Software			Hardware/Software	
Cost Element	Hardware Only	Low $ Software	High $ Software	Hardware Only	Low $ Software	High $ Software
1. Technical Data Maintenance	21	9	6	50	5	2
2. Attrition Training	7	3	2	42	5	2
3. Maintenance Labor	5	2	1	-	-	-
4. Maintenance Material	4	2	1	-	-	-
5. Calibration Labor	-	-	-	NA	NA	NA
6. Calibration Material	-	-	-	NA	NA	NA
7. Operations Labor	54	22	14	NA	NA	NA
8. Operations Space	-	-	-	NA	NA	NA
9. Replenishment Spares	9	4	2	8	1	-
10. Software Maintenance	NA	58	74	NA	89	96
	100	100	100	100	100	100

NOTE: - = Insignificant (<1%) costs
NA = Not Applicable Costs

This table shows 3 different columns of cost distributions for both testers and test subsystems. The tester distributions represent a composite of the six tester categories as identified in this study. These tester/test subsystems categories are further divided into a hardware only column, a hardware/software (low cost software) column and a hardware/software (high cost software) column. These columns represent the composite cost element percentage distribution for the 36 testers and test subsystems studied. Since historical software maintenance data is less accurate than the other cost elements shown in Table 0, a high and low annual recurring software maintenance cost figure was analyzed. The resultant percentage cost distribution for each category is shown in Table 0.

As this table clearly shows, software maintenance costs significantly dominate all other costs. This leads to the conclusion that a CER with software maintenance parameters as the independent variables would probably be the best predictive tool. In addition, software guidelines are probably the best O&S cost estimating aids used for both testers and test subsystems. These conclusions were verified by the results of this study, however, more research is necessary to more accurately quantify the software maintenance costs for testers.

The operations labor costs are the second largest costs for testers, followed by technical data maintenance, spares and training. For test subsystems, the second largest cost is technical data maintenance followed by training. Maintenance, calibration and operations cost are insignificant. For testers, without software cost considerations, the operator costs are the single largest cost, followed by technical data maintenance, spares and training. Since the number of operator/maintainers and the annual operating hours of testers are predictable as a function of the maintenance concept, reliability, physical characteristics and operating scenario of the supported system and since they are the most cost sensitive parameters, CERs containing these parameters are the most useful.

For test subsystems without software considerations, technical data maintenance and attrition training are the largest cost elements. CERs containing the annual operating hours, number of operator/maintainers and training course length are the most useful cost predictors.

Recommendations

Since software maintenance costs are the single most significant costs (58% to 96%) and will continue to dominate O&S costs of testers and test subsystems in the foreseeable future, it is recommended that a software data collection and reduction system be established. This data should be compiled in an existing data bank which is easily accessible in order to store and retrieve data on testers and test subsystems for ground based electronic systems.

It is further recommended that follow on studies be conducted. These studies should concentrate on the O&S software costs of testers and test subsystems. The results of these studies would either verify or be the basis for up dating the CERs and guidelines presented in this report by using the same or similar techniques used in this study. In addition, inclusion of the initial non-recurring O&S costs as well as further evaluation of the impact of automatic testers and test subsystems should be considered.

1.0 INTRODUCTION

1.1 BACKGROUND

Military weapon systems are becoming ever more technologically complex and expensive. In the face of rapidly rising costs, Department of Defense budgets remain relatively constant. Methods must, therefore, be continually sought to achieve the greatest possible capabilities for the dollars invested in mission equipment, support equipment and personnel. Skill levels within the military environment have not been able to match the trend of complex systems which is creating unacceptable operational availability and excessive annual support costs. As shown in Figure 1.1, logistic support costs now account for 55-65% of the total life cycle cost (LCC) and over half of that is attributable to manpower labor costs alone.

One of the solutions to these problems is to increase the test automation capability of a major weapon system and furthermore, to build in the testing capability as an integral part of the system design. However, presently there are very few predictive tools available to the designer which will allow him to perform intelligent tradeoffs. Although there exists several articles on the subject of automatic test equipment (ATE), built-in test (BIT) and built-in test equipment (BITE), as well as a few acquisition planning and design guides, these documents normally only address acquisition costs. Consequently, there is a need for more information on the logistic support cost characteristics of BIT/BITE (test subsystems) and external testers. That, in essence, is the objective and main thrust of this study.

1.2 OBJECTIVE

The specific objective of this study is to develop guidelines and relationships for use early in the development phase of an Air Force electronic equipment program to estimate the operation and support (O&S) costs and ramifications associated with various types of supporting testers and test subsystems.

1.3 APPROACH

To achieve the objective of this study, the following steps were taken: (1) the cost elements and related parameters which have an impact upon operation and support costs were identified, (2) existing in-house and Government data on a large number of systems, testers and test subsystems were collected to form a data base and

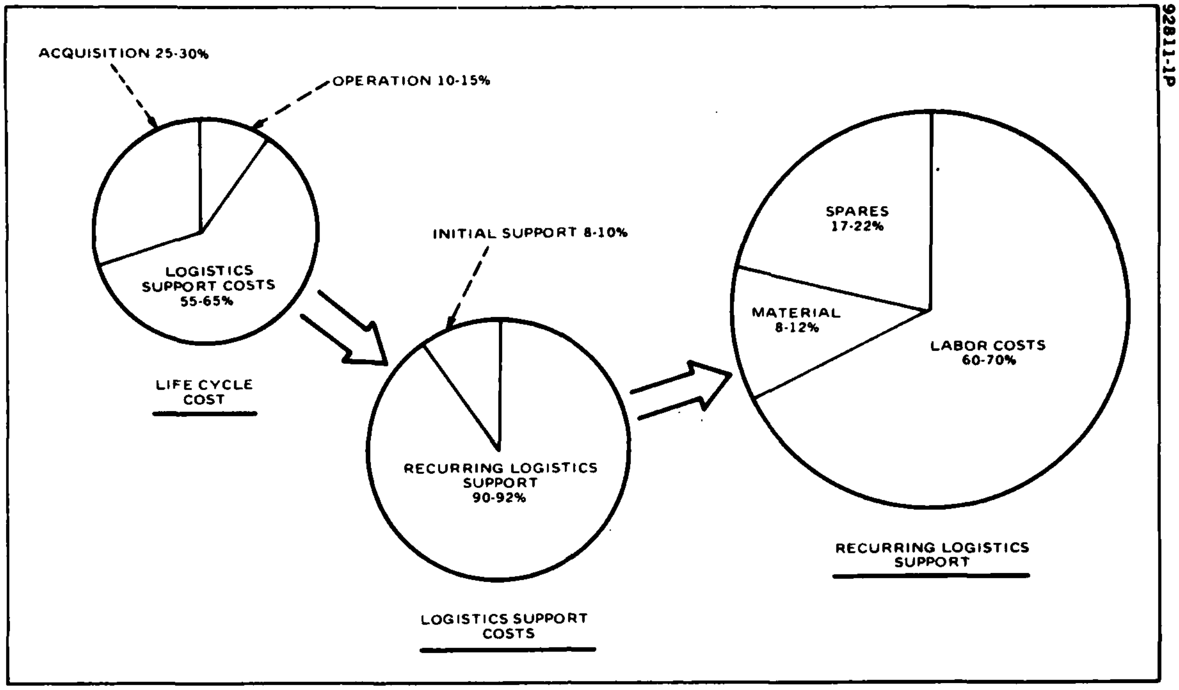

Figure 1.1. Life Cycle Cost/Logistic Support Costs and Recurring Logistics Support Costs Distribution.

from this, (3) cost estimating relationships and guidelines through regression analysis and other techniques were developed. The process, as described above, is shown graphically in Figure 1.2.

1.4 ORGANIZATION OF REPORT

This document is divided into six major sections. Section 1 provides the background, objective and approach. Section 2 presents a discussion of the data required, tables of data sources and candidate tester/test subsystems, a data collection and reduction discussion, and summary of these collected data. Section 3 describes the methods of data analyses, and the development of models, CERs and Guidelines. The results, conclusions and recommendations are presented in Sections 4, 5 and 6 respectively. Supporting data references and detailed analyses are also provided in the attached appendices.

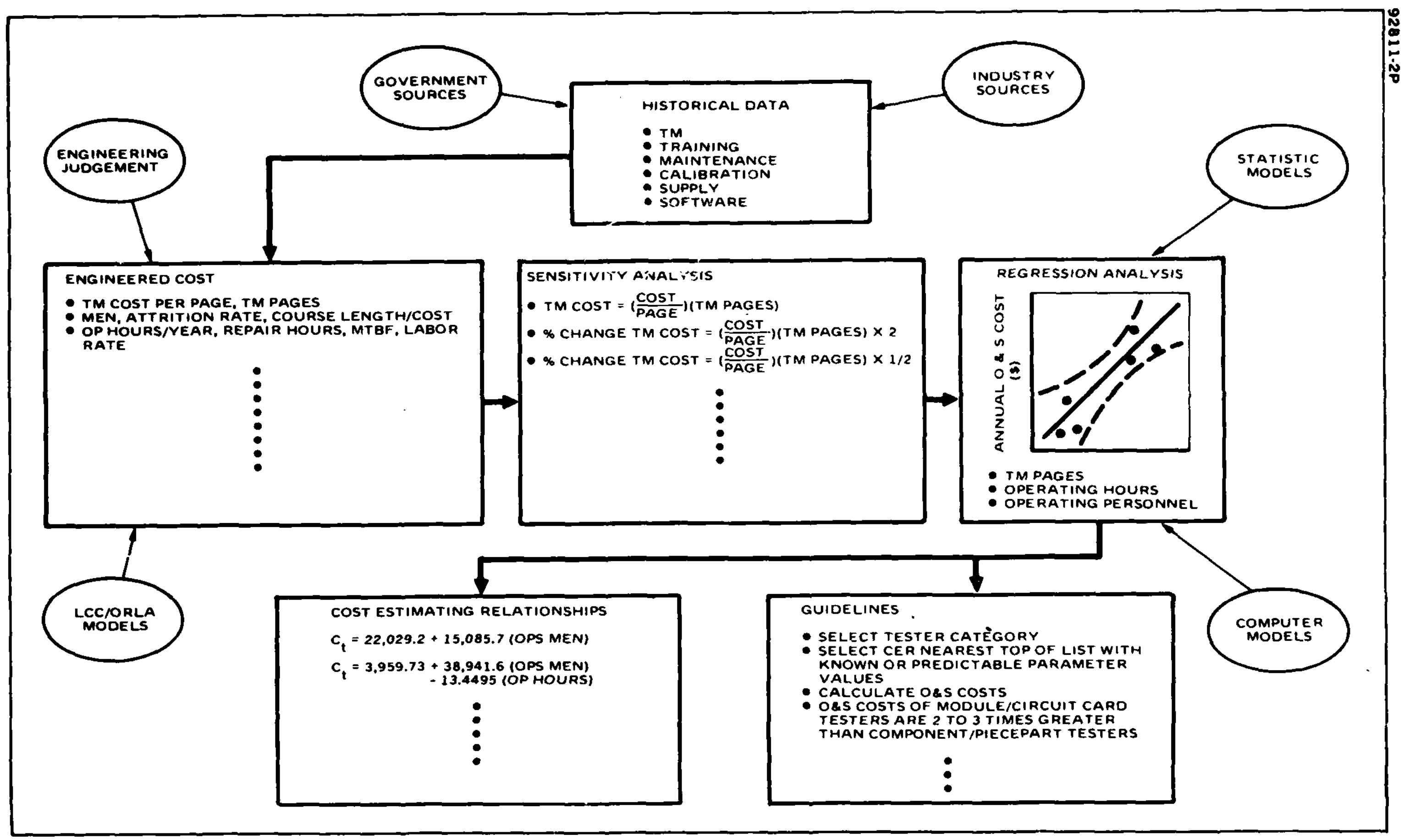

Figure 1.2. O & S Cost Characteristic Study Methodology

2.0 DATA BASE DEVELOPMENT

2.1 BACKGROUND

Life Cycle Costing (LCC) is a Department of Defense management concept that is applied to estimating costs during the acquisition and ownership phases of complete defense weapon systems. This concept has been applied for many years. Recently life cycle costing has been elevated to a prime consideration and requirement for all of the armed services. The main problem with LCC, particularly in estimating costs of undefined weapon systems, is the lack of an adequate data base for use in extrapolating the costs of emerging systems. Test equipment, formerly a lesser support item, has itself become a major cost item in acquisition as well as the operations and support of major systems. In 1973, the U.S. Navy conducted an automatic test equipment (ATE) data bank analysis.(13) As a result of this study, it was concluded that there was a need to establish an easily accessible library on automatic test equipment. There is little doubt that such a useful tool can be highly cost effective if enough systems and complete, accurate data are included.

In October of 1975, the Industry ad hoc Automatic Test Equipment Project for the Navy was formed.(1) This project was given a charter to investigate 13 key areas of technical and management concern, encompassing the broad spectrum of present and future disciplines required to effectively use automatic test systems. The 13 key areas include software, automatic test generation, design for testability, propulsion-electrical and auxilary systems monitoring, new technology, education-training and management, advanced ATE concepts, ATE acquisition planning guide, built-in-test design guide, ATE data banks, operational readiness monitoring systems, ATE interface and specifications review. Of these 13 key areas of investigation at least four are of interest to this study. These four are: (1) Software (2) ATE acquisition planning guide (3) built-in-test design guide and (4) ATE data banks.

The results of the Ad Hoc investigation were reported in April, 1977 (see reference 1). In summary, the investigation indicated the following for these 4 areas of interest:

(1) Software - ATE software has become a major contribution to the life-cycle cost of Naval weapon systems. A combination of the increased reliance on automated techniques, the explosive growth in digital and software technology and the wide spread inexperience in the management and control of software design and production has caused these increased costs. Software cost drivers

and their effect upon test program-set development and maintenance must be quantitatively identified and controlled. There is a need to standardize automatic-test-equipment software tools, techniques and interfaces. Thus the need for software data is apparent and must be collected and added to existing data banks.

(2) ATE acquisition planning guide - ATE can reduce testing time and lower technical skill requirements, thus reduce life cycle costs. Although an ATE acquisition planning guide presently exists, it should be expanded to apply to built-in-test as well as to stand-alone automatic test equipment. The guide is a step in the right direction, however, data collection on ATE is of paramount importance.

(3) Built-in-test design guide - The increasing complexity of electronic systems and the shortage of trained/skilled maintenance personnel have resulted in excessive repair times and costs. The use of built-in-test (BIT) tends to minimize this effect. BIT design features should be included in future procurements and BIT historical data should be collected, stored and made available for future analysis.

(4) ATE data banks - ATE data banks are urgently needed and should be established by a professional technical group charged with structuring the data bank, reviewing and interpreting user requests, interrogating the data bank, interpreting the output and responding to the user. The data bank should be a network of data banks that takes advantage of and builds upon existing data centers.

In 1978, the Industry Ad Hoc committee study task was further expanded to address Army, Navy, Air Force and Marine Corps concerns. The resulting study is entitled the "Industry/Joint Services Automatic Test Project." The Ad Hoc committee charter has been further expanded to include 4 more key areas including, "Calibration" and "Maintenance Planning Concepts" which are of particular interest to this study. The calibration task will explore the implication of calibration on ATE as well as on manual test equipment, calibration cycles, self-calibration, automatic calibration systems and self-test. Maintenance planning and concepts will review the planning of ATE support concepts, addressing levels of maintenance from organizational to depot/factory. Particularly stressed will be interfaces between levels of maintenance, development of maintenance concepts and alternative approaches to conventional support planning. These efforts indicate both the need for greater knowledge and the amount of interest which exists within the major weapon system testing area.

The results of the industry Ad Hoc committee studies further indicates the need of a comprehensive data base. Our study, as well as the Ad Hoc committee study, requires an extensive data base development effort. To meet the requirements of this study data were collected from the following sources:

(1) Hughes factory testers (11 testers used to test ground weapon system equipment in the factory).

(2) Hughes engineering testers (6 testers used to support various ground systems in the field) and

(3) United States Air Force testers (17 testers used to support Air Force systems in the field).

O&S type data, on BIT/BITE, were collected on various ground equipments such as mortar/artillery finding radar systems, air defense systems, shipboard radar systems, display systems and communications systems. This data includes a cross section of data from the various military services equipment including miscellaneous systems, Air Force ground systems, Navy ground systems and Army ground systems. Some of this data was complete and useable and much of the incomplete data identified and collected was of sufficient detail to apply engineering judgment in order to estimate various parameter values as necessary. Detailed information on the data base development is summarized in the next three sections.

2.2 COST ELEMENT IDENTIFICATION

The first step of selecting cost elements for Testers and Test Subsystems is to identify the operation and support cost elements which can be applied to them. This enables specific identification of what type data should be collected.
Based upon prior Life Cycle Cost (LCC) and other cost/economic analyses (e.g. Optimum Repair Level Analysis - ORLA) conducted for the U.S. Military services, a collection of operational LCC and ORLA models have been established at Hughes. Generally speaking, the LCC models address the total cost of a primary system throughout its lifetime, and this cost includes the costs associated with the research and development phase, the production phase and O&S phase. However,

the ORLA models only concern themselves with the O&S phase. The O&S cost elements which are normally considered significant are the initial logistic costs, recurring logistic costs, the operations cost and the maintenance cost.

In addition to system LCC models, there presently exists an LCC model that has been developed by the Air Force which is applicable to testers.[6] This model contains 6 sections of costs which are:

a. Section I - Acquisition Costs: The initial contract or agreed to price for delivery of a specific ATE item of hardware and required companion items.

b. Section II - Initial Logistics Costs: One-time identifiable cost elements accruing to the ATE item upon introduction into the Air Force inventory.

c. Section III - Recurring Logistics Costs: Cost accrued by the Air Force incident to logistics management throughout the life cycle of the ATE item.

d. Section IV - Operation Costs: Direct and indirect costs accrued by the Air Force incident to operation throughout the life cycle of the ATE item.

e. Section V - Maintenance Costs: Scheduled and unscheduled maintenance costs accrued by the Air Force throughout the life cycle of the ATE item.

f. Section VI - Post-Production Modification Costs: Costs of modifying the ATE, its associated software, and UUT test programs, required after the production contract is closed.

Due to its applicability and appropriateness, one of the models developed for this study is patterned after the Air Force ATE LCC model. The specific cost elements utilized in this study include only the costs found under Sections III, IV, V and VI of this model. Sections I and II are initial costs and are not considered applicable for this study. Sections III, IV, V and VI are the annual recurring O&S costs which have been collected for this study. These costs have been broken down further into their subcosts which include technical manual revisions/updates, attrition training, maintenance labor and materials, calibration labor and materials, operator manpower, operational/maintenance facility space and software modification/maintenance as shown in Figure 2.1. Each of these cost categories is broken down further into the constant and variable parameters for which the data were collected. These parameters are described in more detail in Table 1.

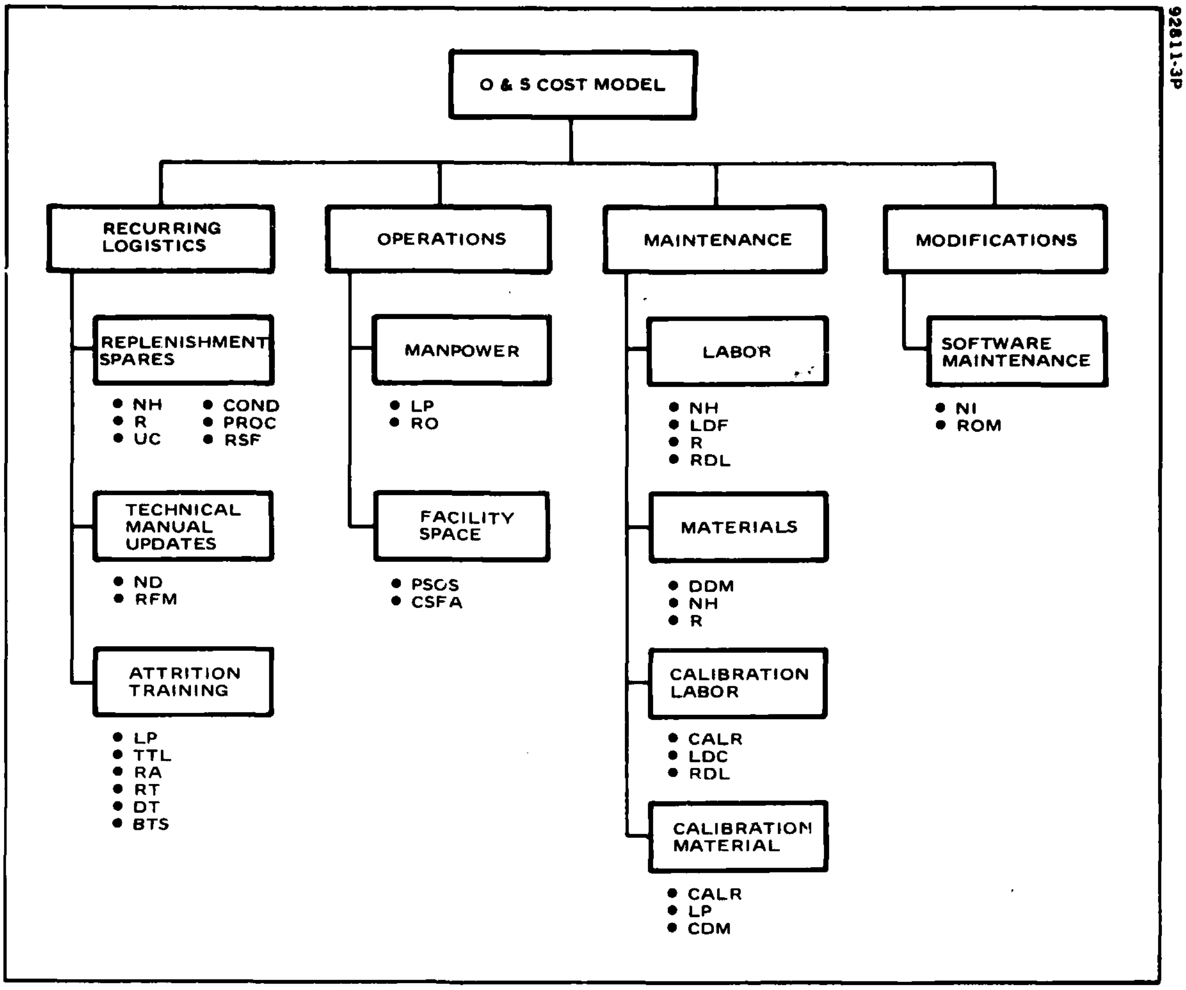

Figure 2.1. O & S Model for Testers and Test Subsystems

TABLE 1. O&S COST CATEGORY BREAKDOWN FOR TESTERS/TEST SUBSYSTEMS

Cost Category	Variable Parameter	Constant Parameter
1. Technical Manual Revisions/Update	ND = Average number of technical manuals (TM) pages	RFM = Average annual cost per page of TM maintenance
2. Attrition Training	LP = Required manning level for maintenance/operator personnel TTL = Average number of weeks per student for training per item	RA = Attrition rate of maintenance operator personnel RT = Average weekly student pay and allowance rate during the training course

TABLE 1. O&S COST CATEGORY BREAKDOWNFOR TESTERS/TEST SUBSYSTEMS (Continued)

Cost Category	Variable Parameter	Constant Parameter
2. Attrition Training (Continued)		DT = Cost to government per man/week for conducting training course (all but student cost) BTS = Student travel cost
3. Maintenance Labor	NH = Operating hours per year LDR = Labor time standard to repair the item R = Mean time between failures	RDL = Average labor rate to repair failed item
4. Maintenance Material	DDM = Average material cost NH = See #3 R =	
5. Calibration Labor	CALR = Average number of days between calibration actions LDC = Average time to calibrate	RDL = See #3
6. Calibration Material	CDM = Average cost of materials consumed per calibration CALR = See #5	
7. Operations Personnel	LP = See #2	RO = Average annual cost for operations personnel
8. Operations Facility Space	PSOS = Floor space required for operations	CSFAS = Annual cost for the item operational floor space
9. Replenishment Spares	UC = Unit recorder Cost PROC = System procurement cost NH = See #3 R =	COND = Fraction of items which are condemned RSF = Replenishment spares factor
10. Software Maintenance	NI = Average number of BIT/diagnostic instructions (lines of code)	ROM = Average annual cost per instruction of program maintenance

From the foregoing cost breakdown structure the complete set of data cost elements required for this analysis was derived and is shown summarized in Table 2.

2.3 DATA SOURCES

Development of an extensive data base was essential to this study. In doing so, one must first identify the data sources, and then collect the data which have been identified.

In the process of identifying the data sources, from which useable data could be collected, reduced and analyzed, an order of priority of selection was applied. As a first priority, sources of well documented data on the same or same type of system being analyzed were chosen. As a second priority, data received from a closely similar system were considered. The next priority included data collected or collectable from systems in general. Last in the order of priority was data collected from expert personnel experienced on the same or similar systems. The later choice was, in fact, preferential in situations where there was little or no prior "objective" cost data available. In this situation, the "subjective" or "personalistic" interpretation of predictive estimates is the only viable way to quantify the unknown variables.

Over 100 military, manufacturing and contractor representatives were contacted to establish possible cost element data sources of Testers/Test Subsystems.

The Government agencies, the Hughes Aircraft Company organizations and commercial companies which were contacted during the course of the study are presented in Table 3. Only one Government agency was able to supply applicable historical data for this study, namely, San Antonio Air Logistics Center (SA-ALC).

2.4 DATA COLLECTION AND REDUCTION

Data were collected on the selected Testers and Test Subsystems in seven general categories:

(1) Technical Data Maintenance

(2) Training

(3) Maintenance

TABLE 2. TABLE OF INPUT DATA REQUIRED FOR O&S COSTS OF TESTER/ TEST SUBSYSTEM CHARACTERISTICS ANALYSIS

PARAMETER	DESCRIPTION	DIMENSIONS	VALUE
CONSTANTS			
1. BTS	Student Travel Cost	$/Student	____
2. COND	Condemnation Rate	Fraction	____
3. CSFAS	Cost of Item Floor Space	$/Sq Feet	____
4. DT	Student Wkly Cost	$/Student/Wk	____
5. RA	Oper/Maint Personnel Turnover Factor	Fraction	____
6. RDL	Hourly Cost of Maint Labor	$/Hour	____
7. RFM	Rate for Maint of TM	$/Page	____
8. RO	Cost of Operators	$/Man	____
9. ROM	Rate for Maint of Software	$/Instruction	____
10. RT	Wkly Student Pay & Allowance	$/Student/Wk	____
11. RSF	Replenishment Spare Factor	Fraction/Year	____
VARIABLES			
1. CALR	Mean Time Between Calibrations	Days	____
2. CDM	Material Cost for Calibration	$	____
3. DDM	Material Cost for Repair	$	____
4. LDC	Time Per Calibration	Hours	____
5. LDR	Labor Time for Repair	Hours	____
6. LP	Annual No. of Oper/Maint	Men/Year	____
7. ND	Annual No. of TM Pages	Pages/Year	____
8. NH	Annual Operating Hours	Hours/Year	____
9. NI	Annual No. of BIT Instr.	Instr/Year	____
10. PROC	System Procurement Cost	$	____
11. PSOS	Annual Operational Floor Space	Sq Feet/Year	____
12. R	Mean Time Between Failure	Hours	____
13. TTL	Length of Training Course	Weeks	____
14. UC	Unit Reorder Cost	$/Item	____

TABL[illegible] . POTENTIAL DATA SOURCES FOR O&S COSTS OF TESTERS/ TEST SUBSYSTEMS

GOVERNMENT AGENCIES	HUGHES AIRCRAFT CO.	COMMERCIAL COMPANIES
1. San Antonio Air Logistics Center (SA-ALC)	Ground Systems Group, Fullerton, California (19 different depts.)	Hewlett Packard Fullerton, Calif.
2. Space and Missile Systems Organization (SAMSO)	Missile Systems Group Canoga Park, Calif. (4 different depts.)	Hewlett Packard Palo Alto, Calif.
3. Sacramento Air Logistics Center (SALC)	Aerospace Groups Culver City, Calif. (3 different depts.)	Lockheed Sunnyvale, Calif.
4. NAVSEC - Washington	Space and Communications Group Los Angeles, Calif. (2 different depts.)	GIDEP - Norco, Calif.
5. NAVSEC - NORDIV		DAVEX - San Diego, Calif.
6. NAVSHIP ENG CENTER Mare Island		
7. Newark AF Station, Ohio		
8. Naval Ocean System Center (NOSC), San Diego, Calif.		
9. Naval Air Engineering Center (NAEC) New Jersey		
10. Naval Ships Parts Control Center		
11. National Aeronautics & Space Administration - Scientific & Technical Information Division		
12. Defense Documentation Center		
13. Defense Logistics Studies Information Exchange (DLSIE)		

NOTE: From these contacts, a list of candidate Testers and Test Subsystems was established for this study. Table A1 in Appendix A, provides more detailed information about these 141 testers. Table A2 in Appendix A presents 24 candidate systems for the BIT/BITE portion of the study.

(4) Calibration

(5) Operations

(6) Supply Support

(7) Software Maintenance

These are the most appropriate categories and data elements for data collection from past experience, that have proven to be the major cost drivers of a prime system and the Testers and Test Subsystems are just two subsets of a prime system.

A literature search was conducted and a total of 1133 papers were screened. These articles can be categorized as shown in Table 4. As the table shows, there was a yield of about 6 articles in every 100 screened that contained useful data.

TABLE 4. ARTICLES RESEARCHED FOR THE TESTER/ TEST SUBSYSTEM O&S STUDY

Subject	Quantities	
	Researched	Utilized
1. Model • Life Cycle Cost • R/M Predictions • O&S Costs	360	10
2. Data Banks, Data Base	154	7
3. Tester/Test Subsystems	401	6
4. LCC of Tester/ Test Subsystem	26	7
5. Automatic Test Equipment	112	38
TOTALS	1133	68

The data sources included the National Aeronautics and Space Administration - Scientific and Technical Information Division, Defense Documentation Center, Defense Logistics Studies Information Exchange and the Hughes Aircraft Company Technical Library. These papers provided some background information of Tester/ Test Subsystems which could be incorporated into the data base for this study.

The information collected includes historical data on mean time between failures, mean time to repair, etc., engineering judgement and experience data (e.g., shop space requirement for each tester) and government/industry cost standards (e.g., labor rate, cost per page, course cost). Furthermore, additional information, which were not listed in the table in Section 2.2, but was required to predict required data (e.g., physical dimensions used to predict operational/maintenance space) were also collected. A summary of these data is included in section 2.5 and the complete data file is contained in Appendix A.

2.5 DATA SUMMARY

The following discussion summarizes the data collected and used. Only the data that was used in the analysis is included in this report.

2.5.1 Training Student Costs

Using the data obtained from the Training Section at SA-ALC on four Automatic Testers, the Hughes training department estimated the average costs of training military personnel on electronic/electromechanical equipment.

Hughes training department personnel determined that the average cost to train each military student in operation and maintenance of this type of equipment, assuming each student has received the service basic electronic courses previously, was $1,000.00 per week per man. The Hughes training department also assisted in estimating the number of personnel, operators/maintainers, required to man a tester for the average hours of usage per year.

The same method was used to develop test subsystem estimates.

2.5.2 Training Personnel/Course Length

The time to train both operator and maintenance personnel on the Hughes manufacturing testers and test subsystems was calculated by Hughes engineering supervisory personnel directly responsible for the planning and conduct of the operating and maintenance courses of that system or similar systems. The course length estimates include the time of the person being trained on the operations and support of these testers/test subsystems only.

The number of personnel to be trained for other testers and the test subsystem maintenance and operations is simply a count of the required operators/maintainers for each system.

2.5.3 Training Cost Allowances

The program training cost allowances for military personnel are calculated based on the following information supplied by SAMSO and/or by the Hughes travel department. It was assumed that each individual would be trained at the company that manufactured the tester and that this company was located in the Southern California area. The test subsystem training is likewise assumed to be in Southern California and therefore is the same as for tester training.

a. Per diem – \$50.00/day/man
b. Air Fare – \$250.00 average round trip.
c. Electronic Technician Skill Level (E5) – \$18,000/year (see paragraph 2.5.5)

Therefore, the weekly pay and allowance for students is:

$$\frac{\$18{,}000/\text{man-yr}}{52\ \text{wks/yr}} + 7\ \frac{\text{dys}}{\text{wk}}\ (\$50/\text{man-dy}) = \$695/\text{man-wk}$$

The attrition training of operators/maintainers is directly related to the military personnel attrition rate. Although, various sources indicate that attrition rates of 13% to 40% exist within the military services, the value of 33% was chosen for this study.[16] This value was based upon data provided by the Naval Weapons Engineering Support Activity, and used by Hughes for a Level of Repair Analysis on a set of tactical display equipments.

2.5.4 Technical Publications

The information on technical publications for the military testers was obtained from the technical library at SA-ALC. An actual page count, section by section, was obtained to determine the total numbers of pages in each technical manual (T.M.). The total cost of technical publications was determined by using this page count and an average annual maintenance cost per page of $6.20 (Technical publications cost = number of pages x cost/page). The average maintenance cost per page of $6.20 was derived by the Hughes technical publication department based on prior experience and historical data.(15) The $6.20 includes a revision rate of 10% per year.

The Hughes manufacturing tester operators use procedures generated by test engineers on each tester. Maintenance personnel work with Hughes drawings; i.e., schematics, wire lists, etc., when troubleshooting the tester. From this information a technical manual page count estimate was made for the Hughes testers.

The pages dedicated to BIT/BITE of the prime system candidates were estimated or counted and used to calculate T.M. maintenance costs for the test subsystem.

2.5.5 Personnel Pay

Pay for operators and maintainers was based on the average billet cost per year. This data was taken from the Department of Navy, Annual Billet Cost Summary.(18) Pay for operator and maintainers from this document was escalated to 1979 dollars. The typical operator/maintainer was assumed to be an electronic technician grade E-5. The calculation follows:

ETN (E5) 1977 Annual Billet Cost = $15,730 allowing for 7%/year escalation,
$\$15{,}730/\text{yr} \times (1.07)^2 = \$18{,}000/\text{yr}$

2.5.6 Repair Labor

All levels of repair labor, organizational, intermediate and depot, are listed as average repair times per failure for each tester and test subsystem. Time spent by maintenance personnel when an actual failure did not occur; i.e., false alarms, were not considered as this information was not available on military testers. The subject of false alarms is covered further in Appendix A (Page A-35) of this report.

$16.75 was used for the average maintenance repair labor rate. This was based on data provided by Naval Weapons Engineering Support Activity, for a Level of Repair Analysis on a set of tactical display equipments.

2.5.7 Repair Material

Cost of materials to repair is listed as an average for the Hughes manufacturing testers, and only covers cost of materials when repairing; material cost during test calibration of the Hughes testers is listed separately. No data on the cost of materials consumed during repair and/or calibration of military testers was available. The cost of materials consumed per repair for the BITE assemblies was derived by taking 5 to 8% of their respective unit cost,[16] or applying engineering judgement based on the technology and packaging of the items.

2.5.8 Scheduled Maintenance

Scheduled maintenance hours are listed for all military testers from data obtained at the ATE data bank at SA-ALC. For the Hughes manufacturing testers, the only scheduled action is scheduled calibration time and that time is shown in the Labor Time per Calibration (LDC) column. Therefore, the times shown in the LDC column, page A-29, on the Hughes testers include both scheduled and unscheduled times.

2.5.9 Space Cost

The floor space requirements on the military, Hughes manufacturing, and other testers have been estimated by allocating four times the area of the actual tester space. For example: if a tester measures 50 inches deep and 100 inches wide (5000 square inches or 34.7 square feet), the additional area required to allow access to the tester for both operation and maintenance, is 20,000 square inches (139 square feet) for a total requirement of 25,000 square inches (173.7 square feet).

The need for the additional square footage is to assure that tester racks can be pulled out, that adequate space exists for maintenance testers (test equipment), test equipment carts, and that personnel work space is adequate. The cost figure of $3.00 per square foot per year, used for space cost requirements, was taken from the Navy LORA data as referenced in paragraph 2.5.6.

Space cost is not applicable to the test subsystems.

2.5.10 Mean Time Between Failures (MTBF)

The MTBF for each tester was taken from information on military testers obtained at SA-ALC. For the Hughes manufacturing testers MTBF information was obtained from the tester maintenance section, from the operator/maintainers and from best engineering estimates. The other tester/test subsystem MTBF data were obtained from the Hughes reliability/maintainability data bank and/or engineering estimates/predictions.

$$\text{Mean Time Between Failure} = \frac{\text{Operating Hours/Year}}{\text{Number of Failures/Year}}$$

2.5.11 Labor Time for Calibration/Mean Time Between Calibration

On all Hughes manufacturing testers, the company calibration department maintains complete files on every calibratable tester item. This data was reduced to obtain the average time to perform a complete tester calibration as well as the time between calibrations. The average time to calibrate includes scheduled and unscheduled actions.

Calibration times for testers in the military inventory and the test subsystems under analysis were not available.

2.5.12 Operating Hours Per Day

The operating base information on the military deployed testers was obtained from the files of the ATE data bank at SA-ALC. Operating hours on the Hughes manufacturing testers were estimated by the engineering supervisory personnel as to actual daily usage. All other tester operating hours were best engineering estimates based on anticipated usage by the military user to cover the number of deployed systems.

The operating hours for the test subsystems were derived from operational scenarios provided by the Government.

2.5.13 Replenishment Spares

In most cases, no specific figure for the spare costs, initial or sustaining, could be found for the testers. The Hughes provisioning engineering department estimates that historically the annual replenishment spares cost is equal to 1% to 3% of the unit procurement cost.

A LCC study by the U.S. Navy, and the current Satellite Communication Links Terminal (AN/MSC-46) depot experience, indicates that replenishment spares average 1.5% of unit procurement cost. Therefore, 1.5% was used for this study to estimate annual spares replenishment costs. All procurement costs were adjusted to 1979 costs.

The test subsystem annual replenishment spares cost was based upon a standard condemnation rate and the weighted unit reorder cost of the BITE cards. A condemnation rate of 10% was used. The 10% is based on U.S. Navy and the Hughes AN/MSC-46 depot experience.

2.5.14 Cost of Parts Used During Calibration

This data was also obtained on the Hughes manufacturing testers from the data files maintained by the Hughes calibration department. The collected data are shown in Appendix A.

Parts costs during calibration of military testers were not available.

2.5.15 Software Maintenance

This data was not available in sufficient detail for the tester analysis, however, software data was collected for the test subsystems under analysis. A change rate of 50% per year was applied to the BIT/diagnostic software instructions. This could vary as much as 5% to 70% per year (see Appendix A Page A-36 for a more detailed discussion). The modification cost per line of code used in this study was $75 per line based on Hughes experience and on several other sources as discussed in detail in Appendix A.

3.0 DATA ANALYSIS

3.1 BACKGROUND

Data on a relatively large sample of different testers and test subsystems have been collected during the period covered by this contract. These data have been categorized, as stated in Section 2.2, into the following:

1. Technical Data Maintenance
2. Attrition Training
3. Maintenance (labor, materials)
4. Calibration (labor, materials)
5. Operations (personnel, facility space)
6. Replenishment Spares
7. Software Maintenance

In order to account for maintenance types and concepts, the data for the testers were further categorized by circuit type and level of fault isolation. These six categories are:

1. Analog circuit testers with fault isolation to a module/card
2. Analog circuit testers with fault isolation to a component
3. Digital circuit testers with fault isolation to a module/card
4. Digital circuit testers with fault isolation to a component
5. Hybrid circuit testers with fault isolation to a module/card
6. Hybrid circuit testers with fault isolation to a component.

As discussed previously, the analysis of the basic data took place in two steps. First, the data for each tester/test subsystem was applied to cost estimating relationships to generate their annual O&S cost; then a statistical analysis was performed on the basic data and the calculated O&S costs to yield a series of cost estimating relationships (CERs) which can be used early in the development phase of a program for estimating O&S costs. Guidelines were then developed for use, in conjunction with these CERs, in estimating the ramifications of utilizing various types of testers and test subsystems.

Sections 3.2 through 3.6 present the following material: Section 3.2 discusses three methods of analysis, two of which are selected for this study and discussed further in Section 3.3. In Section 3.4, the details of the math models and computer models developed and utilized for this study are presented followed by tester/test subsystem CER development examples in Section 3.5. The results of a sensitivity analysis are presented and discussed in Section 3.6.

3.2 METHODS OF DATA ANALYSIS

Estimates of element costs can be obtained through several techniques. One of the most common techniques is through the application of CER. A CER is an analytic device that relates the value (in dollars or physical units) of various cost categories to the cost-generating or explanatory variables associated with the categories.[36] Although there are several major types of cost estimating techniques, two of the more common and appropriate techniques were applied to this study. The two techniques or methods employed in this study are called engineered (an engineering approach) and parametric (a statistical approach). The parametric method is sometimes referred to as "top down" estimating while the engineered technique is referred to as "bottoms up" or the grass roots estimating approach.

3.2.1 Engineering Approach

The engineered cost estimating relationships are based on deterministic as opposed to statistical equations.[37] An engineered cost estimating equation for a given cost element is derived by subdividing the cost elements into finer categories or factors. An example of subdividing the cost elements into finer categories is discussed and shown in Section 2.2 and Figure 2.1. The finer categories are related through cost equations which reflect the way the categories interact to produce the element cost. The resulting equation predicts the logical cause and effect relationships that exist within the actual environment. The element cost of the system or equipment of interest can be computed by substituting the names of the variables into the desired equation.

3.2.2 Statistical Approaches

3.2.2.1 Stochastic Approximation (See references 46 through 51)

One statistical approach is called "stochastic approximation." This analysis approach is more recent than other standard statistical techniques such as regression analysis and is not as well known. However, the approach merits consideration. Because stochastic approximation is primarily documented as a method of classification rather than estimation, it is more difficult to implement. However, it can be used for approximation, as is regression. The main advantage of stochastic approximation is that it allows the choice of a loss function. The sample data obtained for this study is such that no reasonable relationships will be exact. Hence, any estimate is subject to some error. A loss function determines the "penalty" for being wrong. For example if it were a more serious error to overestimate cost than to underestimate cost, the loss function might double the error for overestimates while the error for underestimates are unchanged. Stochastic approximation then provides a system for minimizing the losses described by the loss function.

3.2.2.2 Regression Analysis

Another statistical approach is the regression analysis technique used to develop parametric cost estimating relationships. A parametric or statistical cost estimating relationship can be derived to apply to new equipment not yet in operational use providing historical data from prior systems/equipments that are functionally similar exists. These parametric cost estimating relationships take the form of mathematical equations that can be derived through curve fitting techniques applied to the historical cost and physical parameter data. Linear, multiple linear, curvilinear, logarithmic, or exponential regressions are the most commonly applied curve fitting techniques. After a parametric relationship has been derived, it can be used to predict the costs associated with a new system by direct substitution into the equation of the cost, and physical parameter data of the new system. These parameters are sometimes referred to as independent or predictor variables. It should be noted that in certain cases, boundary conditions play an important role in the application of these parametric cost estimating relationships. It is not unusual to require that the independent variable values stay within specific ranges for the relationships to hold true.

The availability and validity of historical data are major concerns in the derivation of the parametric cost estimating relationships. Typically, historical data are not readily available. When they are available, they are available only within differing work breakdown or accounting structures. Also, there can be various inconsistencies and irregularities within the data itself and this must be resolved in order to ensure a reasonably consistent and comparable set of data. However, if there are little or no data (including expert experience on similar systems), there is no sophisticated mathematical technique that can make up this deficiency.

There usually is a degree of statistical uncertainty associated with the application and utilization of statistically derived cost estimating relationships. The statistical measures pertaining to the regression equations used to derive the parametric cost estimating relationship will aid in estimating this uncertainty. Examples of these statistical measures are:[38]

1. The standard error of estimate (close to zero, indicates a good estimator)
2. The mean and standard deviation of independent variables
3. The relative standard error of estimate
4. The variance-covariance matrix
5. The standard errors of the regression coefficients
6. The T-Ratio
7. The Beta coefficients
8. The upper and lower limit (95%) confidence interval
9. The equation for the standard error of forecast (95% confidence interval)
10. The test of hypothesis
11. The coefficient of multiple determination
12. The residual value
13. The coefficient of multiple correlation.

Care must be taken in the application of a parametric cost estimating relationship to a new weapon system or equipment for which it might not apply. The ground electronics equipment of the future may not follow the parametric relationships derived from the past. The cost estimating relationship should be only the starting point in the estimating process. The first cost estimate will then have to be modified in the light of supplementary qualitative and quantitative data to fit the weapon system or equipment at hand.

In summary, parametric cost estimating relationships provide a means of extrapolating from past experience to estimate the costs of future systems and equipment. They do not provide exact solution unless detailed records have been maintained. The analyst must correctly interpret the basis for their derivation and the uncertainty about the results if an accurate estimation of costs is to be made.

3.3 SELECTED METHOD

Since the various required O&S costs, previously identified, are not normally recorded directly for either testers or test subsystems, these costs had to be estimated using the engineered estimating technique. That is, the cost element data, as shown in Figure 2.1, were collected against each of the tester and test subsystem candidates previously identified. These subdivided cost elements were then combined according to the model CER, discussed in the next section, in order to estimate their actual total O&S costs. These costs were then subjected to statistical analyses using regression analysis techniques. The regression analysis technique was chosen over the stochastic approximation technique for this study due to the risk and uncertainties involved in applying a relatively new technique to a short duration program.

The regression analysis was performed by fitting a curve to the various plots of cost as a function of each of the O&S variables until a best fit was determined, thereby developing the CER or set of CER. See Figure 1.2 for a graphic presentation of the entire process.

3.4 ESTIMATION MODELS

The models used for the O&S cost study are the O&S cost model shown in Figure 2.1, a statistical prediction 95% confidence level model, and a simple multiple linear regression model. These models are discussed in detail in the following paragraphs.

3.4.1 Engineered O&S Cost Model

The Engineered O&S cost model is represented mathematically as:*

$$C = \sum_{i=1}^{10} C_i$$

where a discussion of the C_i ($i = 1,2,3, \ldots, 10$) follows.

*All the parameters shown in the following pages are defined in detail in Section 2.2

The annual cost of technical data maintenance, C_1, is the cost associated with generating and incorporating changes to present technical data and replacing worn out manuals. The cost can be approximated by:

$$C_1 = ND \cdot RFM$$

$$(\$/\text{year}) = (\text{pages/year}) \cdot (\$/\text{page})$$

The annual cost of attrition training, C_2, includes pay and allowances, course fees and material costs, and transportation to and from the training site. These parameters are related as follows:

$$C_2 = LP \cdot RA \cdot (TTL \cdot (RT + DT) + BTS)$$

$$(\$/\text{year}) = (\text{men/year}) \cdot (\text{fraction}) \cdot (\text{weeks}) \cdot ((\$/\text{man-week}) + (\$/\text{man-week})) + (\$/\text{man}))$$

The annual cost of maintenance is divided into two cost elements. The first is maintenance labor, C_3, which includes all maintenance labor costs related as follows:

$$C_3 = NH \cdot LDR \cdot RDL/R$$

$$(\$/\text{year}) = (\text{hours/year}) \cdot (\text{hours}) \cdot (\$/\text{hour}) \cdot (1/\text{hours})$$

Maintenance repair materials, C_4, includes the annual cost of all repair materials related to the labor of C_3 as follows:

$$C_4 = NH \cdot DDM/R$$

$$(\$/\text{year}) = (\text{hours/year}) \cdot (\$) \cdot (1/\text{hours})$$

Calibration labor, C_5, is the annual cost based upon the actual time spent on calibration plus the time spent correcting failures detected during calibration. The corrective maintenance labor included in C_5 is necessitated by the way that data is collected and in no way represents double counting of costs. The relationship of these parameters are:

$$C_5 = 365 \cdot LDC \cdot RDL/CALR$$

$$(\$/\text{year}) = (\text{days/year}) \cdot (\text{hours}) \cdot (\$/\text{hour}) \cdot (1/\text{days})$$

Under normal circumstances, calibration does not require any materials. However, the data collected for calibration includes repair of failures detected during calibration. Thus, the annual cost of calibration materials, C_6, exists as follows:

$$C_6 = 365 \cdot CDM/CALR$$

$$(\$/year) = (days/year) \cdot (\$) \cdot (1/days)$$

Operator personnel, C_7, annual costs are calculated on the assumption that the operator is dedicated to just one tester in the following way:

$$C_7 = LP \cdot RO$$

$$(\$/year) = (men/year) \cdot (\$/men)$$

The annual cost of operating facilities space, C_8, allows for the space required by the tester plus enough additional space for access to the tester for maintenance and is estimated by:

$$C_8 = PSOS \cdot CSFAS$$

$$(\$/year) = (feet^2/year) \cdot (\$/feet^2)$$

The operations personnel and facilities space costs are not required for the test subsystem analysis since these costs are accounted for by the prime weapon system costs.

Replenishment Spares, C_9, is the annual cost of replacing the spared items of a system. The system being a tester or a weapon system (considering only the BITE spare items). The spares replenishment is the annual replacement of initially spared items which have been discarded on failure, damaged beyond repair and/or lost. This cost is estimated for Test Subsystems (BITE assemblies) by:

$$C_9 = NH \cdot UC \cdot COND/R$$

$$(\$/year) = (hours/year) \cdot (\$) \cdot (Fraction) \cdot (1/hours)$$

or for Testers by:

$$C_9 = RSF \cdot PROC$$

$$(\$/year) = (Fraction/year) \cdot (\$)$$

Software Maintenance, C_{10}, represents the annual cost expenditure resulting from inherent software error corrections and future change requirements. The cost is calculated as follows:

$$C_{10} = NI \cdot ROM$$

$$(\$/year) = (instructions/year) \cdot (\$/instruction)$$

3.4.2 Statistical Analysis Model

The statistical method of analysis which has been employed for the development of O&S CERs is that of multiple linear regression. The regression analysis uses a least squares estimate. The theory of regression analysis is discussed thoroughly in the literature (references 38 through 40). This is basically a loss function utilizing the square cf the error. To obtain the best results possible using regression analysis, a multiple linear regression is considered. The term "linear" is a misnomer in that nonlinearities can be introduced prior to the analysis, i.e. using 1/R as a linear factor makes R a nonlinear factor. Multiple linear regression allows for more than one independent variable.

Ideally the O&S cost of a tester/test subsystem would be expressed as a function of some known parameter or parameters. Acknowledging that an exact relationship of a reasonable form does not exist and that no loss function better than a squared error loss function exists, multiple linear regression has been chosen for use. The regression analysis was approached in an iterative manner. For every tester/test subsystem the dependent variable is the calculated annual O&S cost. A linear regression is performed using each input variable, one at a time, as the independent variable. The best or most promising variable(s) determined from this analysis are then paired with other variables. The closer the correlation coefficient, R^2, is to 100%, the more closely the regression line fits the sample points. Consequently the resultant CERs, which are functions of one or more variables, are ranked according to their correlation coefficients. The CERs will be of the form

$$C = a_o + a_1 X_1$$

or

$$C = a_o + a_1 X_1 + a_2 X_2$$

where a_o, a_1, a_2 are constants resulting from the regression analysis and X_1, X_2 are independent variables.

The generation of CERs is purely theoretical and does not consider applicability or utility. Since the applicability of a CER and its utility are as important as the CER itself, these properties will be discussed with the CERs as guidelines for the use of the individual CERs.

3.4.3 Computer Models

Three computer models were developed for this analysis. One model was written to handle the mathematical calculations required to estimate the O&S costs and to perform the sensitivity analysis on each input variable for each tester/test subsystem. This model is called the Engineered O&S Cost Model. Another computer program was developed for this study by modifying an existing multiple linear regression model. This model was developed for use on the Hughes HP3000 minicomputer system, interactively input through a keyboard/display terminal. The program calculates the least-squares estimates of each parameter and provides 95% confidence intervals for a single new value of the dependent variable given a set of independent variables. This model is called the multiple linear regression analysis model.

This model also calculates the correlation coefficients of the data and the goodness of fit (R^2). Since this information merely tells us how good the equation fits our data points but nothing about how good of an estimator it is, another computer program was written to develop confidence intervals of the predictions. This shows the 95% confidence limits (upper and lower limits) of the prediction. With this information, assuming our tester/test subsystem samples are random and a typical represenation, we can then predict the annual recurring O&S cost of any testers which can be fitted into one of our six categories with confidence. This model is also applicable to the test subsystem CER. The computer printouts of all three programs are shown in Appendix B and C.

Table 4A summarizes the inputs and outputs of each of the three computer models.

TABLE 4A. INPUTS AND OUTPUTS OF THE THREE COMPUTER MODELS USED FOR THE O&S COST STUDY

MODEL 1 - Engineered O&S Cost (Estimates and Sensitivity)	
Inputs	Outputs
Constants BTS, COND, CSFAS, DT, RA RDL, RFM, RD, ROM, RT, RSF	Tester/Test Subsystem O&S Costs for • Normal Input Values • Twice Normal Input Values • One Half Normal Input Values
Variables CALR, CDM, DDM, LDC, LDR LP, ND, NH, NI, PROC, PSOS, R, TTL, UC	
MODEL 2 - Multiple Linear Regression Analysis	
Inputs	Outputs
Number of data sets.	Mean and standard deviation of each parameter.
Number of variables per data set.	Correlation coefficients.
Number of regression models.	Covariance matrix.
Actual data.	Regression equation.
Number of independent variables.	Confidence interval for each parameter.
Control number (1 for listing, 0 for no listing).	Test of hypothesis.
Prediction data.	Standard error of estimate.
	Goodness of fit.
	Predictions (actual, predicted and residual).
MODEL 3 - Confidence Intervals of Predictions	
Inputs	Outputs
Data File from Model 2.	Confidence intervals of predictions 1 Variable $\hat{y} \pm \text{multiplier} \sqrt{\text{constant} + (x - \bar{x})^2}$ where

TABLE 4A. INPUTS AND OUTPUTS OF THE THREE COMPUTER MODELS USED FOR THE O&S COST STUDY (Continued)

Inputs	Outputs
	$$\text{multiplier} = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2 / n-2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}}\; t_{.95}(n-2)$$
	$$\text{Constant} = \left(1 + \frac{1}{n}\right)\left(\sum_{i=1}^{n} (x_i - \bar{x})^2\right)$$
	n is the number of data sets
	$\hat{y}$ is the predicted value of y given x
	$\bar{x}$ is the mean of the x_i's
	$t_{.95}(n-2)$ is the student's t variable representing the .95 confidence level and n-2 degrees of freedom
	2 Variables
	$$\hat{y} \pm \text{multiplier} \sqrt{1 + \frac{1}{n} + D^T A^{-1} D}$$
	where
	$$\text{multiplier} = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2}{n - 3}}\; t_{.95}(n-3)$$
	$$A = \begin{bmatrix} \sum_{k=1}^{n} (x_{1k} - \bar{x}_1)^2 & \sum_{k=1}^{n} (x_{1k} - \bar{x}_1) \cdot (x_{2k} - \bar{x}_2) \\ \sum_{k=1}^{n} (x_{2k} - \bar{x}_2) \cdot (x_{1k} - \bar{x}_1) & \sum_{k=1}^{n} (x_{2k} - \bar{x}_2)^2 \end{bmatrix}$$
	$$D^T = (x_1 - \bar{x}_1,\; x_2 - \bar{x}_2)$$

TABLE 4A. INPUTS AND OUTPUTS OF THE THREE COMPUTER MODELS USED FOR THE O&S COST STUDY (Continued)

Inputs	Outputs
	$\hat{y}$ is the predicted value for y given x_1 and x_2
	$\bar{x}_1$ and $\bar{x}_2$ are the means of the x'_{1ks} and x'_{2ks}, respectively
	$t_{.95}(n-3)$ is the student's t variable representing the .95 confidence level and n-3 degrees of freedom.

3.5 CER DEVELOPMENT

3.5.1 Testers

For the tester analysis, only nine out of the ten engineered CER were used to develop O&S costs for each tester. Sufficient data was not available on the selected testers for estimating the annual software maintenance costs. At first thought, this would appear to be a major shortcoming, however, many testers do not have extensive resident software to maintain. The greatest software maintenance cost is associated directly with the system being supported by that particular tester or, in other words, the tester software instructions vary directly according to the number of prime weapon system units under test for which software must be developed and maintained. This tester cost is, therefore, tester independent and system dependent and not required for tester selection comparisons. However, for BIT/BITE versus tester tradeoffs, the software maintenance cost considerations must be included unless the BIT/diagnostic software requirements are identical for the tester and test subsystem under analysis. Due to the significant O&S cost contribution of software maintenance, this subject is discussed in more detail in Appendix A.

The false alarm rate data were also not available. However, this omission does not create any significant error. This is discussed in more detail in Appendix A.

Engineered Estimates

To demonstrate the application of the engineered O&S cost model, as used in this study, an example follows which shows the method of calculating the annual O&S cost for a tester. The data for this example is for the Power and Distribution

Tester (T510019) from the category of analog circuit testers with fault isolation to a component.

Technical manual maintenance

$$C_1 = (ND)(RFM)$$
$$= (785)(6.2)$$
$$= 4867$$

Attrition training

$$C_2 = (LP)(RA)\big((TTL)(RT + DT) + BTS\big)$$
$$= (3)(.33)\quad (1)(696 + 1000) + 250$$
$$= 1927$$

Maintenance labor

$$C_3 = (NH)(LDR)(RDL)/R$$
$$= (4160)(.88)(16.75)/155$$
$$= 396$$

Maintenance materials

$$C_4 = (NH)(DDM)/R$$
$$= (4160)(.57)/155$$
$$= 15$$

Calibration labor

$$C_5 = (365)(LDC)(RDL)/CALR$$
$$= (365)(1.7)(16.75)/22.6$$
$$= 460$$

Calibration materials

$$C_6 = (365)(CDM)/CALR$$
$$= (365)(78.2)/22.6$$
$$= 1263$$

Operator Personnel

$$C_7 = (LP)(RO)$$
$$= (3)(18000)$$
$$= 54000$$

Operating facility space

$$C_8 = (PSOS)(CSFAS)$$
$$= (46.32)(3)$$
$$= 139$$

Replenishment Spares

$$C_9 = (RSF)(PROC)$$
$$= (.015)(11000)$$
$$= 165$$

Total Cost

$$C_t = \sum_{i=1}^{9} C_i$$
$$= 4867 + 1927 + 396 + 15 + 460 + 1263 + 54000 + 139 + 165$$
$$= \$63,232$$

This process is repeated for each tester used in the study prior to continuing with the analysis. The example will be continued as succeeding phases of the analysis are discussed.

Regression

Of the six tester categories identified in Section 3.1, two deserve a special comment. The technique of regression analysis requires at least two more testers than independent variables. That is, to develop the CER

$$C_t = a_o + a_1 X_1$$

which has one independent variable, X_1, a minimum of three testers are required. The first tester category, which contains analog circuit testers with fault isolation to a module/card, has three testers. Thus the CER for the first category is restricted to one independent variable. The third category, which contains digital circuit testers with fault isolation to a module/card, has data for only one tester. Consequently, no CER can be developed for the third tester category. The circuits in modern electronic ground systems are more likely to be a mixture of analog and digital (hybrid) circuits than one or the other - especially when considering fault isolation to a module/card. For this reason, the lack of testers and tester data for categories one and three does not seriously affect the results of this study.

For each tester category, numerous regressions were performed using the annual O&S cost, C_t, as the dependent variable. The independent variable(s) were selected from Table 5.

TABLE 5. CANDIDATE INDEPENDENT VARIABLES

Symbol	Description
1. CALR	Average number of days between calibration actions.
2. CDM	Average cost of materials per calibration.
3. DDM	Average cost of materials per repair.
4. LDC	Average time to calibrate (and repair as required).
5. LDR	Average repair time.
6. LP	The number of operators required to meet operational schedules.
7. ND	The number of pages of technical data.
8. NH	Annual operating hours.
9. PROC	Procurement Cost.
10. PSOS	Area required for tester operation, in square feet.
11. R	Mean time between failures.
12. TTL	Training course length in weeks.

Regardless of which variable(s) is used in a specific CER, the annual O&S cost generated includes the cost of maintenance and provisioning (as impacted by tester reliability and maintainability), calibration, technical data maintenance, attrition training, and operations (personnel and facilities).

The parameters shown in Table 5 can be divided into two groups. The first group contains parameters (CALR, CDM, DDM, LDC, LDR, ND, PROC, PSOS, R, TTL) which change from one tester to another, regardless of the category to which the tester belongs. For example, the mean time between failures, R, will in all likelihood be different for each tester. The second group of parameters contains the number of operators, LP, and the annual operating hours, NH. Both of these parameters are predictable as functions of the maintenance concept, reliability and operating scenario of the supported system. The number of operators is related to the annual operating hours in that LP is based on 1747 productive manhours per manyear. Mathematically, LP is the smallest integer satisfying

$$\frac{NH}{1747} \leq LP.$$

It should be noted that LP only assumes integer values, even though NH assumes real values. Because the relationship between LP and NH is only piecewise continuous, the regression model generated some negative coefficients. To avoid this unrealistic occurrance, after the regression was completed, LP = NH/1747 was substituted in those equations using both LP and NH, thus eliminating LP and the negative term.

The CERs presented in this section are those which can be applied with only knowledge of the supported system's maintenance concept, reliability and operating scenario. That is, CERs which are functions of LP and/or NH. Since the sensitivity analysis of Section 3.6 shows that LP is the most significant single parameter, the CERs presented here are the most important. The CER, the range of the independent variable data used to generate the CER, the correlation coefficient (R^2) and the 95% confidence limits of the CER are shown in Table 6. Section 4, Tables 11 - 16, contain the CERs presented here as well as CERs with independent variables other than LP and NH.

TABLE 6. IMPORTANT CERs FOR TESTER ANNUAL O&S COSTS

Analog Circuit Testers with Fault Isolation to a Module/Card (Category 1)

$C_t = -37496 + 71565\ (LP)$

confidence: $\pm 392470 \sqrt{1.5396 + (LP - 1.66667)^2}$

range: $1 \leq LP \leq 2$

R^2: 84.3%

$C_t = 26976 + 40.797\ (NH)$

confidence: $\pm 151.512 \sqrt{2,823.44 + (NH - 1,343.33)^2}$

range: $130 \leq NH \leq 2080$

R^2: 92.1%

Analog Circuit Testers with Fault Isolation to a Component (Category 2)

$C_t = 22029.2 + 15045.7\ (LP)$

confidence: $\pm 14328.9 \sqrt{6.52245 + (LP - 2.71429)^2}$

range: $2 \leq LP \leq 4$

R^2: 59.3%

TABLE 6. IMPORTANT CERs FOR TESTER ANNUAL O&S COSTS (Continued)

$C_t = 35721.9 + 7.80274\ (NH)$

confidence: $\pm 8.6316 \sqrt{11768.6 + (NH - 3479)^2}$

range: $1820 \le NH \le 5720$

R^2: 51.9%

$C_t = 3959.73 + 8.84106\ (NH)$*

confidence: $\pm 9.32138 \sqrt{67139082 + (NH - 5399.12)^2}$

range: $1820 \le NH \le 5720$

R^2: 64%

*This equation was developed using LP ($2 \le LP \le 4$) and NH where LP = NH/1747, hence LP does not appear as a factor.

Digital Circuit Testers with Fault Isolation to a Module/Card (Category 3)

No CERs were developed for reasons described in the text.

Digital Circuit Testers with Fault Isolation to a Component (Category 4)

$C_t = 9912.41 + 19826\ (LP)$

confidence: $\pm 33040.8 \sqrt{2.14663\ 96 + (LP - 1.2)^2}$

range: $1 \le LP \le 2$

R^2: 54.9%

$C_t + 15169.8 + 25.205\ (NH)$*

confidence: $\pm 22.3319 \sqrt{2317093 + (NH - 1760.07)^2}$

range: $152 \le NH \le 2080$

R^2: 83.9%

*This equation was developed using LP ($1 \le LP \le 2$) and NH where LP = NH/1747, hence LP does not appear as a factor.

TABLE 6. IMPORTANT CERs FOR TESTER ANNUAL O&S COSTS (Continued)

Hybrid Circuit Testers with Fault Isolation to a Module/Card (Category 5)

C_t = 29579.9 + 26837.6 (LP)

confidence: $\pm 15593.8 \sqrt{13.957 + (LP-3.14286)^2}$

range: $1 \leq LP \leq 5$

R^2: 79.7%

C_t = 42651.3 + 17.0399 (NH)

confidence: $\pm 8.80131 \sqrt{22466.8 + (NH - 4182.86)^2}$

range: $200 \leq NH \leq 7200$

R^2: 83.2%

C_t = 77268.1 + 19.9369 (NH)*

confidence: $\pm 12.4172 \sqrt{106145700 + (NH - 2560.32)^2}$

range: $200 \leq NH \leq 7200$

R^2: 86.6%

*This equation was developed using LP ($1 \leq LP \leq 5$) and NH where LP = NH/1747, hence LP does not appear as a factor.

Hybrid Circuit Testers with Fault Isolation to a Component (Category 6)

C_t = 22810.2 + 18255.5 (LP)

confidence: $\pm 11576.7 \sqrt{7.74279 + (LP -2.23077)^2}$

range: $2 \leq LP \leq 4$

R^2: 52.3%

C_t = 25941.6 + 11.6247 (NH)

confidence: $\pm 7.24025 \sqrt{12263.3 + (NH - 3233.85)^2}$

range: $2080 \leq NH \leq 5400$

R^2: 53.2%

TABLE 6. IMPORTANT CERs FOR TESTER ANNUAL O&S COSTS (Continued)

C_t = 22448 + 11.6633 (NH)*

confidence: $\pm 7.49222 \sqrt{13531375 + (NH-3255.57)^2}$

range: $2080 \leq NH \leq 5400$

R^2: 55.5%

*This equation was developed using LP ($2 \leq LP \leq 4$) and NH where LP = NH/1747, hence LP does not appear as a factor.

An example will be used to demonstrate several aspects of the analysis. The example uses the data for the category of Analog Circuit Testers with Fault Isolation to a Component and will show the CER which uses the number of operators, LP, as the independent variable.

Example: The data used in the regression model to generate a CER for the category of Analog Circuit Testers with Fault Isolation to a Component, where NH is the independent variable, is:

Tester	Annual O&S Cost	No. of Operating Hours
T510044	63231	4160
T510055	41543	2080
T510072	82812	5720
T510144	76848	2080
T510146	83580	5720
T510019	42297	2773
T510057	49763	1820

Appendix C, page C-3, columns 1 and 6, show the computer printout associated with this regression. The predicted values shown are used to plot a graph (Figure 3.1) of the regression line

$$C_t = 35721.9 + 7.80274 (NH)$$

and the upper and lower 95% confidence limits

$$C_t \pm 8.6316 \sqrt{11,768.6 + (NH-3479)^2}$$

Although the value of the independent variable in the data has the range of $1820 \leq NH \leq 5720$, the confidence limits allow the user to establish the range he considers viable.

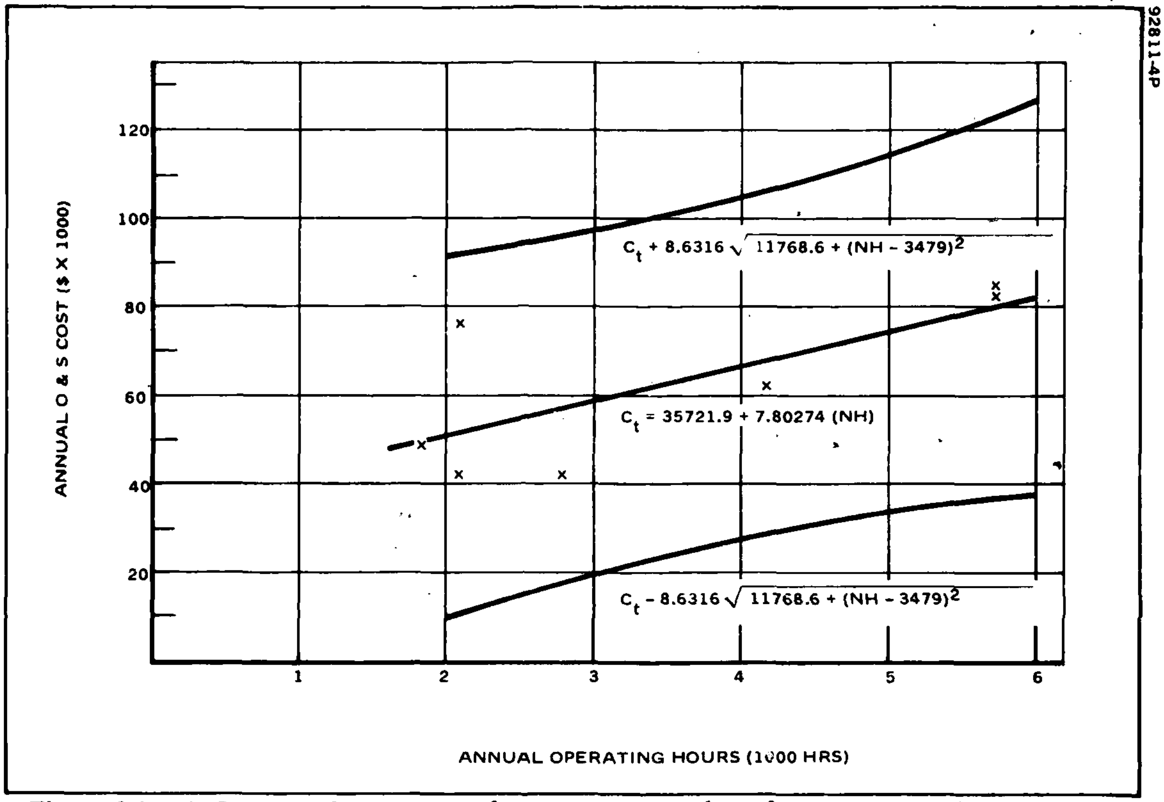

Figure 3.1. A Category 2 Tester Graphic Scatterpoint Plot of O&S Costs and Operating Hours

3.5.2 Test Subsystems

For the test subsystem analysis only six out of the ten engineered CER were used to develop O&S costs for each test subsystem. Data were not available to develop calibration cost nor operations cost. The calibration requirements are usually trivial for the BIT/BITE of a prime system and therefore do not contribute significantly to its annual recurring operations and support costs. The operations costs associated with BIT/BITE is a function of and is an integral part of the prime system. These costs are normally accounted for and associated with the prime system

LCC. The operators as well as the space taken up by the BIT/BITE assemblies cannot easily nor need be allocated to the test subsystem LCC. Since these costs are very small, no significant error is introduced by not including them in our analysis. Likewise, the false alarm rate does not contribute significantly to the test subsystem costs and can be ignored. (See discussion in Appendix A.) The remaining six cost categories for each of the six test subsystems under study were calculated, the results of which are shown in Table 7:

TABLE 7. TEST SUBSYSTEM ANNUAL O&S COSTS

	Test Subsystem					
	1 TPQ37	2 TPQ36	3 ROLAND	4 IPD/TAS	5 SID	6 JTIDS (HIT)
Cost Element	(K$)	(K$)	(K$)	(K$)	(K$)	(K$)
1. Technical Manuals (TM)	4.3	3.5	0.6	13.0	6.2	1.2
2. Training	4.6	3.7	1.2	3.5	9.3	.9
3. Maintenance Labor	0.0	0.0	0.0	0.3	0.0	0.1
4. Maintenance Material	0.0	0.0	0.0	1.4	0.3	0.1
5. Software	2752.5	2550.0	0	150.0	75.0	750.0
6. Spares	0.0	0.0	3.7	2.4	0.1	0.3
TOTALS	2761.5	2557.2	5.5	170.6	91.0	752.6

A sample calculation follows to demonstrate how each of the values in the table was derived.

Example: AN/TPQ37 Annual O&S Costs.

T.M. $C_1 = ND \cdot RFM$

$= (700)(6.2) \qquad = 4340$

Training $C_2 = LP \cdot RA \quad TTL(RT + DT) + BTS$

$= (5)(.33)\ 1.5\ (696 + 1000) + 250 \qquad = 4610$

Main Labor $C_3 = \frac{NH \cdot LDR \cdot RDL}{R}$

$= \frac{(1600)(1)(16.75)}{(10,776)} \qquad = 2$

Main Material $C_4 = \frac{NH \cdot DDM}{R}$

$= \frac{(1600)(191)}{(10,776)}$ $= 28$

Software $C_5 = NI \cdot ROM$

$= (36,700)(75)$ $= 2,752,500$

Replen Spares $C_6 = \frac{NH \cdot UC \cdot COND}{R}$

$= (1600)(2386)(.1)$ $= 35$

Total Cost $C = \sum_{i=1}^{6} C_i$

$= 4340 + 4610 + 2 + 28 + 2,752,500 + 35$

$= \$2,761,515$

Regression

The regression analysis for the test subsystem is identical to that of the testers. However, the list of candidate independent variables is reduced to the 9 shown below in Table 8.

TABLE 8. TEST SUBSYSTEM CANDIDATE INDEPENDENT VARIABLES

Symbol	Description
1. DDM	Average cost of materials per repair.
2. LDR	Average repair time.
3. LP	The number of operators required to meet operational schedules.
4. ND	The number of pages of technical data.
5. NH	Annual operating hours.
6. NI	Annual number of BIT instructions.
7. R	Mean time between failures.
8. TTL	Training course length in weeks.
9. UC	Unit reorder cost.

An interesting result of the test subsystem regression and engineered O&S cost analysis is that although the software costs account for 82% to 99% of the O&S costs, the operating hours, NH, has a high value of R^2 (92.1%). Since NH is, in most cases, easier to estimate than NI, the annual number of software instructions to be changed, NH can be used to predict the test subsystem O&S cost with good results.

Consequently, these two variables and their CER plus prediction confidence intervals, their range and correlation coefficients, R^2, are shown below in Table 9.

TABLE 9. CER FOR IMPORTANT TEST SUBSYSTEM ANNUAL O&S COSTS

C	$= 14{,}417.4 + 74.1568\ (NI)$
Confidence:	$\pm 1.14896 \sqrt{99004.4 \times 10^9 + (NI - 13950)^2}$
Range:	$0 \leq NI \leq 36{,}700$
R^2:	99.9%
C	$= 3{,}135{,}700 - 338.252\ (NH)$
Confidence:	$\pm 137.072 \sqrt{20{,}830.8 + (NH - 6169.33)^2}$
Range:	$1600 \leq NH \leq 8760$
R^2:	92.1%

3.6 SENSITIVITY ANALYSIS

3.6.1 Testers

There is a great deal of interest in the parameters which vary from tester to tester and/or application to application. The relative significance of each of these parameters (ND, LP, TTL, NH, LDR, R, DDM, LDC, CALR, CDM, PSOS) is determined by performing a sensitivity analysis. The sensitivity analysis consists of perturbating the parameters one at a time and determining the average impact on total cost for a given category of testers. An example will clarify the procedure.

Example: This example will show the sensitivity analysis for the parameter ND (the number of technical manual pages) for analog circuit testers with fault isolation to a component. The result is to calculate the percent change in the average total cost given that the values for ND have been (a) doubled and (b) halved.

$$\begin{bmatrix}\text{\% change in}\\ \text{average total}\\ \text{cost}\end{bmatrix} = \frac{\sum\left\{\begin{bmatrix}\text{total cost using}\\ \text{the value}\\ \text{X(ND)}\end{bmatrix} - \begin{bmatrix}\text{total cost using}\\ \text{the value}\\ \text{ND}\end{bmatrix}\right\}}{\sum\begin{bmatrix}\text{total cost using}\\ \text{the value}\\ \text{ND}\end{bmatrix}} (100\%)$$

where X = 2 to double the value of ND and X = 1/2 to halve the value of ND. The summations extend over all testers in the category being considered as shown below in Table 10.

TABLE 10. TESTER O&S COST SENSITIVITY ANALYSIS DATA

A Total Cost Using the Value ND	B Total Cost Using the Value 2(ND)	C Total Cost Using the Value 1/2 (ND)	D1 = B-A	D2 = C-A
63231	68098	60797	4867	-2434
41543	45139	39745	3596	-1798
82812	88392	80022	5580	-2790
76848	103508	63518	26660	-13330
83580	91361	79689	7781	-3891
42297	46203	40344	3906	-1953
49763	57203	46043	7440	-3720
440074	499904	410158	59830	-29916

For a 100% increase in ND

$$\begin{bmatrix}\text{\% change in}\\ \text{average}\\ \text{total cost}\end{bmatrix} = \frac{59830}{440074} \times 100\% = 13.60\%$$

For a 50% reduction in ND

$$\begin{bmatrix}\text{\% change in}\\ \text{average}\\ \text{total cost}\end{bmatrix} = \frac{-29916}{440074} \times 100\% = -6.80\%$$

These results indicate that a 100% increase in the number of pages of technical manuals causes a 14% increase in O&S costs and a 50% reduction in the number of pages results in a 7% decrease in O&S costs.

The complete results of the sensitivity analysis are given in Appendix C. An interesting result of the sensitivity analysis is that a 100% increase in the number of operators increases the O&S cost by 47% to 81%. That is the number of operators is the most significant parameter affecting the O&S cost. The next most significant parameter is the number of technical manual pages for which a 100% increase in the number of pages causes the O&S cost to increase by as much as 24%.

3.6.2 Test Subsystem

The test subsystem sensitivity analysis is performed in the same manner as described previously for the testers. The parameters halved and doubled include ND, LP, TTL, NH, R, UC, LDR, DDM and NI. Of these, only one is significantly sensitive and that is the number of software instructions changed per year (NI). The other parameters are relatively insignificant. See Appendix C for complete results.

4.0 RESULTS

The data which were gathered for this study has produced many CERs. The process of multiple linear regression was used to create relationships which would estimate the total annual O&S cost of a tester/test subsystem. These CERs are linear functions of one or two independent variables. The independent variables, described in Table 5 are either dependent upon a particular tester considered or dependent upon the system being supported.

The CERs which use the number of operators (LP) and/or the annual operating hours (NH) as independent variables were described briefly in Section 3.5. However, many CERs were developed which yield better results given that some knowledge of the tester exists, other than to which category it belongs. These CERs are tabulated and presented in this section. The regression model which was used to generate the CERs also provides several pieces of information which indicate how well the CERs perform. In addition to the CERs, the model generates equations which provide upper and lower confidence limits. The confidence limits have been established such that there is a 95% probability that the true annual O&S cost is between the upper and lower confidence limits.

Since these equations require matrix algebra operations, an example calculation is shown below for illustration.

Example from Table 12, No. 1:

$$\pm 3765.14 \sqrt{1.14286 + (LP-2.71429,\ ND-1378.57) \begin{pmatrix} 0.195442 & 3.39123 \times 10^{-5} \\ 3.39123 \times 10^{-5} & 1.02397 \times 10^{-7} \end{pmatrix} \begin{pmatrix} LP-2.71429 \\ ND-1378.57 \end{pmatrix}}$$

can be rewritten as:

$$\pm 3765.14 \sqrt{1.14286+(LP-2.71429)^2(0.195442)+(LP-2.71429)(ND-1378.57)(3.39123 \times 10^{-5}+3.39123 \times 10^{-5})+(ND-1378.57)^2(1.02397 \times 10^{-7})}$$

or in general as:

$$\pm b \sqrt{c + D^T A^{-1} D}$$

where

$$D^T = (d_1, d_2)$$

$$A^{-1} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}.$$

Then

$$D^T A^{-1} D = d_1^2 a_{11} + d_1 d_2 (a_{12} + a_{21}) + d_2^2 a_{22}$$

There are two measures of the goodness of fit: the correlation coefficient, R^2, and the standard error of the estimate. Both of these measures are indications of the deviation between the estimated value (the CER) and the observed value. The closer the correlation coefficient is to unity (or 100%) and the closer the standard error of the estimate is to zero, the better the CER.

4.1 COST ESTIMATING RELATIONSHIPS

The following tables list the CER in order of the best fit (correlation coefficient, R^2, nearest to 100%) from top to bottom. There are six tables which follow. These tables include the title which also indicates the tester and its category for Tables 11 through 15. Table 16 includes the test subsystem data set. The CER is shown in the form

$$a_o + a_1 X_1 + a_2 X_2$$

where a_o, a_1, a_2 are the constants resulting from the regression analysis and X_1, X_2 are independent variables. Each independent variable is described by its definition followed by its computer name. The computer name is then followed by the dimensional units of the variable. The tables also include the sensitivity ranking of each variable within that category of tester or test subsystem. For multiple variable CER, the ranking of both variables are shown opposite the CER including that variable. The corresponding equation for the 95% prediction confidence interval for each CER is also included in the tables.

TABLE 11. ANNUANL RECURRING O&C COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON ANALOG TESTERS WITH FAULT ISOLATION TO A MODULE/CARD ($/YEAR)

	Cost Estimating Relationships*	R^2 (100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	29,903 + (943.2) (Material Cost for Repair, DDM, $)	99.9	5	$\pm 302.229\sqrt{127.192 + (DDM-55)^2}$
2.	-97,018 + (22,349.7) (Labor Time per Calibration, LDC, Hours)	98.7	8	$\pm 33134.1\sqrt{5.3333 + (LDC-8.0)^2}$
3.	15,343 + (8,305.0) (Length of Training Course, TTL, Weeks)	95.4	3	$\pm 23301\sqrt{14.1107 + (TTL-8.0)^2}$
4.	26,976 + (40.797) (Annual Operating Hours, NH, Hours/Year)	92.1	4	$\pm 151.512\sqrt{2{,}823.44 + (NH-1343.33)^2}$
5.	26,216 + (209.6) (Operational Floor Space, PSOS, Sq. Feet/Year)	86.1	6	$\pm 1071.16\sqrt{531.114 + (PSOS-265.047)^2}$
6.	-37,496 + (71,565.0) (Number of Operator/Maintainers, LP, Men/Year)	84.3	1	$\pm 392{,}470\sqrt{1.5396 + (LP-1.66667)^2}$
7.	-37,496 + (26,121,400) (Calibration Rate, 1/CALR, Number of Calibrations/Day)	84.3	7	$\pm 1.43251 \times 10^8\sqrt{4.21808 \times 10^{-4} + (1/CALR-0.0045662)^2}$
8.	32,248 + (9.544) (Number of T.M. Pages, ND, Pages/Year)	80.8	2	$\pm 59.0958\sqrt{11{,}303.7 + (ND-5190)^2}$

*Parameter ranges: $5 \le DDM \le 100$; $6 \le LDC \le 10$; $2 \le TTL \le 12$; $130 \le NH \le 2080$; $35.14 \le PSOS \le 385$; $1 \le LP \le 2$; $182.5 \le CALR \le 365$; $2000 \le ND \le 10{,}000$

NOTE: Since the CERs were designed for use with values that fall within the ranges used in the development, use of CERs with values outside these ranges may produce unrealistic costs. Care must be used in selecting variable values outside the specified range.

TABLE 12. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON ANALOG TESTERS WITH FAULT ISOLATION TO A COMPONENT ($/YEAR)

	Cost Estimating Relationships	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	961.105 + (18,109) (Number of Operator/ Maintainers, LP, Men/Year) + (9.25) (Number of TM Pages, ND, pages/year)	99.6	1 2	$\pm 3765.14\sqrt{1.14286 + (LP-2.71429, ND-1378.57)\begin{pmatrix}.195442 & 3.39123\times10^{-5}\\ 3.39123\times10^{-5} & 1.02397\times10^{-7}\end{pmatrix}\begin{pmatrix}LP-2.71429\\ ND-1378.57\end{pmatrix}}$
2.	-149.469 + (19,656) (Number of Operator/ Maintainers, LP, Men/Year) + (0.27415) (Tester Procurement Cost, PROC, $)	98.9	1 6	$\pm 6714.24\sqrt{1.4286 + (LP-2.71429, PROC-35257.1)\begin{pmatrix}.210143 & 1.54215\times10^{-6}\\ 1.54215\times10^{-6} & 9.17083\times10^{-11}\end{pmatrix}\begin{pmatrix}LP-2.71429\\ PROC-35257.1\end{pmatrix}}$
3.	12,853 + (11.249) (Annual Operating Hours, NH, hours/year) + (0.308496) (Tester Procurement Cost, PROC, $)	98.9	5 6	$\pm 6511.2\sqrt{1.14286 + (NH-3479, PROC-35257.1)\begin{pmatrix}6.87847\times10^{-8} & 1.09197\times10^{-9}\\ 1.09197\times10^{-9} & 9.77263\times10^{-11}\end{pmatrix}\begin{pmatrix}NH-3479\\ PROC-35257.1\end{pmatrix}}$
4.	-15,690 + (20,630) (Number of Operator/ Maintainers, LP, Men/Year) + (18.581) (Labor Time for Repair, LDR, Hours)	98.0	1 4	$\pm 8803.21\sqrt{1.14286 + (LP-2.71429, LDR-1.21429)\begin{pmatrix}.223061 & .129276\\ .129276 & .430166\end{pmatrix}\begin{pmatrix}LP-2.71429\\ LDR-1.21429\end{pmatrix}}$
5.	-4,972 + (19,309) (Number of Operator/ Maintainers, LP, Men/Year) + (10,800) (Length of Training Course, TTL, Weeks)	97.9	1 3	$\pm 8955.04\sqrt{1.14286 + (LP-2.71429, TTL-1.42857)\begin{pmatrix}.206897 & 5.74713\times10^{-2}\\ 5.74713\times10^{-2} & .145594\end{pmatrix}\begin{pmatrix}LP-2.71429\\ TTL-1.42857\end{pmatrix}}$
6.	14,555 + (9.979) (Annual Operating Hours, NH, Hours/Year) + (9.863) (Number of TM Pages, ND, Pages/Year)	96.5	5 4	$\pm 11713.4\sqrt{1.14286 + (NH-3479, ND-1378.57)\begin{pmatrix}6.17055\times10^{-8} & 2.32185\times10^{-8}\\ 2.32185\times10^{-8} & 1.05249\times10^{-7}\end{pmatrix}\begin{pmatrix}NH-3479\\ ND-1378.57\end{pmatrix}}$
7.	2590 + (12.73) (Annual Operating Hours, NH, Hours/Year) + (1,017,360) (Failure Rate, 1/R, Number of Failures/Hour)	94.9	5 7	$\pm 14264\sqrt{1.14286 + (NH-3479, \frac{1}{R} -1.57176\times10^{-2})\begin{pmatrix}8.38735\times10^{-8} & 5.63473\times10^{-3}\\ 5.63473\times10^{-3} & 1163.43\end{pmatrix}\begin{pmatrix}NH-3479\\ \frac{1}{R} -1.57196\times10^{-2}\end{pmatrix}}$
8.	-9,766 + (21,717) (Number of Operator/ Maintainers, LP, Men/Year) + (870,901) (Failure Rate, 1/R, Number of Failures/Hour)	94.3	1 7	$\pm 15044.2\sqrt{1.14286 + (LP-2.71429, \frac{1}{R} -1.57176\times10^{-2})\begin{pmatrix}.245611 & 8.01596\\ 8.01596 & 1046.5\end{pmatrix}\begin{pmatrix}LP-2.71429\\ \frac{1}{R} -1.57176\times10^{-2}\end{pmatrix}}$
9.	-937.141 + (11.43) (Annual Operating Hours, NH, Hours/Year) + (19,790) (Labor Time for Repair, LDR, Hours)	93.9	5 4	$\pm 15548.7\sqrt{1.14286 + (NH-3479, LDR-1.21429)\begin{pmatrix}7.17352\times10^{-8} & 8.26071\times10^{-5}\\ 8.26071\times10^{-5} & .45037\end{pmatrix}\begin{pmatrix}NH-3479\\ LDR-1.21429\end{pmatrix}}$
10.	10,653 + (10.44) (Annual Operating Hours, NH, Hours/Year) + (11,118) (Length of Training Course, TTL, Weeks)	92.0	5 3	$\pm 17797.1\sqrt{1.14286 + (NH-3479, TTL-1.42857)\begin{pmatrix}6.49788\times10^{-8} & 3.53521\times10^{-5}\\ 3.53521\times10^{-5} & .148863\end{pmatrix}\begin{pmatrix}NH-3479\\ TTL-1.42857\end{pmatrix}}$

TABLE 12. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON ANALOG TESTERS WITH FAULT ISOLATION TO A COMPONENT ($/YEAR) (Continued)

	Cost Estimating Relationships*	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
11.	6,638 + (14,211) (Number of Operator/ Maintainers, LP, Men/Year)	90.7	1	$\pm 19182.9 \sqrt{1.14286 + (LP-2.71429,\ PSOS-69.8686)\begin{pmatrix} .185282 & -3.24346\times10^{-4} \\ -3.24346\times10^{-4} & 9.81614\times10^{-5}\end{pmatrix}\begin{pmatrix} LP-2.71429 \\ PSOS-69.8686\end{pmatrix}}$
	+ (253) (Operational Floor Space, PSOS, Sq. Feet/Year)		9	
12.	18,256 + (7.52) (Number of Operating Hours, NH, Hours/Year)	86.3	5	$\pm 23302 \sqrt{1.14286 + (NH-3479,\ PSOS-69.8686)\begin{pmatrix} 5.66928\times10^{-8} & -1.03470\times10^{-7} \\ -1.03470\times10^{-7} & 9.77825\times10^{-5}\end{pmatrix}\begin{pmatrix} NH-3479 \\ PSOS-69.8686\end{pmatrix}}$
	+ (264) (Operational Floor Space, PSOS, Sq. Feet/Year)		9	
13.	6,892 + (15,812) (Number of Operator/ Maintainers, LP, Men/Year)	85.4	1	$\pm 24062.9 \sqrt{1.14286 + (LP-2.71429,\ LDC-2.24286)\begin{pmatrix} .185296 & 8.25301\times10^{-3} \\ 8.25301\times10^{-3} & 6.27228\times10^{-2}\end{pmatrix}\begin{pmatrix} LP-2.71429 \\ LDC-2.24286\end{pmatrix}}$
	+ (5,822) (Time for Calibration, LDC, Hours)		8	
14.	3959.73 + (8.84106) (Annual Operating Hours, NH, Hours)	64.0	**	$\pm 9.32138 \sqrt{67139082 + (NH - 5399.12)^2}$
15.	22029.2 + (15045.7) (Number of Operator/ Maintainers, LP, Men/Year)	59.3	1	$\pm 14328.9 \sqrt{6.52245 + (LP-2.71429)^2}$
16.	35721.9 + (7.80274) (Annual Operating Hours, NH, Hours)	51.9	5	$\pm 8.6816 \sqrt{11,768.6 + (NH-3479)^2}$

*Parameter ranges: 580 ≤ ND ≤ 4300; 2 ≤ LP ≤ 4; 1 ≤ TLL ≤ 4; 5800 ≤ PROC ≤ 132,000; 1820 ≤ NH ≤ 5720; 0.83 ≤ LDR ≤ 2.75; 23 ≤ R ≤ 155; 0.5 ≤ LDC ≤ 5.2; 41.25 ≤ PSOS ≤ 145.83

**This equation was developed using LP and NH, where LP = NH/1747, hence LP does not appear as a factor.

TABLE 13. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON DIGITAL TESTERS WITH FAULT ISOLATION TO A COMPONENT ($/YEAR)

	Cost Estimating Relationships*	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	-1726 + (20,194) (Number of Operator/ Maintainers, LP, Men/Year) + (8.685) (Number of TM Pages, ND, Pages/Year)	98.8	1 2	$\pm 7940.39\sqrt{1.2 + (LP-1.2,\ ND-1292)\begin{pmatrix}1.25048 & 1.19761\times10^{-5}\\ 1.19761\times10^{-5} & 2.99401\times10^{-7}\end{pmatrix}\begin{pmatrix}LP-1.2\\ ND-1292\end{pmatrix}}$
2.	365 + (6,745) (Number of Operator/ Maintainers, LP, men/year) + (24,798) (Labor Time for Repair, LDR, Hours)	95.8	1 6	$\pm 14887.7\sqrt{1.2 + (LP-1.2,\ LDR-1.018)\begin{pmatrix}1.97866 & -1.38134\\ -1.38134 & 2.61866\end{pmatrix}\begin{pmatrix}LP-1.2\\ LDR-1.018\end{pmatrix}}$
3.	3666 + (29,507) (Labor Time for Repair, LDR, Hours)	91.8	6	$\pm 16188\sqrt{1.86596 + (LDR-1.018)^2}$
4.	11,317 + (13,643) (Number of Operator/ Maintainers, LP, Men/Year) + (207,165) (Calibration Rate 1/CALR, Number of Calibrations/Day)	89.3	6	$\pm 23815.6\sqrt{1.2 + \left(LP-1.2,\ \frac{1}{CALR} -2.90332\times10^{-2}\right)\begin{pmatrix}1.44357 & -6.48545\\ -6.48545 & 217.296\end{pmatrix}\begin{pmatrix}LP-1.2\\ \frac{1}{CALR} -2.90332\times10^{-2}\end{pmatrix}}$
5.	-4,172 + (24,968) (Number of Opertor/ Maintainers, LP, Men/Year) + (120) (Operational Floor Space, PSOS, Sq. Feet/Year)	88.8	1 6	$\pm 24404.2\sqrt{1.2 + (LP-1.2,\ PSOS-65.958)\begin{pmatrix}1.386 & 3.17304\times10^{-3}\\ 3.17304\times10^{-3} & 7.40328\times10^{-5}\end{pmatrix}\begin{pmatrix}LP-1.2\\ PSOS-65.958\end{pmatrix}}$
6.*	15,170 + (25.205) (Annual Operating Hours, NH, Hours)	83.9	**	$\pm 22.3319\sqrt{2317093 + (N4-1760.07)^2}$
7.	7,428 + (18,584) (Number of Operator/ Maintainers, LP, Men/Year) + (6,210) (Material Cost for Calibration, CDM, $)	83.9	1 6	$\pm 29206.4\sqrt{1.2 + (LP-1.2,\ CDM-0.64)\begin{pmatrix}1.25926 & -4.62963\times10^{-2}\\ -4.62963\times10^{-2} & .231481\end{pmatrix}\begin{pmatrix}LP-1.2\\ CDM-0.64\end{pmatrix}}$
8.	6,640 + (18,062) (Number of Operator/ Maintainers, LP, Men/Year) + (0.08501) (Procurement Cost, PROC, $)	81.3	1 5	$\pm 31529\sqrt{1.2 + (LP-1.2,\ PROC-63400)\begin{pmatrix}1.27055 & -9.90418\times10^{-7}\\ -9.90418\times10^{-7} & 4.77310\times10^{-11}\end{pmatrix}\begin{pmatrix}LP-1.2\\ PROC-63400\end{pmatrix}}$
9.	-14,662 + (25,092) (Number of Operator/ Maintainers, LP, Men/Year) + (7,021) (Length of Training Course, TTL, Weeks)	78.5	1 3	$\pm 33772.9\sqrt{1.2 + (LP-1.2,\ TTL-2.6)\begin{pmatrix}1.45455 & .272727\\ .272727 & .363636\end{pmatrix}\begin{pmatrix}LP-1.2\\ TTL-2.6\end{pmatrix}}$
10.	9912.41 + 19826 (Number of Operator/ Maintainers, LP, Men/Year)	54.9	1	$\pm 33040.8\sqrt{.14663 + (LP-1.2)^2}$

*Parameter ranges: $300 \le ND \le 2400$; $1 \le LP \le 2$; $2 \le TTL \le 4$; $10{,}000 \le PROC \le 18{,}400$; $152 \le NH \le 2080$; $0.5 \le LDR \le 1.44$; $12.3 \le CALR \le 999{,}999$; $0 \le CDM \le 2.4$; $16 \le PSOS \le 147.57$

**This equation was developed using LP and NH, where LP = NH/1747, hence LP does not appear as a factor.

TABLE 14. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON HYBRID TESTERS WITH FAULT ISOLATION TO A MODULE/CARD ($/YEAR)

	Cost Estimating Relationships*	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	-54076.9 + (44286.1) (Number of Operator/ Maintainers, LP, Men/Year + (28881.5) (Time per Calibration, LDC, Hours)	98.0	1 8	$\pm 29160.4\sqrt{1.14286 + (LP-3.14286,\ LDC-1)\begin{pmatrix}.113821 & .121951\\ .121951 & .202091\end{pmatrix}\begin{pmatrix}LP-3.14286\\ LDC-1\end{pmatrix}}$
2.	15224 + (19.6929) (Annual Operating Hours, NH, Hours) + (5.26575) (Number of TM Pages, ND, Pages/Year)	96.2	3 2	$\pm 40539.1\sqrt{1.14286 + (NH-4182.86,\ ND-3101.41)\begin{pmatrix}1.79406X10^{-8} & 4.79290X10^{-9}\\ 4.79290X10^{-9} & 9.51279X10^{-9}\end{pmatrix}\begin{pmatrix}NH-4182.86\\ ND-3101.41\end{pmatrix}}$
3.	-11864.5 + (24.8246) (Annual Operating Hours, NH, Hours) + (21953.2) (Time per Calibration, LDC, Hours)	95.9	3 8	$\pm 42180.9\sqrt{1.14286 + (NH-4182.86,\ LDC-1)\begin{pmatrix}3.68361X10^{-8} & 6.00954X10^{-5}\\ 6.00954X10^{-5} & .16947\end{pmatrix}\begin{pmatrix}NH-4182.86\\ LDC-1\end{pmatrix}}$
4.	-6016.54 + (32258.7) (Number of Operator/ Maintainers, LP, men/year) + (5.98447) (Number of TM Pages, ND, Pages/Year)	95.8	1 2	$\pm 42678.3\sqrt{1.14286 + (LP-3.14286,\ ND-3101.14)\begin{pmatrix}4.83485X10^{-2} & 8.96232X10^{-6}\\ 8.96232X10^{-6} & 9.89369X10^{-9}\end{pmatrix}\begin{pmatrix}LP-3.14286\\ ND-3101.4\end{pmatrix}}$
5.	77268.1 + (19.9369) (Annual Operating Hours NH, Hours)	86.6	**	$\pm 12.4172\sqrt{106145700 + (NH-2560.32)^2}$
6.	-53283.5 + (44097.8) (Number of Operator/ Maintainers, LP, Men/Year +(1.46191X10⁷) (Calibration Cycle, 1/CALR, Number of Calibrations/Day)	85.4	1 8	$\pm 79113.2\sqrt{1.14286 + (LP-3.14286,\ \frac{1}{CALR}-1.95752X10^{-3})\begin{pmatrix}.269421 & 194.122\\ 194.122 & 164418\end{pmatrix}\begin{pmatrix}LP-3.14286\\ \frac{1}{CALR}-1.95752X10^{-3}\end{pmatrix}}$
7.	44697.7 + (11.8401) (Annual Operating Hours, NH, Hours) + (4.72519X10⁶) (Failure Rate, 1/R, Number of Failures/Hour)	85.3	3 6	$\pm 79387.7\sqrt{1.14286 + (NH-4182.86,\ \frac{1}{R}-4.16983X10^{-3})\begin{pmatrix}7.19692X10^{-8} & -5.12924X10^{-2}\\ -5.12924X10^{-2} & 46611.5\end{pmatrix}\begin{pmatrix}NH-4182.86\\ \frac{1}{R}-4.16983X10^{-3}\end{pmatrix}}$
8.	28694.2 + (12.8593) (Annual Operating Hours, NH, Hours) + (3.73126X10⁻²) (Procurement Cost, PROC, $)	84.9	3 4	$\pm 80389.7\sqrt{1.14286 + (NH-4182.86,\ PROC-842714)\begin{pmatrix}5.97394X10^{-8} & -3.94617X10^{-10}\\ -3.94617X10^{-10} & 3.52205X10^{-12}\end{pmatrix}\begin{pmatrix}NH-4182.86\\ PROC-842714\end{pmatrix}}$
9.	37642.9 + (16201) (Number of Operator/ Maintainers, LP, Men/Year) + (6.08326X10⁶) (Failure Rate, 1/R, Number of Failures/Hour)	83.5	1 6	$\pm 84172.2\sqrt{1.14286 + (LP-3.14286,\ \frac{1}{R}-4.16983X10^{-3})\begin{pmatrix}.170577 & -74.5478\\ -74.5478 & 42635.4\end{pmatrix}\begin{pmatrix}LP-3.14286\\ \frac{1}{R}-4.16983X10^{-3}\end{pmatrix}}$
10.	42651.3 + (17.0399) (Annual Operating Hours, NH, Hours)	83.2	3	$\pm 8.80131\sqrt{22,466.8 + (NH-4182.86)^2}$
11.	16095.4 + (18257.2) (Number of Operator/ Maintainers, LP, Men/Year) + (4.80014X10⁻²) (Procurement Cost, PROC, $)	82.7	1 4	$\pm 86201\sqrt{1.14286 + (LP-3.14286,\ PROC-842714)\begin{pmatrix}.147371 & -5.99380X10^{-7}\\ -5.99380X10^{-7} & 3.35312X10^{-12}\end{pmatrix}\begin{pmatrix}LP-3.14286\\ PROC-842714\end{pmatrix}}$
12.	2[illegible].9 - 26837.6 (Number of Operator/ Maintainers, LP, Men/Year)	79.7	1	$\pm 15593.3\sqrt{13.957 + (LP-3.14286)^2}$

*Parameter ranges: 484 ≤ ND ≤ 13,158; 1 ≤ LP ≤ 5; 3 ≤ TTL ≤ 5; 500,000 ≤ PROC ≤ 1,387,000; 200 ≤ NH ≤ 7200; 1 ≤ LDR ≤ 12.20; 113 ≤ R ≤ 2785; 50 ≤ DDM ≤ 500; 0 ≤ LDC ≤ 4; 182.5 ≤ CALR ≤ 999,999; 0 ≤ CDM ≤ 5; 15.83 ≤ PSOS ≤ 382.81

**This equation was developed using LP and NH, where LP = NH/1747, hence LP does not appear as a factor.

TABLE 15. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTION ON HYBRID TESTERS WITH FAULT ISOLATION TO A COMPONENT ($/YEAR)

	Cost Estimating Relationships*	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	11433.2 + (16300.6) (Number of Operator/ Maintainers, LP, Men/Year) + (8.97345) (Number of TM Pages, ND, Pages/Year)	88.9	1 2	$\pm 12286.7 \sqrt{1.07692 + (LP-2.23077,\ ND-1753.85)\begin{pmatrix} .235939 & -1.74246X10^{-5} \\ -1.74246X10^{-5} & 7.99817X10^{-8} \end{pmatrix}\begin{pmatrix} LP-2.23077 \\ ND-1753.85 \end{pmatrix}}$
2.	15395.3 + (10.1554) (Annual Operating Hours, NH, Hours) + (8.72254) (Number of TM Pages, ND, Pages/Year)	87.5	3 2	$\pm 13044.1 \sqrt{1.07692 + (NH-3233.85,\ ND-1753.85)\begin{pmatrix} 9.48303X10^{-8} & -1.35843X10^{-8} \\ -1.35843X10^{-8} & 8.06408X10^{-8} \end{pmatrix}\begin{pmatrix} NH-3233.85 \\ ND-1753.85 \end{pmatrix}}$
3.	8471.08 + (19821.7) (Number of Operator/ Maintainers, LP, Men/Year) + ($2.79409X10^{-2}$) (Procurement Cost, PROC, $)	79.1	1 4	$\pm 16860.8 \sqrt{1.07692 + (LP-2.23077,\ PROC-388154)\begin{pmatrix} .235466 & 5.92818X10^{-8} \\ 5.92818X10^{-8} & 1.05759X10^{-12} \end{pmatrix}\begin{pmatrix} LP-2.23077 \\ PROC-388154 \end{pmatrix}}$
4.	1499.5 + (20795.3) (Number of Operator/ Maintainers, LP, Men/Year) + (119.983) (Operational Floor Space, PSOS, Sq. Feet/Year)	75.7	1 8	$\pm 18188.8 \sqrt{1.07692 + (LP-2.23077,\ PSOS-130.395)\begin{pmatrix} .242153 & 4.72876X10^{-4} \\ 4.72876X10^{-4} & 2.23395X10^{-5} \end{pmatrix}\begin{pmatrix} LP-2.23077 \\ PSOS-130.395 \end{pmatrix}}$
5.	15368.5 + (11.9358) (Annual Operating Hours, NH, Hours) + ($2.46478X10^{-2}$) (Procurement Cost, PROC, $)	74.3	3 4	$\pm 18702.3 \sqrt{1.07692 + (NH-3233.85,\ PROC-388154)\begin{pmatrix} 9.28287X10^{-8} & 1.31837X10^{-11} \\ 1.31837X10^{-11} & 1.04454X10^{-12} \end{pmatrix}\begin{pmatrix} NH-3233.85 \\ PROC-388154 \end{pmatrix}}$
6.	22448.1 + (11.6633) (Annual Operating Hours, NH, Hours)	55.5	**	$\pm 7.49222 \sqrt{13531375 + (NH - 3255.57)^2}$
7.	25941.6 + (11.6247) (Annual Operating Hours, NH, Hours)	53.2	3	± 7.24025 $\pm 7.24025 \sqrt{12{,}263.3 + (NH-3233.85)^2}$
8.	22810.2 + (18255.5) (Number of Operator/ Maintainers, LP, Men/Year)	52.3	1	± 11576.7 $\pm 11576.7 \sqrt{7.74279 + (LP-2.23077)^2}$

*Parameter ranges: $450 \le ND \le 4200$; $2 \le LP \le 4$; $5000 \le PROC \le 1{,}112{,}000$; $2080 \le NH \le 5400$; $39.72 \le PSOS \le 208.33$

**This equation was developed using LP and NH, where LP = NH/1747, hence LP does not appear as a factor.

TABLE 16. ANNUAL RECURRING O&S COST ESTIMATING RELATIONSHIPS FOR PREDICTIONS ON TEST SUBSYSTEM (BIT/BITE/DIAGNOSTIC) CIRCUITS ($/YEAR)

	Cost Estimating Relationships*	R^2(100%)	Sensitivity Rank	95% Prediction Confidence Interval
1.	14,419.4 + (74.1568) (Number of BIT Instructions, NI, Instructions/Year)	99.9	1	$\pm 1.14896 \sqrt{99004.4 + (NI-13950)^2}$
2.	8793.1 + (74.2135) (Number of BIT Instructions, NI, Instructions/Year) + (6.22424) (Number of TM Pages, ND, Pages/Year)	99.9	1 2	$\pm 51225.5 \sqrt{1.16667 + (NI-13950,\ ND-4.33333) \begin{pmatrix} 6.94442 \times 10^{-10} & 1.56249 \times 10^{-7} \\ 1.56249 \times 10^{-7} & 0.187535 \end{pmatrix} \begin{pmatrix} NI-13950 \\ ND-4.33333 \end{pmatrix}}$
3.	10,869.7 + (74.1703) (Number of BIT Instructions, NI, Instructions/Year) + (2240.61) (Length of Training Course, TTL, Weeks)	99.9	1 4	$\pm 56596.9 \sqrt{1.16667 + (NI-13950,\ TTL-1.5) \begin{pmatrix} 6.98318 \times 10^{-10} & 6.6325 \times 10^{-7} \\ 6.6325 \times 10^{-7} & 0.1098 \end{pmatrix} \begin{pmatrix} NI-13950 \\ TTL-1.5 \end{pmatrix}}$
4.	7457.22 + (74.1402) (Number of BIT Instructions, NI, Instructions/Year) + (44.002) (Material Cost for Repair, DDM, $)	99.9	1 7	$\pm 54688.8 \sqrt{1.16667 + (NI-13950,\ DDM-163.5) \begin{pmatrix} 6.96849 \times 10^{-10} & -6.70835 \times 10^{-9} \\ -6.70835 \times 10^{-9} & 1.77363 \times 10^{-5} \end{pmatrix} \begin{pmatrix} NI-13950 \\ DDM-163.5 \end{pmatrix}}$
5.	12,441.6 + (74.1937) (Number of BIT Instructions, NI, Instructions/Year) + (627.319) (Labor Time for Repair, LDR, Hours)	99.9	1 8	$\pm 57834.8 \sqrt{1.16667 + (NI-13950,\ LDR-2.33333) \begin{pmatrix} 2.15379 \times 10^{-9} & 2.48468 \times 10^{-5} \\ 2.48468 \times 10^{-5} & 0.423006 \end{pmatrix} \begin{pmatrix} NI-13950 \\ LDR-2.33333 \end{pmatrix}}$

*Parameter ranges: 102≤ND≤2100; 0.2≤TTL≤4; 20≤DDM≤300; 1 LDR≤4; 0≤NI≤36,700

4.2 GUIDELINES

4.2.1 General

1. When collecting data for known parameter values of the selected category of testers or when estimating these values, consider that the number of operator/maintainers (LP) and the total page count of the tester technical manuals (ND) are the two most cost sensitive parameters. To minimize error, great care and accuracy must be applied in developing these values.

2. The course length (TTL), annual operating hours (NH) and tester procurement costs (PROC) are also cost sensitive parameters, to a lesser degree, but nonetheless, for best results care must be exercised in estimating these values.

3. If there are significant software costs associated with the tester of interest, these CERs may not accurately predict its O&S cost.

4. As a rule of thumb, testers designed to fault isolate to the module/circuit card assembly can be expected to incur annual O&S costs at a rate of 2 or 3 times that of the testers designed to fault isolate to the component/piecepart.

5. Generally, hybrid testers can be expected to incur more O&S cost than either the analog or digital testers.

6. The annual O&S cost of testers designed to fault isolate to the module/circuit card assembly can be expected to be on the order of $100,000 per year (rough order of magnitude-ROM estimate). This figure increases significantly if the tester requires software maintenance. The increase could range from 2 to 20 times.

7. The annual O&S cost of testers designed to fault isolate to the component/piece part can be expected to be on the order of $50,000 per year (ROM).

8. The CERs developed from this study can only be considered as the starting point in the estimating process. The first estimates must be further modified in order to fit supplementary data as it prevails.

9. Preliminary indications (based on limited data) show that software O&S costs for both testers and test subsystems can be equal to or greater than the hardware O&S costs. At this point in time, it appears that the software recurring O&S costs can be as much as twenty to thirty times greater than hardware recurring O&S costs. Since software is still undergoing technological development, this large difference in software and hardware costs should eventually disappear. See Appendix A for further discussion.

10. All CERs have been developed using cost data expressed in constant 1979 dollars, therefore, any future use of these CERs must consider any inflation that has occured after 1979 and adjust the dollar results accordingly.

4.2.2 Guidelines for Estimating Tester Annual Recurring O&S Costs

1. Select the appropriate tester from 1 of the 6 classifications shown in the list below.

Tester	Fault Isolation Level	
Analog	Module/CCA	Piece Part
Digital	Module/CCA	Piece Part
Hybrid (Analog/Digital)	Module/CCA	Piece Part

2. Determine which parameter or parameters are known or can reasonably be estimated from the list below:

1.	CALR	Expected mean time between calibrations of tester	Days
2.	CDM	Average material cost for each calibration	$
3.	DDM	Average material cost for each repair of the tester	$
4.	LDC	Labor time expended per calibration	Manhours
5.	LDR	Labor time expended for each repair	Hours
6.	LP*	Annual no. of Operator/Maintainers required	Men/Year

7.	ND	Annual no. of TM pages to be maintained (total Tester TM pages)	Pages/Year
8.	NH*	Estimated annual operating hours of the tester	Hours/Year
9.	PROC	Tester system procurement cost	$
10.	PSOS	Required Operational/Maintenance floor space	Sq. Feet
11.	R	Estimated mean time between failure of the tester	Hours to failure
12.	TTL	Length of operator/maintainer training courses	Weeks

*Note: NH cannot exceed 8,760 hours/year and LP cannot exceed 6 men.

3. Select the appropriate table to enter (Table 11 through 15) as selected in step number 1. Enter this table to find the applicable CER.

4. Select the CER nearest the top of the list in the selected table which contains these known or predictable parameters and calculate the predicted annual recurring O&S cost for that type of tester.

5. Negative costs cannot exist, therefore, if the

   a. Tester cost is negative, set it to zero.

   b. Tester confidence limit is negative, set the limit to zero.

6. Optional Step — Since the user has the best concept of what he considers an acceptable error, he can determine the 95 percent confidence limits for his prediction as follows: Determine the error the user is willing to accept. Calculate the cost using the prediction confidence interval equation shown in the column next to the selected CER and compare this interval to the acceptable error of prediction. If the acceptable error falls within the calculated cost range, there is a 95 percent probability that the error of the calculated cost estimate is acceptable.

4.2.3 Guidelines for Estimating Test Subsystem Annual Recurring O&S Cost

1. Determine which parameter or parameters are known or can reasonably be estimated from the list below:

1.	DDM	Material Cost for Repair	$
2.	LDR	Labor Time for Repair	Hours
3.	LP	Annual No. of Oper/Maint	Men/Year
4.	ND	Annual No. of TM Pages	Pages/Year
5.	NH	Annual Operting Hours	Hours/Year
6.	NI	Annual No. of BIT Instr.	Instr/Year
7.	R	Mean Time Between Failure	Hours
8.	TTL	Length of Training Course	Weeks
9.	UC	Unit Reorder Cost	$/Item

2. Enter Table 16 to find the applicable CER and select the CER nearest the top of the list which contains these known or predictable parameters and calculate the predicted annual recurring O&S cost for the BIT/BITE of a typical ground electronics equipment system.

3. Negative costs cannot exist, therefore, if the

   a. Test subsystem cost is negative, set it to zero.

   b. Test subsystem confidence limit is negative, set the limit to zero.

4. Optional Step – Determine the error the user is willing to accept. Calculate the cost interval using the prediction confidence interval equation shown in the column next to the selected CER and compare this interval to the acceptable error of prediction. If the acceptable error falls within the calculated cost range, there is a 95 percent probability that the error of the calculated cost estimate is acceptable.

5.0 CONCLUSIONS

5.1 TESTERS

1. Tester O&S costs can reasonably be predicted using the prime weapon system operating hours that the tester is to support, its reliability and maintainability characteristics and physical characteristics (i.e., number of modules/circuit card assemblies). This information determines the tester usage (NH) and consequential O&S costs.

2. The tester CERs do not contain O&S cost of software maintenance and therefore may not estimate costs accurately when trying to compare costs of external testers to a prime weapon system test subsystem. However, cost comparisons of one category of tester to another can be made.

3. The circuits in modern electronic ground systems are more likely to be a mixture of analog and digital (hybrid) circuits than one or the other - especially when considering fault isolation to a module/circuit card assembly. Since the hybrid tester CERs are based on the largest number of tester samples (20), these CERs provide better and more useful predictions.

4. The number of operator/maintainers (LP) and the annual operating hours (NH) of testers are predictable as a function of the maintenance concept, reliability and operating scenario of the supported system. Since LP is the most cost sensitive parameter, it is the single most significant parameter and since NH is related directly to LP the CERs containing LP and NH are the most important CERs.

5. The NH and LP for testers are limited in range for this study as follows:

   $0 < NH \leq 8760$

   $0 < LP \leq 6$

6. The most sensitive O&S cost parameters of testers for all categories are the number of operator/maintainers (LP) and the total number of pages of the

tester technical manuals (ND). These two parameters more than any others, must be carefully and accurately estimated to minimize prediction error. The course length (TTL), the annual operating hours (NH) and the procurement cost of the tester (PROC) are also sensitive but somewhat less. These parameters must also be carefully estimated.

7. Regardless of which variables are used in a CER, the annual O&S cost generated includes the cost of maintenance (as impacted by tester reliability and maintainability), calibration, technical data maintenance, attrition training, replenishment spares and operations.

5.2 TEST SUBSYSTEM

1. The annual number of software instructions (lines of code) changed, NI, is the single most important O&S cost parameter because it is the largest cost driver, and the most cost sensitive parameter. The CER containing this parameter also shows the best fit (highest R^2 value).

2. The test subsystem operating hours, NH, is the second most important cost parameter since, as a single predictor, it has the second highest R^2 and is relatively cost sensitive.

3. Calibration and operations cost for test subsystems are negligible. The prime system operator, for example, is required regardless of whether or not there is an integral test subsystem.

5.3 SOFTWARE

Since software maintenance costs continue to increase annually at a significant rate and since this cost is often far greater than annual hardware maintenance cost, a separate section of discussion on this subject is presented in Appendix A. The conclusions of this discussion and this O&S cost study results are:

1. Software costs are major contributors to LCC of weapon systems.

2. Software cost drivers and their effect upon test program set development and maintenance must be more quantitatively identified and controlled.

3. Software BIT/diagnostic standardization is needed since methods, techniques and tools are still undergoing development.

4. There is a need to establish a uniform software error and cost data collection and analysis system.

5. BIT software costs can account for more than 80 percent of the test subsystem annual recurring O&S costs.

6. Software maintenance costs (cost per instruction) increases exponentially as the percent of memory utilization approaches 100 percent.

7. Software development cost is based on productivity, i.e., lines of code per manmonth, while maintenance cost is usually a level of effort (repair and enhance) equalling from 100 to 800 lines of code per manmonth at a change rate from 10 percent to 70 percent.

8. Software is "softer" than hardware, therefore, subjected to higher maintenance incidents (repair and enhancements).

5.4 DATA

During the course of the study, one area revealed itself as an area of major concern. This area includes the collection, organization/reduction and storage, with easy retrieval capabilities, of data on testers and test subsystems. This data is either non-existent or very inaccessible at the present time. Accurate field data on testers is difficult to assemble and catalog. In reference to the Air Force ATE LCC model, which was developed and published in 1974 by SA-ALC/MMIMP, Kelley AFB, Air Force personnel state that,

> "We have used a portion of it on ATE systems but never applied the total model because of the difficulty of getting recurring costs from operating sites."

Furthermore, they state,

> "It is recognized that present cost accounting procedures in the Air Force do not provide optimum methods for documenting LCC of ATE."

As stated previously, the objective of this study was to develop guidelines and cost estimating relationships for the operation and support costs of Testers and Test Subsystems which will enable designers to estimate O&S costs and in making trade-offs early in the development phase of a weapon system. In order to provide a useful tool, a large collection of O&S cost data is required. However, large amounts of tester, test subsystem O&S cost data do not exist even though there presently exist 12 or more government data banks. The conclusion of the Ad Hoc committee from a survey conducted between 1974 and 1976 was that presently existing data banks have a need for more accurate, reliable and timely data on test equipment. This conclusion was further substantiated by our attempts to acquire applicable tester data (O&S cost data) for this study. In general, it does not exist or cannot easily be accessed or retrieved. To quote another Air Force comment which typifies the situation,

> "Present data retrieval systems for support equipment are not used extensively due to information being incorrect, incomplete, outdated, costly and difficult to use. Decisions, based on these data systems, are difficult if not impossible to make."[14]

6.0 RECOMMENDATIONS

1. Although software costs account for more than half of the O&S costs and despite repeated recommendations, few data are being collected, in government and industry, on the history, progress, results and personnel participating in software development and maintenance. Efforts to improve the software production process, to assess qualitative and quantitative aspects of the process and product, are severely handicapped by a lack of data concerning past efforts. Therefore, it is recommended that better and more complete historical data on software error incidence and elimination, software enhancements and annual percentage change rates of BIT/diagnostic programs be collected and maintained. In addition, accurate records should be maintained on the production rate (e.g., lines of code per hour) of fault detection/isolation software programs for both external testers and internal prime system BIT/BITE diagnostic and equipment test programs.

2. It is necessary to have available various hardware aspects of the tester/test subsystem annual recurring O&S costs, therefore, more data should be collected in the various data categories as identified in this report and the CERs in this report should be appropriately updated as new data become available.

3. Since software O&S costs appear to overwhelm hardware O&S costs in hardware/software systems and since many systems exist (testers and test subsystems) which have little if any software functional capabilities, data should be collected and analyzed separately for hardware and separately for software. A separate hardware, a separate software and a combined hardware/software analysis should be conducted in order to develop separate and combined cost estimating relationships.

4. The results of the Industry Ad Hoc committee study task entitled "Industry/Joint Services Automatic Test Project" should be studied for possible incorporation in the results of this study.

5. Further study on the O&S cost characteristics of testers/test subsystems should consider stochastic approximation as a tool for developing cost estimators as a supplement to the presently developed CERs by regression techniques.

6. Even though false alarm rates (FAR) do not seem to contribute significantly to the ultimate tester/test subsystem costs, it is recommended that this subject be explored further. It is especially essential to establish an adequate FAR data collection, reduction and analysis system in order to evaluate this situation more closely.

APPENDIX A – DATA

The first section of the appendix contains a complete list of all testers considered as study candidates. Out of the 141 testers listed in Table A1, only 34 yielded enough complete data to be included in this study. Table A1 is followed by a listing of 25 ground electronic prime weapon systems containing candidate test subsystems for this study. These 25 candidates are shown in Table A2 which also indicates the final 6 systems yielding sufficient recurring O&S cost data to warrant inclusion in this study.

The next section of this appendix includes a listing of the complete set of data collected for this study. This section is followed by two discussions germane to this study. The topics of these two discussions are false alarm rates and tester/test subsystem software.

STUDY CANDIDATE TESTERS AND TEST SUBSYSTEMS

TABLE A-1. CANDIDATE TESTERS

Description	Manufacturer	Part No.	National Stock No.
1. Automatic Panel and Assembly Tester	Hughes	T510120	
2. Automatic Digital Card Tester	Hughes	*T510140	
3. Precision Analog Card Tester	Hughes	*T510144	
4. Manual Analog Tester	Hughes	*T510146	
5. Flexible Automatic Circuit Tester (FACT II)	Hughes	T510075	
6. Power Beam Unit Group Tester	Hughes	T160600	
7. In-Circuit Component Inspection Tester	Hughes	T510173	
8. System Memory Array Tester	Hughes	T510177	
9. Digital Card Tester	Hughes	*T510192	
10. General Analog Tester	Hughes	T510196	

NOTE: *Indicates testers used for this study

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock No.
11. Equate	RCA		
12. U.S. Roland Surveillance Radar Organizational Maintenance Test Set	Hughes	*	
13. U.S.Roland Field Maintenance Test Set	Hughes	*	
14. Digital Assembly & Test System	Hughes	*HC-192	6625-01-016-1866
15. NTDS Electronic Circuit Plug-in Unit Test Set (AN/SPM 19)	Hughes		
16. NTDS Electronic Circuit Plug-in Unit Test Set (UYA-4(V))	Hughes	TS 2460	
17. NTDS Electronic Circuit Plug-in Unit Test Set (SYA-4(V))	Hughes	TS 1780	
18. Digital Card Tester		TRENDAR 1000/2000	
19. Automatic Test System	Hewlett-Packard	HP 9510	
20. Power Distribution Tester	Hughes	*T510019	
21. Medium Rate Card Test Set	Hughes	*T510044	
22. Precision DC Tester	Hughes	*T510055	
23. High Frequency Logic Tester	Hughes	*T510056	
24. Universal Power Supply Tester	Hughes	*T510057	
25. Logic Analyzer Test Station	Hughes	*T510071	
26. Analog Card Tester	Hughes	*T510072	
27. Integrated Circuit Automatic Tester	Hughes	T510111	
28. Audio Card Tester	Hughes	T510101	
29. Electronic Test System	AAI Corporation	5500	6625-00-127-0082

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock No.
30. Assembly Tester	AAI Corporation	37654460-001	
31. Circuit Board Test System	Data Test Corp	5700	
32. Digital Circuit Analyzer	Data Test Corp	4700	
33. Auto Versatile Programmable Test Sys.	Bendix Corp	13A3770	4920-00-915-8388
34. Checkout Sequence Programming Set	Bendix Corp	AN/GJQ-9	4920-00-065-7877
35. Digital Circuit Analyzer	Data Test Corp	4000A	
36. Programmer Comparator	General Electric	230E654G1	4920-00-090-93310
37. Data Acquisition Systems	Hewlett-Packard	2014	
38. Logic Circuit Analyzer	General Radio	1790	6625-00-243-7461
39. AC/DC Systems Universal Test Set	Avtron, Inc.	T282	
40. Video Test Station	General Dynamics	*12A16815-1	4920-00-449-2903
41. Display Test Station	General Dynamics	12A6887	
42. Modular Automatic Test System	AVCO Systems Div.	3200-600	6625-00-140-2339
43 Auto Digital Assy. Test Equip.	Watkins Johnson	1175	
44. Universal Card Tester	Instrumentation Eng	IE390	
45. Automatic Wiring Analyzer	Dalmo Victor Co.	AN/USM185	6625-00-071-0083
46. Analog Digital Tester	PRD Electronics, Inc.	940/1	
47. Auto Test System for Complex Wiring	Automation Dynamics	QC442-444	
48. Automated High Speed Circuit Tester	Automation Dynamics	QC420-430	

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock Co.
49. Auto High Speed Ckt Tester	Automation Dynamics	QC400-410	
50. Automated Test System	Automation Dynamics	QC440	
51. Model T170 Test Set	Aviron, Inc.	T-170	4920-00-070-16129
52. Computer Diagnostic T/S	Automation Dynamics	QC440C/448	
53. Automatic Circuit Tester	Automation Dynamics	QC320P	
54. Logic Circuit Test System	Automation Dynamics	QC363	
55. Logic Module Diagnostic T/S	Automation Dynamic	QC560	
56. Automatic Camera Test Set	Computer Automation	212A	
57. Digital Logic Test Station	General Dynamics	66FC99-1	4920-00-106-5336
58. Analog Digital T/S	General Dynamics	12A11007	4920-00-012-4941
59. Flexible Test Station	Hughes	T1012500	4920-00-998-3480
60. Data Acquisition System	Hewlett-Packard	2018A	
61. Electronic Test Set	General Dynamics	12A6861	4920-00-192-1094
62. Microwave Test Station	General Dynamics	12A11019	4920-00-494-8635
63. Navigation Test Set	Vought Aero Div. LTV	*216-01942-1	4920-00-126-5548
64. Rev-Trans-Moor Test Station	General Dynamics	*12A16802-1	4920-00-350-7092
65. Computer Test Station	General Dynamics	*12A16803-7	4920-00-830-0740
66. AFCS Module Test Station	Honeywell Inc.	UG2395AA01	4920-00-446-3338
67. F 111 Test Station	General Dynamics	12A16846-6	4920-00-229-3760

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

	Description	Manufacturer	Part No.	National Stock No.
68.	Automatic Avionics Test System	Martron Systems	1200	4920-00-037-8167
69.	Navigation and Flight Control T/S	General Dynamics	*12A6873-3	4920-00-351-5023
70.	Converter and Flight Controls Test Set	General Dynamics	*12A6883	4920-00-681-4810
71.	Programmable Automatic Tester	Singer Co.	203	
72.	Auto Pilot Depot Tester F105	Hewlett-Packard	9205B	4920-00-458-4625
73.	Drove Checkout Flight Line	Hewlett-Packard	9500A-213	
74.	Depot Tester TSC-60/407L	Hewlett-Packard	9500D-244	6625-00-005-6509
75.	Instrument Calibration System	Hewlett-Packard	9550A-100	4920-00-020-9511
76.	Transmitter Depot Tester F4	Hewlett-Packard	9203C	4920-00-176-4080
77.	Automated Test System	Tektronix	S3260	
78.	Test Station Precision AC/DC Analog	General Dynamics	12A11097-1	4920-00-463-6113
79.	Video/Pulse/Analog Module Tester	General Dynamics	12A11098	4920-00-463-6108
80.	Automatic Circuit Analyzer	General Dynamics	*12A6863-2	4920-00-850-7349
81.	HSI Test Station	General Dynamics	12A6877	4920-00-105-1393
82.	Servo Ind Test Set	General Dynamics	*12A6825	4920-00-794-7581
83.	Servo and Indicator Test Set	General Dynamics	*12A6895	4920-00-850-7354
84.	Video Test Station	General Dynamics	*12A6875	
85.	Digital Logic Module T/S	General Dynamics	66FC	
86.	Central Air Data Computer T/S	General Dynamics	*12A1803	

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock No.
87. Central Data Processor - Controller	Burroughs	12A6830-1	
88. Automatic Component T/S	General Radio	2990/9259	
89. Automatic Test System	AAI Corporation	6000	
90. Auto Leakage Current Measuring SYSTEM	General Radio	2980/9152	
91. Auto Leakage Current Measuring SYSTEM	General Radio	2990/8178	
92. Auto High-Speed Electronic Circuit Tester	Sistomation	FIXIT700	
93. Punched Tape Programmed Inspection T/S	Sistomation	FIXIT701	
94. Disc-Programmed Inspection T/S	Sistomation	FIXIT706	
95. Automated Test System	Texas Instruments	ATS960	
96. Navigation Equip T/S	Northrop Corp	MR0192	6625-00-182-7802
97. Madar System Set	Lockheed Elec Div	2551F0200-4	
98. Auto Dynamic Digital Test	Sperry Microwave	A3100	
99. Computers/Inertial T/S	General Dynamics	7210000	
100. R F Test Station	General Dynamics	7310000	
101. Processors/Pneumatic T/S	General Dynamics	7410000	
102. Elect Equip Test Station	RCA	AN/USM-410	6625-00-614-9535
103. Microwave Test Station	Bendix	*13A6570-1	6625-00-003-1849
104. Circuit Analyzer	DIT-MCO	660B	6625-00-386-2068
105. Displays/Indicators T/S	General Dynamics	7510000	
106. Computer Test Station	Bendix	*13A6550-1	4920-00-016-3002

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock No.
107. Display Test Station	Bendix	*13A6560-1	4920-00-169-3000
108. Camera Test Set	CAI	LM212B	
109. Automatic Test System	AAI Corp	AAI5565	
110 Electro-Optical Viewing	Boeing	*F311018-1	4920-00-152-6633
111. Depot EVS Test Station	Boeing	F311024-1	4920-00-226-0423
112. Automatic Test System	AVCO	3200-5000	6625-00-279-5781
113. Automatic Test System	AAI Corp	AAI 6500	
114. Unit Automatic Test System	Hughes	1046245	
115. Electronic Test Set	Singer	C053870051	4920-00-068-9762
116. Automatic Test System	Martin Mariata	Martron	
117. Naval Air Rework Facility Automatic Test Station	Hughes		
118. Tailored Automatic Functional	Hughes	*1047874-100	
119. Radar TX/RX Test Station	Hughes	1046240	
120. Automate (Analog)	Hughes	None	
121. Automate (Digital)	Hughes	None	
122. Video Test Station	General Dynamics	*12A6885-1	4920-00-068-1482
123 Automatic Diagnostic System	Chrysler Corp		
124. Indicator & Sensors Test Station	Genreal Dynamics	*12A6876	4920-00-850-7104
125. Automatic Test System	ECI	Model 1121	
126. Special Acceptance T/E	AAI Corp	AAI 5500	

NOTE: *Indicates tester used for this study.

TABLE A-1. CANDIDATE TESTERS (Continued)

Description	Manufacturer	Part No.	National Stock No.
127. Mainframe Automatic Test System	Emerson	E8205	
128. RTM Test Station	General Dynamics	12A6872	4920-00-350-7350
129. Computerized Auto Tester	Grumman	A31U14000	
130. Computerized Auto Tester (Digital)	Grumman	A31U12000-3	
131. Computerized Auto Tester (Analog)	Grumman	A31U13000	
132. Universal DC Test Position	Hughes	*T510051	
133. Portable Digital Tester	General Radio	*GR-2225	
134. Radar Morter Locating	Hughes	*AN/TPQ-36	
135. Radar Artillery Locating	Hughes	*AN/TPQ-37	
136. Guided Missile System Interrupt - Aerial (US ROLAND FIRE UNIT)	Hughes	*AN/GSG-11	
137. System, Target Acquisition (IPD/TAS)	Hughes	*MK-23	
138. Console, Display (SID)	Hughes	*OJ-326(V)	
139. Radio, General Utility Special	Hughes	*AN/URQ-31	
140. Analog Module Test Set for AN/UYQ-21 (NTDS)		*AN/UYQ-21	
141. Electronic Circuit Plug-in Unit for AN/TSM-109		*AN/TSM-109	

NOTE: *Indicates tester used for this study

TABLE A-2. CANDIDATE SYSTEMS FOR BIT/BITE

Description	System	Branch
1. General Purpose Computer	HMP 1116	Air Force
2. General Purpose Digital Computer	H5118	Air Force
3. Tactical Air Control System	407L	Air Force
4. Tactical Air Control System/ Tactical Air Defense System	TACS/TADS	Air Force
5. Communications Systems	AN/TYQ-10	Air Force
6. Tactical Air Control System	AN/TYC-6	Air Force
7. Iranian Air Defense System	Seek Sentry	Air Force
8. Spain Air Defense System	Combat Grande	Air Force
9. Joint Surveillance System	JSS	Air Force
10. Hughes Improved Terminal	*Hit	Air Force
11. Joint Tactical Information Distribution System	JTIDS	Air Force
12. SEEK IGLOO	MAR	Air Force
13. Surveillance Radar	*U.S. ROLAND	Army
14. Mortar Locating Radar	*AN/TPQ-36	Army
15. *Artillery Locating* Radar	*AN/TPQ-37	Army
16. Firefinder Trainer	AN/TPQ-36/37	Army
17. Naval Tactical Display System	NTDS	Navy
18. Sea Control Ship Helicopter	SH-3D	Navy
19. Standard Information Display	*SID	Navy
20. Surveillance Towed Array Sensor	SURTASS	Navy
21. Air Search Radar	AN/SPS-52C	Navy
22. Improved Point Defense/Target Acquisition System	*IPD/TAS	Navy
23. Electronic Warfare System	AN/SLQ-31	Navy
24. Electronic Warfare System	AN/SLQ-17	Navy
25. Three Dimensional Search Radar	AN/SPS-39	Navy

NOTE: *Indicates system used for this study.

COLLECTED DATA UTILIZED FOR THIS STUDY

TABLE A-3. AIR FORCE TESTER O&S COST DATA

Seq	Num/Type	Air Force Tester Nomenclature	Tester Category
1	12A16815	Video Test Station	6
2	216019421	Inertial Measurement Test Set	3
3	12A16802	Receiver-Transmitter-Modular Test Station	6
4	12A16803	Computer Test Station	6
5	12A6873	Navigation and Flight Control Test Station	6
6	12A6883	Converter and Flight Controls Test Station	6
7	12A6863-2	Navigational and Weapon Components Test Station	6
8	12A6825	Servo and Indicators Test Station	6
9	12A6895	Servo and Indicators Test Station	6
10	12A6875	Video Test Station	6
11	12A1803A1	Central Air Data Computer Test Station	6
12	13A6570-1	Microwave Test Station	5
13	1346550-1	Computer Test Station	5
14	13A6560-1	Displays Test Station	5
15	F311018-1	Test Set-Line Replaceable Unit	5
16	12A6885	Video Test Station	6
17	12A6876	Indicator and Sensors Test Station	6

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Seq Num	National Stock Number (NSN)	Level of Fault Isolation	Manufactures Name
1	4920-00-449-2903	Component	General Dynamics
2	4920-00-126-5548	Plug-in Module	Vought Aero Div
3	4920-00-350-7092	Component	General Dynamics
4	4920-00-830-0740	Component	General Dynamics
5	4920-00-351-5023	Component	General Dynamics
6	4920-00-068-1481	Component	General Dynamics
7	4920-00-850-7349	Component	General Dynamics
8	4920-00-794-7581	Component	General Dynamics
9	4920-00-850-7354	Component	General Dynamics
10	4920-00-350-7104	Component	General Dynamics
11	4920-00-460-0397	Component	General Dynamics
12	6625-00-003-1849	Module	Bendix
13	4920-00-169-3002	Module	Bendix
14	4920-00-169-3000	Module	Bendix
15	4920-00-152-6633	Module	Bendix
16	4920-00-068-1482	Component	General Dynamics
17	4920-00-850-7353	Module/Component	General Dynamics

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Seq Num	Functional Description
1	Support various LRU's in attack RDR altimeter, terrian RDR, and ECM Systems
2	Test 3 LRU in AN/ASN-90
3	Support of Terrian following and attack radar systems
4	Maintenance on various airborne LRU's and modules
5	Maintenance on various F-111 airborne LRU's and modules
6	Maintenance support of F-111 flight control systems
7	Maint support of various navig and weapons delivery components of F-111
8	Maint support of various F-111 airborne components
9	Maint support of various F-111 A/B components of attack RDR set
10	Maint support of various LRU's of F-111 attack RDR altimeter terrian RDR
11	Maint of select F-111 weapons system LRU's
12	Testing and fault isolation of F-15 LRU's D/A processors microwave assys
13	Test/fault isolate to UUT internal measurement systems
14	Test/fault isolate to LRU A/D process, video dsply data proc arm cntrl
15	Perform oper checkout, align checks for 852 elec-optical viewing sys LRU
16	Support of LRU's in attack RDR, terrian RDR and ECM systems
17	Check LRU's of F-111 APN-167, ARN-52, ARN-58, AAR-34, ALF-23, 28, APQ-114, 110, 94

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Seq Num	Level	Application	Usage Level	Physical Derivations				
				Qty	Depth	Size (in) Width	Ht	Wt (lbs)
1	Module	F-111	Field	9	50	120	72	4000
2	SUBAS/ LRU	AN/ASN-70	Field	19	34	72	68	4650
3	MOD/ LRU	F-11/APQ- 110/128	Field	9	50	20	72	3810
4	Module	F-11/AJQ20/ ASG23	Field	9	30	106	75	3550
5	Module	F-111/ASG25/ ASQ119	Field	8	30	96	80	4550
6	Module	F-111/Conv	Field	8	50	96	72	3436
7	LRU	F-111/NAV/ WPN Sys	Int	15	50	72	75	2800
8	Module	F-111/APQ 113/ASG23	Field	14	30	48	72	1440
9	Module	F-111/APQ 34/113/114	Field	7	57	48	75	1600
10	Module	F-111	Field	8	50	120	72	4000
11	Module	F-111 LRU	Field	9	51	48	75	1800
12	LRU	F15 Avionics	Int/Dep	20	50	144	76	7200
13	LRU	F15 Avionics	Int	20	50	144	76	5450
14	LRU	F15 Avionics	Int	20	50	144	76	5450
15	LRU	B-52 EVS	Int	15	105	105	72	2400
16	MOD/ LRU	F-111/APQ- 111	Int	8	50	170	72	3200
17	LRU	F-111 Avionics	Int	9	30	96	72	6000

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Seq Num	Technical Publications: Technical Manual Pages (ND, Pages/Year)	Technical Publications: Course Length (TTL, Hours)	Training: Operator/ Maintainer (LP, Men/Year)
1	2000	80	2
2	2150	160	4
3	1500	80	2
4	1200	120	2
5	2700	80	2
6	2300	80	2
7	2300	80	4
8	1600	80	3
9	450	80	2
10	1900	80	2
11	450	80	2
12	1250	160	5
13	1200	160	5
14	1300	160	5
15	3000	200	4
16	4200	80	2
17	1600	80	2

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Seq Num	Operating Hours (NH, Hours/ Year)	Mean Time Between Failures (R, Hours)	Calibration: Mean Time Between Calibration (CALR, Days)	Calibration: Labor Time Per Calibration (LDC, Hours)	Calibration: Material Cost Per Calibration (CDM, $)
1	3240	71	-	-	-
2	6840	903	-	-	-
3	3240	138	-	-	-
4	3240	80	-	-	-
5	2880	210	-	-	-
6	2880	106	-	-	-
7	5400	277	-	-	-
8	5040	980	-	-	-
9	2520	1604	-	-	-
10	2880	177	-	-	-
11	3240	136	-	-	-
12	7200	118	-	-	-
13	7200	113	-	-	-
14	7200	122	-	-	-
15	5400	764	-	-	-
16	2880	73	-	-	-
17	2520	122	-	-	-

TABLE A-3. AIR FORCE TESTER O&S COST DATA (Continued)

Maintenance			Operations Space	Supply Support
Seq Num	Labor Time For Repair (LDR, Hours)	Material Cost For Repair (DDM, $)	Operational Floor Space (PSOS, Sq. Feet/ Year)	Procurement Cost (PROC, $)
1	11.80	0	208	508.00
2	17.48	0	85	704.00
3	11.91	0	208	465.00
4	11.00	0	110	502.00
5	7.38	0	100	1112.00
6	11.60	0	167	440.00
7	6.68	0	125	436.00
8	5.50	0	50	51.00
9	2.92	0	85	181.00
10	10.31	0	208	581.00
11	10.93	0	85	210.00
12	11.28	500.00	250	1287.00
13	10.17	500.00	250	1387.00
14	11.80	400.00	250	1213.00
15	12.20	200.00	383	512.00
16	7.80	0	208	285.00
17	8.60	0	100	270.00

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA

Seq	Num/Type	General Purpose Tester Nomenclature	Tester Category
1	-	Tailored Automatic Functional Test Set - Tafts	1
2	-	Analog Module Test Set for AN/UYQ-21 (NTDS)	1
3	-	Electronic Circuit Plug-in Unit for AN/TSM-109	5
4	-	Terminal Intermediate Level Tester for JTIDS	5
5	-	Roland Surveillance Radar Test Set (SRTS)	5
6	-	Roland Surveillance Radar Test Set (FMTS)	1
7	HC-192	Digital Assembly Test System	4
8	GR-2225	Portable Digital Tester	4

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

Seq Num	National Stock Number (NSN)	Level of Fault Isolation	Manufactures Name
1	-	Module	Hughes
2	-	Module	Hughes
3	-	Module/Card	Hughes
4	-	Module/Card	Hughes
5	-	Module/Card	Hughes
6	-	Module	Hughes
7	6625-01-016-1866	Component	Hughes
8	-	Component	General Radio

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OPERATIONS AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST--ETC(U)
JAN 80 D R BOGARD, T H HSU, R KIRKPATRICK F30602-78-C-0150

UNCLASSIFIED RADC-TR-79-334 NL

2 OF 4
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TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

Seq Num	Functional Description
1	Test Analog, Digital, Optical & Infared Modules
2	Test Analog Circuit Card Assemblier, Pwr Supl & Deflect Ampl.
3	Test Analog and Digital Printed Circuit Boards
4	Test of Analog and Digital Modules of JTIDS
5	Fault Isolate of the Roland Surveillance Radar Subassemblies
6	Fault Isolate of the Roland Surveillance Radar Subassemblies
7	Fault Isolate to Component of IC, Ram etc.
8	Fault Isolate to Component

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

Seq Num	Level	Application	Usage Level	Physical Dimensions Qty	Depth	Size (in) Width	Ht	Wt (lbs)
1	-	TAFTC	-	1	44	44	252	4800
2	Module	NTDS	-	1	23	44	26	490
3	-	AN/TSM-109	-	1	10	48	24	250
4	-	JTIDS	-	1	72	30	54	1500
5	Module	US Roland	Field	1	16	11	15	205
6	Module	US Roland	Field	1	30	120	67	5000
7	Component	IC DTL/	Field	1	25	22	14	85
8	Component	General	Field	1	21	22	14	70

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

	Technical Publications	Training	
Seq Num	Technical Manual Pages (ND, Pages/Year)	Course Length (TTL, Hours)	Operator/ Maintainer (LP, Men/Year)
1	10000	12	2
2	2000	2	1
3	13158	3	1
4	1316	2	1
5	484	3	1
6	3570	10	2
7	300	2	1
8	500	2	1

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

Seq Num	Operating Hours (NH, Hours/ Year)	Mean Time Between Failures (R, Hours)	Calibration: Mean Time Between Calibration (CALR, Days)	Calibration: Per Calibration (LDC, Hours)	Calibration: Material Cost Per Calibration (CDM $)
1	2080	180	182.5	10.00	40
2	130	2800	365	6.00	10
3	1040	1000	-	4.00	0
4	1040	1000	-	2.00	5
5	1040	2785	-	1.00	1
6	1820	48	182.5	8.00	50
7	1700	1000	-	0	0
8	1700	800	-	0	0

TABLE A-4. WEAPON SYSTEM TESTER O&S COST DATA (Continued)

Maintenance			Operations Space	Supply Support
Seq Num	Labor Time For Repair (LDR, Hours)	Material Cost For Repair (DDM, $)	Operational Floor Space (PSOS, Sq. Feet/ Year)	Procurement Cost (PROC, $)
1	0.75	100.00	385	600.00
2	1.50	5.00	35	150.00
3	1.00	50.00	16	500.00
4	1.00	192.00	135	500.00
5	4.00	200.00	33	500.00
6	4.00	60.00	420	-
7	0.50	20.00	19	14.00
8	0.80	20.00	16	29.00

TABLE A-5. HUGHES TESTER O&S COST DATA

Seq	Num/Type	Air Force Tester Nomenclature	Tester Category
1	T510019	Power and Distribution Test Position	2
2	T510044	Medium Rate Card Test Set	2
3	T510051	Universal DC Test Position	2
4	T510056	High Frequency Logic Test Position	6
5	T510057	Universal Power Supply Tester	2
6	T510071	Computer Peripherial Equip. (Logic Auto Tst Sys)	4
7	T510072	Analog Card Test Position	2
8	T510140	Automatic Digital Circuit Tester	4
9	T510144	Precision Analog Card Tester	2
10	T510146	Manual Analog	2
11	T510192	Digital Card Tester	4

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Seq Num	National Stock Number (NSN)	Level of Fault Isolation	Manufactures Name
1	-	Component	Hughes
2	-	Component	Hughes
3	-	Component	Hughes
4	-	Component	Hughes
5	-	Component	Hughes
6	-	Component	Hughes
7	-	Component	Hughes
8	-	Component	Hughes
9	-	Component	Hughes
10	-	Component	Hughes
11	-	Component	Hughes

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Seq Num	Functional Description
1	NTDS Power Circuit Card Tester
2	NTDS General Analog Card Tester
3	General Analog Card Tester
4	Analog/Digital Card Tester
5	Check Out of High Voltage Power Supplies
6	Automatic Perpherial Digital Card Tester
7	Manual Check of High Density Analog Cards
8	Automatic Digital Card Tester
9	Automatic/Manual Card Tester
10	Manual High Density Analog Card Tester
11	Digital Card Tester

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Seq Num	Level	Application	Usage Level	Physical Dimensions				
				Qty	Depth	Size (in) Width	Ht	Wt (lbs)
1	Card	NTDS Power Circuit	Org/Int	3	31	46	63	1100
2	Card	NTDS Analog Card	Org/Int	3	29	46	61	1100
3	Card	Analog Card	Org/Int	1	27	44	61	1200
4	Card	Anlg/Dig Card	Org/Int	1	26	44	61	1100
5	Module	Module	Org/Int	2	28	47	70	1400
6	Card	Digital Card	Org/Int	1	38	24	70	1050
7	Card	Analog Card	Org/Int	2	31	46	63	1500
8	Card	Digital Card	Org/Int	1	95	35	63	3475
9	Card	Card	Org/Int	4	120	34	63	4200
10	Card	Analog Card	Org/Int	1	34	94	64	1700
11	Card	Digital Card	Org/Int	1	85	40	38	1650

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Seq Num	Technical Publications: Technical Manual Pages (ND, Pages/Year)	Technical Publications: Course Length (TTL, Hours)	Training: Operator/ Maintainer (LP, Men/Year)
1	630	40	2
2	785	40	3
3	580	40	2
4	600	40	2
5	1200	40	2
6	1260	80	2
7	900	40	4
8	2400	120	1
9	4300	160	2
10	1255	40	4
11	2000	160	1

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Seq Num	Operating Hours (NH, Hours/ Year)	Mean Time Between Failures (R, Hours)	Calibration		
			Mean Time Between Calibration (CALR, Days)	Labor Time Per Calibration (LDC, Hours)	Material Cost Per Calibration (CDM, $)
1	2773	103	37	2.40	4.90
2	4160	155	23	1.70	78.20
3	2080	153	19	0.50	-
4	2080	58	91	1.90	1.00
5	1820	35	17	1.50	119.80
6	2080	36	19	1.50	0.80
7	5720	118	17	3.50	2.40
8	152	1	12	1.10	2.40
9	2080	23	14	5.20	16.50
10	5720	147	74	0.90	-
11	1700	-	91	7.30	-

TABLE A-5. HUGHES TESTER O&S COST DATA (Continued)

Maintenance			Operations Space	Supply Support
Seq Num	Labor Time For Repair (LDR, Hours)	Material Cost For Repair (DDM, $)	Operational Floor Space (PSOS, Sq. Feet/ Year)	Procurement Cost (PROC, $)
1	0.90	0.84	50	5.80
2	0.88	0.57	46	11.00
3	1.10	0.60	41	8.00
4	0.96	1.04	40	5.00
5	1.09	1.91	46	53.00
6	1.44	2.76	32	80.00
7	0.95	2.59	50	20.00
8	1.35	0.89	115	184.00
9	2.75	1.78	146	132.00
10	0.83	0.69	111	17.00
11	1.0	100.00	148	10.00

TABLE A-6. TEST SUBSYSTEM O&S COST DATA

Seq	Num/Type	Test Subsystem Nomenclature
1	AN/TPQ-36	Radar, Mortar Locating
2	AN/TPQ-37	Radar, Artillery Locating
3	AN/GSG-11 (SO-1)(V-2)	Guided Missile System, Intercept - Aerial (U.S. Roland Fire Unit)
4	Mk 23	System, Target Acquisition (IPD/TAS)
5	OJ-326(V)/ UYK(1-4)	Console, Display (SID)
6	AN/URQ-31	Radio, general Utility, Special (JTIDS/HIT)

TABLE A-6. TEST SUBSYSTEM O&S COST DATA (Continued)

Seq Num	Technical Publications: Technical Manual Pages (ND, Pages/Year)	Course Length (TTL, Hours)	Training: Operator/ Maintainer (LP, Men/Year)
1	560	60	4
2	700	60	5
3	162	8	6
4	2100	56	4
5	1000	160	4
6	200	16	3

TABLE A-6. TEST SUBSYSTEM O&S COST DATA (Continued)

Seq Num	Operating Hours (NH, Hours/ Year)	Mean Time Between Failures (R, Hours)	Calibration		
			Mean Time Between Calibration (CALR, Days)	Labor Time Per Calibration (LDC, Hours)	Material Cost Per Calibration (CDM, $)
1	1600	13508	NA	NA	NA
2	1600	10776	NA	NA	NA
3	8760	9533	NA	NA	NA
4	8760	1850	NA	NA	NA
5	7536	5950	NA	NA	NA
6	8760	5000	NA	NA	NA

TABLE A-6. TEST SUBSYSTEM O&S COST DATA (Continued)

Maintenance			Operations Space	Supply Support
Seq Num	Labor Time For Repair (LDR, Hours)	Material Cost For Repair (DDM, $)	Operational Floor Space (PSOS, Sq. Feet/ Year)	Procurement Cost (PROC, $)
1	1	170	NA	2123
2	1	191	NA	2386
3	3	200	NA	39079
4	4	300	NA	5000
5	2	240	NA	1000
6	3	60	NA	1666

FALSE ALARM RATE

The false alarm rate of testers and test subsystems is related to the number of times (or the rate at which) the tester or test subsystem (BIT/BITE) indicates that a particular item is faulty when it really is not. Therefore, this good item, thought to be faulty, is removed from the system and sent to a repair facility for further testing and repair or else the item is locally repaired unnecessarily. In either case, additional support resources are needlessly consumed.

The false alarm rate has been called by many other names such as cannot duplicate rate, no fault rate, false pull rate, unverified failure rate, false removal rate etc. The meaning is still the same, however, a good unit or units have been worked on unnecessarily.

In most cases, the false alarm rate can be reduced since it is a design problem. That is, a different design could detect faults with greater certainty by performing more thorough tests. BIT is one way to accomplish this and BIT is being specified more and more by the military services for new weapon system designs. For example, this is typically specified for Airborne Radar Systems, as follows:[8]

BIT Thoroughness: BIT shall detect 98 percent of all failures weighted by failure rates. BIT shall fault isolate 99 percent of all detected failures to the faulty WRA.*

"BIT Performance: A failure for purposes of the specification means that the equipment does not meet the requirements of the procurement specification.

BIT False Alarms: A false alarm occurs if a WRA is declared defective and it is found to be failure free. The BIT false alarm rate shall be less than 1 percent.

BIT Thoroughness Calculation: A BIT thoroughness analysis is to be provided which uses a procedure defined in the specification. The procedure is similar to that described in the Navy BIT Design Guide."[3]

Another contributing factor to a systems false alarm rate is the human element. Many times, the pressures exerted to increase the systems operational availability causes maintenance personnel to remove more units than absolutely necessary in order to guarantee that the bad units are found. In addition to this factor, it is

*NOTE: WRA is the Weapon Replaceable Assembly and it is the unit removed from the aircraft and sent to a shop for repair.

sometimes only possible and/or desireable (i.e., economical) to fault isolate to a group of line replaceable units (LRU) instead of single LRU. This requirement may be stated, as it was recently for the Seek Igloo Minimally Attended Ground Radar System, as follows:

Features	Specification
Fault Detection	98% of all faults
Fault Isolation	85% to 1 LRU 95% to 3 LRU 100% to 8 LRU

Unfortunately, virtually no historical recorded data could be found for the false alarm rate on either testers or test subsystems which support ground weapon systems. However, several studies have been conducted and data continues to be collected on the false alarm rate of Avionic Systems (primarily radar systems). The data found is summarized in the following list:

System	Far	Comments
1. DC 10 Multiplexer System	5%	5 years experience
2. F15/AWG-9 Radar	17-26%	Reference (19)
3. Airline Avionics	30-40%	Reference (22)
4. Avionics	30%	Reference (23)
5. SH 3D Helicopter	2-46%	Reference (25)
6. Electronically Agile Radar	23.7%	Reference (12)
7. Navy LORA	20%	Reference (16)

From this data, it can be assumed that the average false alarm rate is about 20%. The only cost elements which are appreciably affected by the false alarm rate are the maintenance labor of the item being repaired and spares. This effect in itself is very small and the omission of the false alarm rate cost contribution in the CER development does not significantly affect the final CER.

SOFTWARE

In recent years we have seen a marked increase in the demand for some software capabilities included within the design of prime weapon systems. The major attraction being the mythical ease and cost effectiveness associated with incorporating new design requirements in an existing design. Software design changes are not only thought to be made with ease but with low cost due to that fact that there is no recurring costs as that associated with hardware modifications. It is true that software has no recurring cost element associated with it, i.e., it is only necessary to develop the design, copy it to tape or disc and distribute the new program. Unfortunately, history does not bear out this theory. Software costs, presently being experienced far exceed hardware development and maintenance costs. This trend is evidenced both in commercial systems as well as military systems.

As figure A-1 shows, software costs are running between 80 and 90 percent of the total system costs.

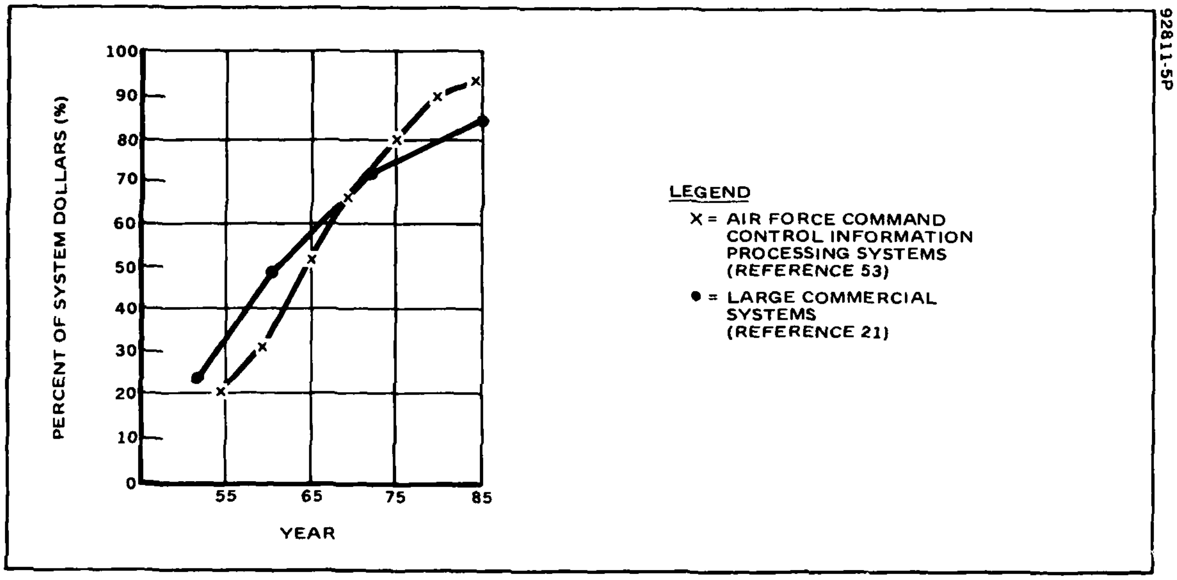

Figure A-1. Percentage of Large System Dollars Spent for Software/Support

Software costs are presently consuming a significant portion of the DoD budget. DoD presently spends over $3 billion per year on defense system software and these are only the direct costs.[54] Indirect costs such as operational delays and readiness, mission rates and other operations oriented concerns lead to many other significant dollar losses within the military services.

One contributing cost factor is the requirement of full or near full memory utilization. Due to such things as weight, size and acquisition cost constraints imposed upon many military weapon systems, memory hardware elements tend to be minimized. Due to sophisticated and complex operational/maintenance requirements, the software is designed to utilize maximum capacity of the memory. As shown in the graph below, Figure A-2, the relative cost per instruction increases exponentially as the computer memory utilization approaches capacity.[21] In this case, changes, modifications and updates are very difficult to achieve and require great labor intensive efforts with consequential high costs.

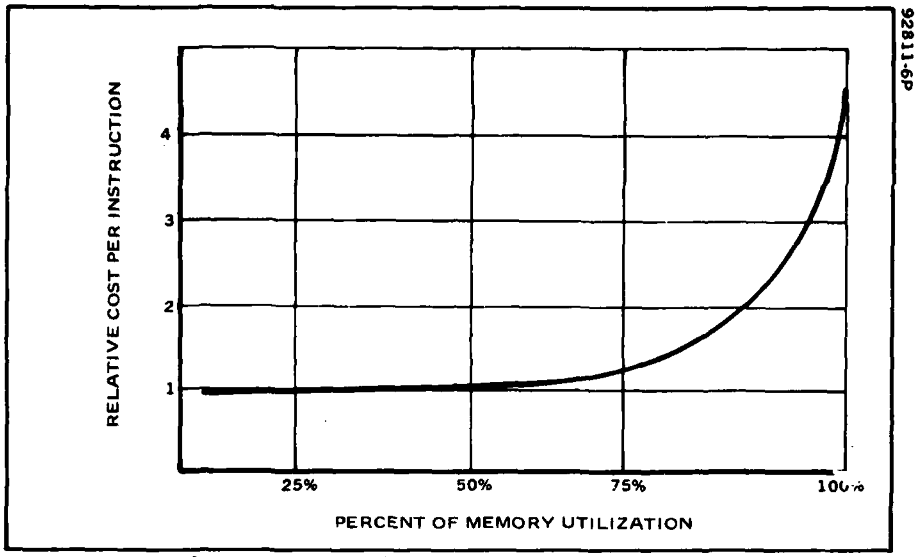

Figure A-2. Software Cost Tends to Increase Sharply as Memory Utilization Approaches Capacity

Software costs can be thought of as being developed in phases. The phases can be described as including the following:[45]

(1) System Software Requirements

(2) Preliminary/Detailed Design

(3) Coding and Debugging

(4) Development Testing

(5) Test and Preoperations Validation

(6) Operations and Maintenance

As the software development evolves the cost of changing the software program increases exponentially.[53] This is illustrated below in Figure A-3. Therefore, it is more economical to maximize the implementation of change requirements and software fixes as early in the development cycle as possible. Unfortunately, most of the costs associated with software are incurred after software development during the operations and maintenance phase.

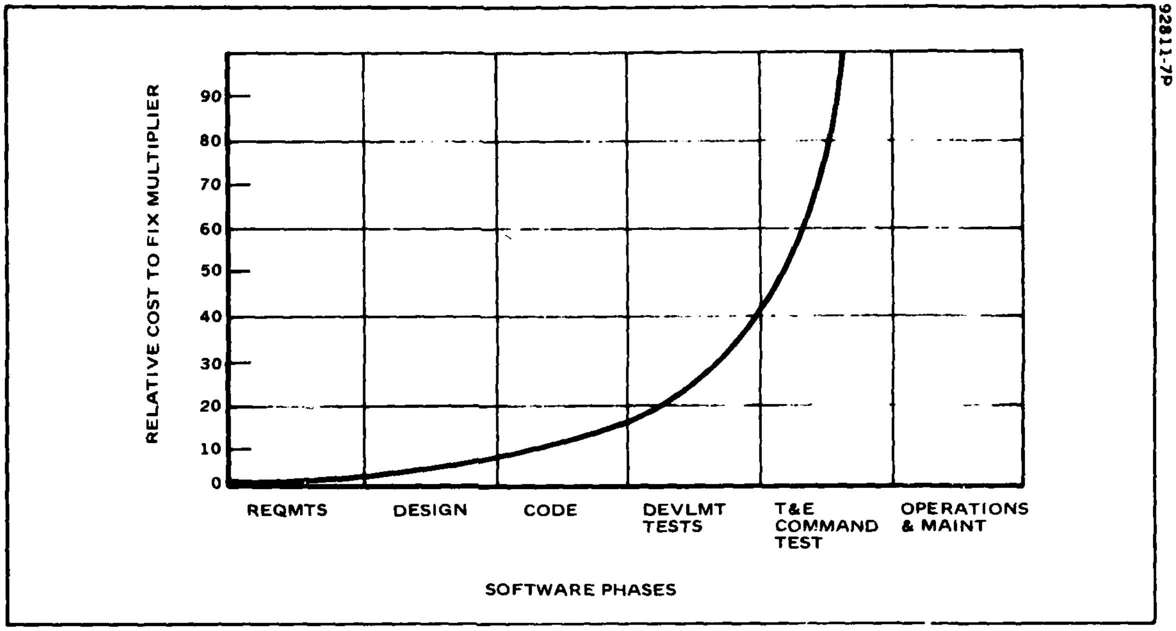

Figure A-3. Changes in Software in Succeeding Phases of Development Drive Up the Cost Exponentially

The operations and maintenance phase presently accounts for nearly 60% of the total system costs, as shown in Figure A-4,(45) or about 2/3 of the total software costs.

Most of this can be attributed to a lack of adequate early testing which could minimize much of this software maintenance cost. However, program errors can never be completely eliminated because of the complex logical relationships and the vast number of distinct internal states which exist in computer programs. Unfortunately, no reasonable amount of testing can completely check out any but the simplest programs.

The other major factor contributing to high software maintenance costs is the number of changes, updates and modifications applied to developed software programs. This rate of change can be minimized by making the users more aware of the high cost per change. The following example illustrates how extreme this cost can become. In 1973, an Air Force survey of avionics software revealed that it cost $75

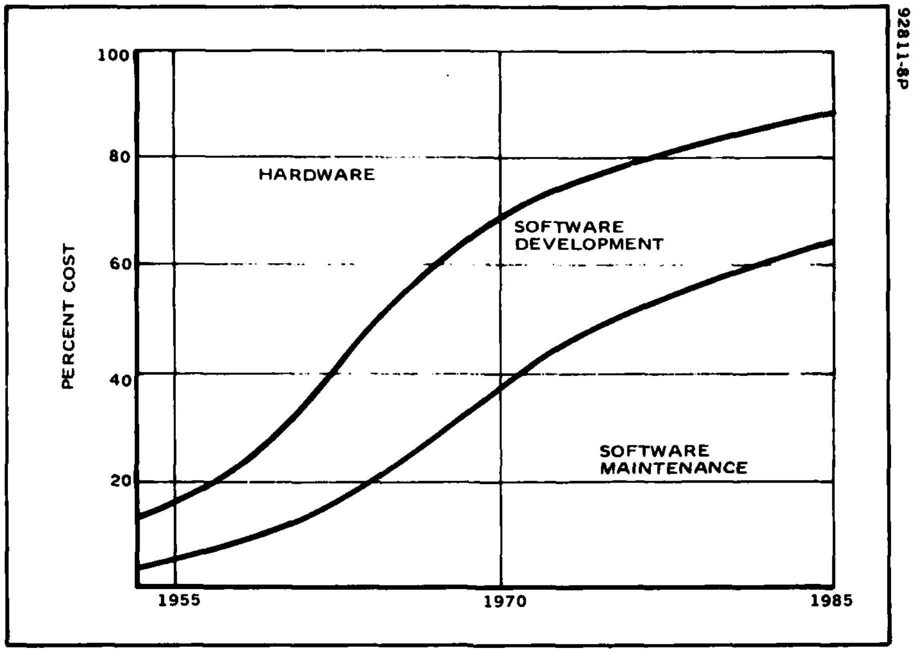

Figure A-4. Hardware-Software Cost Trends Reveal the Increasing Proportion of Costs Going to Software Maintenance

to develop a single instruction, while maintenance of that instruction cost upwards to $4,000.[42] Other studies, further reveal enormous error rates such as the experience of the strategic Air Command's Automated Command Control System study. This study indicated software errors were discovered at a rate as high as one per day. Eventually, nearly 95% of its software had to be rewritten after delivery.[53]

Most of the experiences previously sited are based upon operational software as opposed to BIT/diagnostic type software, however, enough similarities between the two types of software applications exist to permit the development of software maintenance cost estimating relationships. Both operational and maintenance type software require better and more complete data on software error incidence and elimination. Software maintenance cost estimating is hampered by the unpredictable nature of future changes and by the lack of good solid historical data. However, a number of significant software cost drivers have been identified but quantitative impacts need much more study. For this study a simple multiplicative relationship between the number of software instructions per year which require maintenance (revision rate) and the cost per maintenance instruction (productivity rate), was developed and used. Since software maintenance is a modification process due to the discovery of software errors or by introduction of new operational requirements and since it is, to a certain extent, a repeat in miniature of the development process, many of the same cost drivers apply. That is, the major influencing factor is still how often changes are made to programs (for whatever reason) and how difficult it is to make these changes.

The challenge to software cost estimating attempts is to overcome the little standardization that exists today for the methods, tools and software activity. Methods and controls are still undergoing constant revision. Cost data are sparse, ill-defined and difficult to correlate among systems.[55] Shown in Table A-7 is the productivity rate of a number of systems for software development and at least one example for maintenance.

TABLE A-7. SOFTWARE LIFE CYCLE COST DATA

Source	Productivity (Lines of Code per Man-year)	
	Development	Maintenance
IBM	20-1500	-
SAFEGUARD	146-1600	-
BCS	300-2000	-
VIKING	720-2880	-
IBM (1975)	3200	15,000

Even though the table displays wide variations of productivity, some general feel can be developed from the data. In fact, useful rules of thumb for estimating purposes have developed from this and similar such data sets. These generally accepted and applied rules are shown below in Table A-8.

TABLE A-8. SOFTWARE LCC PERCENTAGE DISTRIBUTION OF EFFORT

	Development			Maintenance	
Rules of Thumb	50%			50%	
	Design	Code	Test	Repair	Enhance
	40%	40%	40%	25-50%	50-75%

To further aid in the analysis efforts of this study, several sources were consulted in order to develop an annual revision rate estimate for software maintenance programs (percent change of the original code per year) and the productivity rate of the changes (dollars per line, or instruction of code). The data collected showed that the change rate varied from 5% to 100% per year. The selected average for this study was 50%. The productivity rate varied from $3 per line to $4,000 per line with a selected average of $75 per line. The data collected is shown in Table A-9.

TABLE A-9. ESTIMATING DATA FOR PRIME WEAPON SYSTEMS SOFTWARE MAINTENANCE COSTS

Source	Revision Rate (% per Year)	Productivity Rate ($/Line)
1. Firefinder TMDE/TRA Study	-	50
2. Combat Grande Proposal	-	3
3. Seek Igloo Proposal	-	6
4. Historical Experience	-	41
5. Historical Experience	-	16
6. Historical Experience	-	52
7. Historical Experience	-	35
8. U.S. Roland FMTS	50	24
9. AN/USM-7	65	50
10. GR 1792	70	-
11. Trident-Unit 1	5	40
12. Trident-Unit 2	40	40
13. Engineering Estimate	30	40
14. Engineering Estimate	10	-
15. Boeing	-	7
16. USAFLC-Sacramento	-	44
17. USAF Avionics	-	*
18. IBM	-	5
19. GTE Labs	-	50
Selected Average	50	75

*NOTE: This source indicated $75 per line to develop and $4000 per line to maintain but this was not included in the consideration of a selected average because of its extreme deviation which indicates an atypical situation probably caused this condition.

APPENDIX B – REGRESSION AND PREDICTION CONFIDENCE INTERVAL MODEL RESULTS

The first section of this appendix contains a complete set of the regression analysis results. Only 73 out of 150 were chosen as the most useful and these are summarized in Section 4 of the main body of the report. The remainder can be found in this appendix in case the reader desires to develop more CERs.

The second section of this appendix contains a complete set of the prediction confidence interval results.

On the computer printouts, "N" is the sample size (i.e., number of testers in that group or number of test subsystems) and "V" is the number of values listed for each data set sample shown immediately below. V (the independent or dependent variable) is numbered 1 through 22 and represents the variable data as shown by Table B-1.

TABLE B-1. REGRESSION MODEL LEGEND

Independent or Dependent Variable No.	Tester	Test Subsystem
1.	O&S Cost	O&S Cost
2.	RFM	ND
3.	RA	LP
4.	RT	TTL
5.	DT	NH
6.	BTS	R
7.	RSF	UC
8.	RDL	LDR
9.	CSFAS	DDM
10.	RO	NI
11.	ND	
12.	LP	
13.	TTL	
14.	PROC	
15.	NH	
16.	LDR	
17.	R	
18.	DDM	
19.	LDC	
20.	CALR	
21.	CDM	
22.	PSOS	

NOTE: For definitions see Section 2.2.

The remaining results as displayed are explained in Section 3.

REGRESSION ANALYSIS RESULTS

The complete computer printout results of 5 of the 6 tester categories are contained within this section. One category of testers, i.e., digital circuit testers that fault isolate to the module/circuit card assembly is not included since there were not enough samples. This section also includes the complete computer printout results of the 6 test subsystems used in this study. The sets of data used for these results are labeled DATA 1, DATA 2, DATA 4, DATA 5, DATA 6, and DATA 7. DATA 1, 2, 4, 5 and 6 represent tester data on tester Categories 1, 2, 4, 5 and 6 respectively. Tester categories are explained in Section 3. When there are two sets of data such as for DATA 2, DATA 4, DATA 5, DATA 6 and DATA 7, the second such data set is for the multiple linear regression analysis which applies more than one variable. Likewise for both of the test subsystem data sets, DATA 7.

MULTIPLE LINEAR REGRESSION ANALYSIS

MON, JUN 11, 1979, 10:12 AM

DATA IS FROM FILE => DATA1

N = 3
V = 22

123468.	6.2	.33	696	1000
250	.015	16.75	3	18000
10000	2	12	600000	2080
.75	5.55556E-03	100	10	5.47945E-03
40	385			
34069.2	6.2	.33	696	1000
250	.015	16.75	3	18000
2000	1	2	150000	130
1.5	3.57143E-04	5	6	2.73973E-03
10	35.14			
87801.	6.2	.33	696	1000
250	.015	16.75	3	18000
3570	2	10	800000	1820
4	2.08333E-02	60	8	5.47945E-03
50	375			

NUMBER OF REGRESSION MODELS = 12

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
11	5190	4238.9
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.898931
.898931	1.

COVARIANCE MATRIX

8.41808E+08	-112270
-112270	21.632

INDEX	B	STD. ERROR	T-RATIO
0	32248.4	29013.9	1.11148
11	9.54356	4.65102	2.05193

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-336403.	400899.
11	-49.5523	68.6394

****** TEST OF HYPOTHESIS ******

```
INDEX
0             ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL        32248.4
11            ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL        9.54356

STAND. ERROR OF EST. = 27881.5                 D.F.= 1
```

ACTUAL	PREDICTED	RESIDUAL
123468.	127684.	-4215.88
34069.2	51335.5	-17266.3
87801.	66318.9	21482.2

R-SQUARED = .808076

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.66667	.57735
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.918132
.918132	1.

COVARIANCE MATRIX

2.86231E+09	-1.59017E+09
-1.59017E+09	9.54103E+08

INDEX	B	STD. ERROR	T-RATIO
0	-37496.2	53500.5	-.700856
12	71565.3	30888.6	2.31689

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-717274	642282.
12	-320905.	464035.

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-37496.2
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	71565.3

STAND. ERROR OF EST. = 25220.4 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	105635.	17833.5
34069.2	34069.2	0
87801.	105635.	-17833.5

R-SQUARED = .842964

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
13	8	5.2915
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.976476
.976476	1.

COVARIANCE MATRIX

2.78011E+08	-2.69043E+07
-2.69043E+07	3.36304E+06

INDEX	B	STD. ERROR	T-RATIO
0	15342.5	16673.7	.920161
13	8304.62	1833.86	4.5285

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-196513.	227198.
13	-14996.4	31605.6

****** TEST OF HYPOTHESIS ******

INDEX		
C	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	15342.5
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8304.62

STAND. ERROR OF EST. = 13723.3 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	114998.	8470.14
34069.2	31951.7	2117.48
87801.	98388.7	-10537.7

R-SQUARED = .953505

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
14	516667.	332917.
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1	.756701
.756701	1.

COVARIANCE MATRIX

2.66186E+09	-4035.09
-4035.09	7.80985E-03

INDEX	B	STD. ERROR	T-RATIO
0	28930.4	51593.2	.560741
14	.102288	8.83734E-02	1.15746

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-626613.	684474.
14	-1.02058	1.22516

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	28930.4
14	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	.102288

STAND. ERROR OF EST. = 41607.5 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	90303.5	33164.6
34069.2	44273.7	-10204.5
87801.	110761.	-22960.1

R-SQUARED = .572595

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	1343.33	1058.79
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.95984
.95984	1.

COVARIANCE MATRIX

3.62860E+08	-191011.
-191011.	142.192

INDEX	B	STD. ERROR	T-RATIO
0	26975.6	19048.9	1.41613
15	40.7969	11.9244	3.42128

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-215059.	269011.
15	-110.715	192.309

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	26975.6
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	40.7969

STAND. ERROR OF EST. = 17855.1 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	111833.	11634.9
34069.2	32279.2	1789.95
87801.	101226.	-13424.9

R-SQUARED = .921292

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
16	2.08333	1.70171
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1	-.105851
-.105851	1.

COVARIANCE MATRIX

4.33644E+09	-1.44068E+09
-1.44068E+09	6.91526E+08

INDEX	B	STD. ERROR	T-RATIO
0	87611.3	65851.7	1.33043
16	-2799.28	26296.9	-.106449

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-749100.	924322.
16	-336927.	331329.

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	87611.3
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-2799.28

STAND. ERROR OF EST. = 63285.7 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	85511.8	37956.3
34069.2	83412.3	-49343.1
87801.	76414.1	11386.9

R-SQUARED = 1.12042E-02

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
17	8.91534E-03	1.06435E-02
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.354931
.354931	1.

COVARIANCE MATRIX

2.42202E+09	-1.39305E+11
-1.39305E+11	1.56253E+13

INDEX	B	STD. ERROR	T-RATIO
0	68400.1	49214.	1.38985
17	1.50071E+06	3.95288E+06	.379649

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-556913.	693713
17	-4.87246E+07	5.17260E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	68400.1
17	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	1.50071E+06

STAND. ERROR OF EST. = 59499.6 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	76737.4	46730.7
34069.2	68936.1	-34866.9
87801.	99664.8	-11863.8

R-SQUARED = .125976

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
18	55	47.697
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1	.999683
.999683	1.

COVARIANCE MATRIX

2.56962E+06	-31118.4
-31118.3	565.788

INDEX	B	STD. ERROR	T-RATIO
0	29902.8	1603.	18.6543
18	943.211	23.7863	39.6535

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	9535.08	50270.6
18	640.982	1245.44

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	29902.8
18	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	943.211

STAND. ERROR OF EST. = 1604.47 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	124224.	-755.859
34069.2	34618.9	-549.717
87801.	86495.5	1305.54

R-SQUARED = .999364

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
19	8	2
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1	.993263
.993263	1.

COVARIANCE MATRIX

4.53359E+08	-5.44031E+07
-5.44031E+07	6.80038E+06

INDEX	B	STD. ERROR	T-RATIO
0	-97017.8	21292.2	-4.55649
19	22349.7	2607.75	8.57046

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-367557.	173521.
19	-10784.5	55483.8

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-97017.8
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	22349.7

STAND. ERROR OF EST. = 7375.84 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	126479.	-3010.69
34069.2	37080.1	-3010.94
87801.	81779.4	6021.59

R-SQUARED = .986572

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
20	4.56621E-03	1.58178E-03
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.918131
.918132	1.

COVARIANCE MATRIX

2.86227E+09	-5.80406E+11
-5.80406E+11	1.27109E+14

INDEX	B	STD. ERROR	T-RATIO
0	-37496.4	53500.2	-.700863
20	2.61214E+07	1.12743E+07	2.31691

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-717270.	642278.
20	-1.17129E+08	1.69372E+08

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-37496.4
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2.61214E+07

STAND. ERROR OF EST. = 25220.2 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	105635.	17833.5
34069.2	34069.1	.078125
87801.	105635.	-17833.6

R-SQUARED = .842964

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBEP = 1
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
21	33.3333	20.8167
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.796072
.796072	1.

COVARIANCE MATRIX

2.39654E+09	-5.70604E+07
-5.70604E+07	1.71181E+06

INDEX	B	STD. ERROR	T-RATIO
0	24413.1	48954.4	.49869
21	1720.99	1308.36	1.31538

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-597602	646428.
21	-14903.1	18345.

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	24413.1
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1720.99

STAND. ERROR OF EST. = 38517.2 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	93252.7	30215.4
34069.2	41623	-7553.82
87801.	110463.	-22661.6

R-SQUARED = .633728

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
22	265.047	199.168
1	81779.4	45002.6

CORRELATION COEFFICIENTS

1.	.927791
.927791	1.

COVARIANCE MATRIX

6.87222E+08	-1.88372E+06
-1.88372E+06	7107.12

INDEX	B	STD. ERROR	T-RATIO
0	26215.8	26214.9	1.00003
22	209.637	84.3037	2.48669

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-306871.	359303.
22	-861.526	1280.8

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	26215.8
22	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	209.637

STAND. ERROR OF EST. = 23745.5 D.F.= 1

ACTUAL	PREDICTED	RESIDUAL
123468.	106926.	16542.
34069.2	33582.4	486.741
87801.	104830.	-17028.7

R-SQUARED = .860794

```
MULTIPLE LINEAR REGRESSION ANALYSIS

              TUE, JUN 12, 1979,  7:35 AM

DATA IS FROM FILE => DATA2

N =  7
V =  22
63231.3        6.2             .33            696            1000
250            .015            16.75          3              18000
785            3               1              11000          4160
.88            6.45161E-03     .57            1.7            4.42478E-02
78.2           46.32
41542.8        6.2             .33            696            1000
250            .015            16.75          3              18000
530            2               1              8000           2080
1.1            6.53595E-03     .6             .5             .052356
0              41.25
82812.1        6.2             .33            696            1000
250            .015            16.75          3              18000
900            4               1              20000          5720
.95            8.47458E-03     2.59           3.5            5.91716E-02
2.4            49.51
76847.6        6.2             .33            696            1000
250            .015            16.75          3              18000
4300           2               4              132000         2080
2.75           4.34783E-02     1.78           5.2            7.40741E-02
16.5           145.83
83579.7        6.2             .33            696            1000
250            .015            16.75          3              18000
1255           4               1              17000          5720
.83            6.80272E-03     .69            .9             1.34953E-02
0              110.97
42296.9        6.2             .33            696            1000
250            .015            16.75          3              18000
630            2               1              5800           2773
.9             9.70874E-03     .84            2.4            2.68817E-02
4.9            49.51
49762.8        6.2             .33            696            1000
250            .015            16.75          3              18000
1200           2               1              53000          1820
1.09           2.85714E-02     1.91           1.5            5.78035E-02
119.8          45.69

NUMBER OF REGRESSION MODELS =  12

REGRESSION NUMBER =  1
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  11
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1     :DEPENDENT VARIABLE IS  1

INDEX         MEANS          STANDARD DEVIATIONS
11             1378.57        1314.11
1              62867.6        18583.1

CORRELATION COEFFICIENTS
1              .431948
.431948        1.

COVARIANCE MATRIX
1.09981E+08    -44848.3
-44848.2       32.5324
```

INDEX	B	STD. ERROR	T-RATIO
0	54446.9	10487.2	5.19177
11	6.10825	5.70372	1.07092

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	27484.4	81409.5
11	-8.55601	20.7725

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	54446.9
11	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6.10825

STAND. ERROR OF EST. = 18359.7 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	59241.9	3989.33
41542.8	57989.7	-16446.9
82812.1	59944.4	22867.8
76847.6	80712.4	-3864.81
83579.7	62112.8	21466.9
42296.9	58295.1	-15998.3
49762.8	61776.8	-12014.

R-SQUARED = .186579

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	.770126
.770126	1.

COVARIANCE MATRIX

2.52930E+08	-8.43101E+07
-8.43101E+07	3.10616E+07

INDEX	B	STD. ERROR	T-RATIO
0	22029.2	15903.8	1.38515
12	15045.7	5573.29	2.69961

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-18859.4	62917.8
12	716.791	29374.7

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	22029.2
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	15045.7

STAND. ERROR OF EST. = 12985.4 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	67166.4	-3935.13
41542.8	52120.6	-10577.8
82812.1	82212.1	600.031
76847.6	52120.6	24727.
83579.7	82212.1	1367.59
42296.9	52120.6	-9823.77
49762.8	52120.6	-2357.84

R-SQUARED = .593098

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
13	1.42857	1.13389
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	.331732
.331732	1.

COVARIANCE MATRIX

1.50249E+08	-6.82952E+07
-6.82952E+07	4.78066E+07

INDEX	B	STD. ERROR	T-RATIO
0	55100.9	12257.6	4.49524
13	5436.67	6914.23	.786301

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	23586.6	86615.3
13	-12339.8	23213.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	55100.9
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	5436.67

STAND. ERROR OF EST. = 19204. D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	60537.6	2693.65
41542.8	60537.6	-18994.8
82812.1	60537.6	22274.5
76847.6	76847.6	3.90625E-03
83579.7	60537.6	23042.1
42296.9	60537.6	-18240.7
49762.8	60537.6	-10774.8

R-SQUARED = .110046

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
14	35257.1	45532.4
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	.318291
.318291	1.

COVARIANCE MATRIX

9.04181E+07	-1055.56
-1055.56	2.99389E-02

INDEX	B	STD. ERROR	T-RATIO
0	58287.6	9508.85	6.12983
14	.129904	.173029	.750765

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	33840.3	82734.8
14	-.314953	.57476

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	58287.6
14	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	.129904

STAND. ERROR OF EST. = 19298.1 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	59716.5	3514.75
41542.8	59326.8	-17784.
82812.1	60885.6	21926.5
76847.6	75434.9	1412.74
83579.7	60495.9	23083.8
42296.9	59041.	-16744.1
49762.8	65172.5	-15409.7

R-SQUARED = .101309

```
REGRESSION NUMBER =  5
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  15
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5    :DEPENDENT VARIABLE IS  1

INDEX          MEANS            STANDARD DEVIATIONS
15              3479              1716.25
1               62867.6           18583.1

CORRELATION COEFFICIENTS
1.              .720626
.720626        1.

COVARIANCE MATRIX
1.64880E+08    -39213.3
-39213.3        11.2714

INDEX          B                STD. ERROR      T-RATIO
0               35721.9           12840.6         2.78196
15              7.80274           3.35729         2.32412

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT          U-LIMIT
0               2708.78           68735.
15             -.828862           16.4343

****** TEST OF HYPOTHESIS ******

INDEX
0              REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL      35721.9
15             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL      7.80274

STAND. ERROR OF EST. = 14113.8              D.F.= 5

ACTUAL         PREDICTED        RESIDUAL
63231.3         68181.3          -4950.02
41542.8         51951.6          -10408.8
82812.1         80353.5           2458.6
76847.6         51951.6           24896.
83579.7         80353.5           3226.16
42296.9         57358.9          -15062.
49762.8         49922.9          -160.055

R-SQUARED =     .519302
```

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
16	1.21429	.684954
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	.244179
.244179	1.

COVARIANCE MATRIX

2.59790E+08	-1.68099E+08
-1.68099E+08	1.38435E+08

INDEX	B	STD. ERROR	T-RATIO
0	54823.4	16118.	3.40137
16	6624.67	11765.8	.563043

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	13363.9	96262.8
16	-23625.3	36874.6

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	54823.4
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6624.67

STAND. ERROR OF EST. = 19740.6 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	60653.1	2578.18
41542.8	62110.5	-20567.7
82812.1	61116.8	21695.3
76847.6	73041.2	3806.41
83579.7	60321.8	23257.9
42296.9	60785.6	-18488.7
49762.8	62044.3	-12281.4

R-SQUARED = 5.96235E-02

```
REGRESSION NUMBER =  7
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  17
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7    :DEPENDENT VARIABLE IS  1

INDEX          MEANS            STANDARD DEVIATIONS
17              1.57176E-02      1.45721E-02
1               62867.6          18583.1

CORRELATION COEFFICIENTS
1.              .127142
.127142         1.

COVARIANCE MATRIX
1.37295E+08    -5.02956E+09
-5.02955E+09    3.19995E+11

INDEX          B                STD. ERROR      T-RATIO
0               60319.2          11717.3         5.14787
17              162138.          565681.         .286625

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT          U-LIMIT
0               30194.           90444.4
17             -1.29223E+06      1.61650E+06

****** TEST OF HYPOTHESIS ******

INDEX
0              REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL      60319.2
17             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL      162138.

STAND. ERROR OF EST. = 20191.6             D.F.= 5

ACTUAL         PREDICTED        RESIDUAL
63231.3         61365.2          1866.02
41542.8         61378.9         -19836.1
82812.1         61693.2          21118.9
76847.6         67368.7          9478.95
83579.7         61422.2          22157.6
42296.9         61893.3         -19596.5
49762.8         64951.7         -15188.9

R-SQUARED =     1.61651E-02
```

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
18	1.28286	.803237
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1	.401239
.401239	1.

COVARIANCE MATRIX

1.97477E+08	-1.15218E+08
-1.15218E+08	8.98138E+07

INDEX	B	STD. ERROR	T-RATIO
0	50959.1	14052.7	3.6263
18	9282.76	9477.01	.979503

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	14829.7	87088.6
18	-15082.6	33648.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	50959.1
18	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	9282.76

STAND. ERROR OF EST. = 18646.2 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	56250.3	6980.93
41542.8	56528.8	-14986.
82812.1	75001.5	7810.64
76847.6	67482.5	9365.15
83579.7	57364.3	26215.4
42296.9	58756.7	-16459.8
49762.8	68689.2	-18926.4

R-SQUARED = .160994

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
19	2.24286	1.63489
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	.450232
.450232	1.

COVARIANCE MATRIX

1.50835E+08	-4.62071E+07
-4.62071E+07	2.06019E+07

INDEX	B	STD. ERROR	T-RATIO
0	51389.6	12281.5	4.18431
19	5117.6	4538.93	1.12749

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	19813.8	82965.3
19	-6551.99	16787.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	51389.6
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	5117.6

STAND. ERROR OF EST. = 18176.8 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	60089.5	3141.77
41542.8	53948.4	-12405.6
82812.1	69301.2	13511.
76847.6	78001.1	-1153.46
83579.7	55995.4	27584.3
42296.9	63671.8	-21374.9
49762.8	59066.	-9303.15

R-SQUARED = .202709

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
20	4.68614E-02	2.06612E-02
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	3.66163E-02
3.66163E-02	1.

COVARIANCE MATRIX

4.13936E+08	-7.57160E+09
-7.57160E+09	1.61574E+11

INDEX	B	STD. ERROR	T-RATIO
0	61324.2	20345.4	3.01415
20	32934.5	401963.	8.19342E-02

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	9016.17	113632.
20	-1.00051E+06	1.06638E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	61324.2
20	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	32934.5

STAND. ERROR OF EST. = 20343.1 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	62781.5	449.728
41542.8	63048.6	-21505.8
82812.1	63273.	19539.1
76847.6	63763.8	13083.8
83579.7	61768.7	21811
42296.9	62209.6	-19912.7
49762.8	63228.	-13465.2

R-SQUARED = 1.34075E-03

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
21	31.6857	47.8564
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.255584
-.255584	1.

COVARIANCE MATRIX

8.36318E+07	-893122.
-893123.	28186.9

INDEX	B	STD. ERROR	T-RATIO
0	66012.3	9145.04	7.21837
21	-99.2457	167.89	-.591137

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	42500.4	89524.2
21	-530.89	332.398

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	66012.3
21	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-99.2457

STAND. ERROR OF EST. = 19680.7 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	58251.3	4980.
41542.8	66012.3	-24469.5
82812.1	65774.1	17038.1
76847.6	64374.7	12472.9
83579.7	66012.3	17567.4
42296.9	65526.	-23229.1
49762.8	54122.6	-4359.82

R-SQUARED = 6.53235E-02

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
22	69.8686	41.3251
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	.617351
.617351	1.

COVARIANCE MATRIX

1.58819E+08	-1.74874E+06
-1.74874E+06	25028.9

INDEX	B	STD. ERROR	T-RATIO
0	43471.4	12602.3	3.44947
22	277.611	158.205	1.75475

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	11070.7	75872.
22	-129.135	684.357

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	43471.4
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	277.611

STAND. ERROR OF EST. = 16014.4 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
63231.3	56330.3	6900.98
41542.8	54922.8	-13380.
82812.1	57215.9	25596.3
76847.6	83955.3	-7107.68
83579.7	74277.8	9301.91
42296.9	57215.9	-14919.
49762.8	56155.4	-6392.57

R-SQUARED = .381124

MULTIPLE LINEAR REGRESSION ANALYSIS

MON, JUN 11, 1979, 4:19 PM

DATA IS FROM FILE => DATA2

N = 7
V = 22

63231.3	6.2	.33	696	1000
250	.015	16.75	3	18000
785	3	1	11000	4160
.88	6.45161E-03	.57	1.7	4.42478E-02
78.2	46.32			
41542.8	6.2	.33	696	1000
250	.015	16.75	3	18000
580	2	1	8000	2080
1.1	6.53595E-03	.6	.5	.052356
0	41.25			
82812.1	6.2	.33	696	1000
250	.015	16.75	3	18000
900	4	1	20000	5720
.95	8.47458E-03	2.59	3.5	5.91716E-02
2.4	49.51			
76847.6	6.2	.33	696	1000
250	.015	16.75	3	18000
4300	2	4	132000	2080
2.75	4.34783[illegible]-02	1.78	5.2	7.40741E-02
16.5	145.83			
83579.7	6.2	.33	696	1000
250	.015	16.75	3	18000
1255	4	1	17000	5720
.83	6.80272E-03	.69	.9	1.34953E-02
0	110.97			
42296.9	6.2	.33	696	1000
250	.015	16.75	3	18000
630	2	1	5800	2773
.9	9.70874E-03	.84	2.4	2.68817E-02
4.9	49.51			
49762.8	6.2	.33	696	1000
250	.015	16.75	3	18000
1200	2	1	53000	1820
1.09	2.85714E-02	1.91	1.5	5.78035E-02
119.8	45.69			

NUMBER OF REGRESSION MODELS = 21

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
11	1378.57	1314.11
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.23972	.770126
-.23972	1	.431948
.770126	.431948	1.

COVARIANCE MATRIX

3.76355E+06	-1.06958E+06	-432.12
-1.06958E+06	362140.	62.8372
-432.12	62.8372	.189734

INDEX	B	STD. ERROR	T-RATIO
0	961.105	1939.99	.495419
12	18109.4	601.781	30.093
11	9.25052	.435585	21.237

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-4404.9	6327.11
12	16444.8	19773.9
11	8.04569	10.4553

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	961.105
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	18109.4
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	9.25052

STAND. ERROR OF EST. = 1361.22 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	62550.9	680.397
41542.8	42545.1	-1002.33
82812.1	81724.	1088.11
76847.6	76957.1	-109.461
83579.7	85008.	-1428.26
42296.9	43007.7	-710.78
49762.8	48280.5	1482.35

R-SQUARED = .996426

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
13	1.42857	1.13389
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.331133	.770126
-.331133	1.	.331732
.770126	.331732	1.

COVARIANCE MATRIX

2.52604E+07	-6.74683E+06	-3.81517E+06
-6.74683E+06	2.16862E+06	602395.
-3.81517E+06	602396.	1.52607E+06

INDEX	B	STD. ERROR	T-RATIO
0	-4971.55	5025.98	-.989172
12	19309.	1472.62	13.112
13	10800.3	1235.34	8.74276

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-18873.4	8930.29
12	15235.7	23382.3
13	7383.34	14217.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-4971.55
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	19309.
13	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	10800.3

STAND. ERROR OF EST. = 3237.54 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	63755.8	-524.5
41542.8	44446.8	-2903.95
82812.1	83064.8	-252.617
76847.6	76847.6	0
83579.7	83064.8	514.945
42296.9	44446.8	-2149.88
49762.8	44446.8	5316.05

R-SQUARED = .979769

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
14	35257.1	45532.4
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.351289	.770126
-.351289	1.	.318291
.770126	.318291	1.

COVARIANCE MATRIX

1.23752E+07	-3.68131E+06	-43.7166
-3.68131E+06	1.23824E+06	9.08688
-43.7166	9.08689	5.40378E-04

INDEX	B	STD. ERROR	T-RATIO
0	-149.469	3517.84	-4.24888E-02
12	19655.8	1112.76	17.664
14	.274149	.023246	11.7934

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-9879.82	9580.88
12	16577.9	22733.7
14	.20985	.338447

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-149.469
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	19655.8
14	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	.274149

STAND. ERROR OF EST. = 2427.42 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	61833.5	1397.78
41542.8	41355.3	187.543
82812.1	83956.6	-1144.43
76847.6	75349.7	1497.88
83579.7	83134.1	445.577
42296.9	40752.1	1544.75
49762.8	53692.	-3929.15

R-SQUARED = .988627

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
15	3479	1716.25
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	.984699	.770126
.984699	1.	.720626
.770126	.720626	1.

COVARIANCE MATRIX

9.07051E+08	-9.22812E+08	466907.
-9.22812E+08	1.13140E+09	-617459.
466907.	-617459.	347.529

INDEX	B	STD. ERROR	T-RATIO
0	3959.73	30117.3	.131477
12	38941.6	33636.3	1.15772
15	-13.4495	18.6421	-.721457

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-79344.7	87264.2
12	-54096.5	131980.
15	-65.0136	38.1146

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	3959.73
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	38941.6
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-13.4495

STAND. ERROR OF EST. = 13656.7 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	64834.7	-1603.42
41542.8	53868	-12325.2
82812.1	82795.1	17.0781
76847.6	53868.	22979.6
83579.7	82795.1	784.641
42296.9	44547.5	-2250.63
49762.8	56927.1	-7164.3

R-SQUARED = .639951

```
REGRESSION NUMBER =  5
NUMBER OF INDEPENDENT VARIABLES =  2
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  12
INDEPENDENT OR DEPENDENT VARIABLE -  16
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5    :DEPENDENT VARIABLE IS  1

INDEX          MEANS          STANDARD DEVIATIONS
12              2.71429        .95119
16              1.21429        .684954
1               62867.6        18583.1

CORRELATION COEFFICIENTS
 .999999       -.417337        .770126
-.417338        1.             .244179
 .770126        .244179        1.

COVARIANCE MATRIX
 3.31502E+07   -7.72298E+06   -8.84536E+06
-7.72297E+06    2.25948E+06    1.30949E+06
-8.84537E+06    1.30949E+06    4.35732E+06

INDEX          B              STD. ERROR     T-RATIO
0              -15689.6       5757.62        -2.72502
12              20629.7       1503.16         13.7243
16              18580.7       2087.42         8.90127

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT        U-LIMIT
0              -31615.2        235.973
12              16472.         24787.4
16              12806.9        24354.5

****** TEST OF HYPOTHESIS ******

INDEX
0              ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL     -15689.6
12             REJECT HO (COEFFICIENT = 0) AT 95% LEVEL      20629.7
16             REJECT HO (COEFFICIENT = 0) AT 95% LEVEL      18580.7

STAND. ERROR OF EST. = 3182.67              D.F.= 4

ACTUAL         PREDICTED      RESIDUAL
63231.3         62550.5        680.715
41542.8         46008.6       -4465.78
82812.1         84480.9       -1668.75
76847.6         76666.7        180.883
83579.7         82251.2        1328.49
42296.9         42292.4        4.4375
49762.8         45822.8        3940.04
R-SQUARED =     .980447
```

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
17	1.57176E-02	1.45721E-02
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.499991	.770126
-.499991	1.	.127142
.770126	.127142	1.

COVARIANCE MATRIX

8.56371E+07	-2.34487E+07	-1.13023E+09
-2.34487E+07	7.26583E+06	2.37133E+08
-1.13023E+09	2.37133E+08	3.09581E+10

INDEX	B	STD. ERROR	T-RATIO
0	-9766.13	9254.03	-1.05534
12	21716.7	2695.52	8.05658
17	870901.	175949	4.94973

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-35362.8	15830.5
12	14260.9	29172.5
17	384226.	1.35758E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-9766.13
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	21716.7
17	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	870901.

STAND. ERROR OF EST. = 5438.99 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	61002.6	2228.66
41542.8	39359.4	2183.42
82812.1	84481.1	-1668.92
76847.6	71532.5	5315.16
83579.7	83025.	554.661
42296.9	42122.6	174.316
49762.8	57364.9	-7602.06

R-SQUARED = .942893

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
18	1.28286	.803237
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	.156127	.770126
.156127	1	.401239
.770126	.401239	1.

COVARIANCE MATRIX

2.91530E+08	-7.89735E+07	-4.13547E+07
-7.89735E+07	3.10914E+07	-5.89436E+06
-4.13547E+07	-5.89436E+06	4.47077E+07

INDEX	B	STD. ERROR	T-RATIO
0	15865.5	17074.3	.929204
12	14167.2	5646.36	2.50909
18	6663.46	6686.38	.996572

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-31361.9	63092.9
12	-1450.62	29785.
18	-11831.1	25158.

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	15865.5
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	14167.2
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6663.46

STAND. ERROR OF EST. = 12994.3 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	62165.3	1065.98
41542.8	48198.	-6655.17
82812.1	89792.7	-6980.53
76847.6	56060.9	20786.8
83579.7	77132.1	6447.62
42296.9	49797.2	-7500.32
49762.8	58550.1	-8787.29

R-SQUARED = .674033

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
19	2.24286	1.63469
1	62867.6	18593.1

CORRELATION COEFFICIENTS

.999999	-7.65527E-02	.770126
-7.65527E-02	1.	.450232
.770126	.450232	1.

COVARIANCE MATRIX

1.45612E+08	-3.94648E+07	-1.23421E+07
-3.94648E+07	1.40235E+07	624595
-1.23421E+07	624595	4.74696E+06

INDEX	B	STD. ERROR	T-RATIO
0	6892.42	12067.	.57118
12	15811.8	3744.8	4.22232
19	5821.84	2178.75	2.6721

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-26484.8	40269.7
12	5453.64	26169.9
19	-204.59	11848.3

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	6892.42
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	15811.8
19	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	5821.84

STAND. ERROR OF EST. = 8699.51 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	64224.8	-993.563
41542.8	41426.9	115.948
82812.1	90515.9	-7703.75
76847.6	68789.5	8058.12
83579.7	75379.1	8200.6
42296.9	52488.3	-10191.5
49762.8	47248.7	2514.12

R-SQUARED = .8539

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
20	4.68614E-02	2.06612E-02
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.379299	.770126
-.379299	1.	3.66163E-02
.770126	3.66163E-02	1.

COVARIANCE MATRIX

5.35820E+08	-1.10512E+08	-4.58986E+09
-1.10512E+08	3.12837E+07	5.46276E+08
-4.58986E+09	5.46277E+08	6.63043E+10

INDEX	B	STD. ERROR	T-RATIO
0	-1877.29	23147.8	-.0811
12	17891.	5593.18	3.19872
20	345348.	257496.	1.34118

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-65904.	62149.5
12	2420.28	33361.8
20	-366886.	1.05758E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1877.29
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17891.
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	345348.

STAND. ERROR OF EST. = 12057.9 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	67076.7	-3845.46
41542.8	51985.8	-10443.
82812.1	90121.7	-7309.51
76847.6	59486.1	17361.5
83579.7	74347.4	9232.29
42296.9	43188.3	-891.455
49762.8	53867.1	-4104.3

R SQUARED = .719318

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
21	31.6857	47.8564
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	-.276171	.770126
-.276171	1.	-.255584
.770126	-.255584	1.

COVARIANCE MATRIX

3.94200E+08	-1.20806E+08	-1.14676E+06
-1.20806E+08	4.18271E+07	229595.
-1.14676E+06	229595.	16523.9

INDEX	B	STD. ERROR	T-RATIO
0	23280.7	19854.5	1.17257
12	14795.2	6467.39	2.28766
21	-18.0329	128.545	-.140284

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-31636.8	78198.1
12	-3093.63	32684.
21	-373.589	337.523

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	23280.7
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	14795.2
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-18.0329

STAND. ERROR OF EST. = 14482.5 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	66256	-3024.75
41542.8	5[illegible]71.	-11328.2
82812.1	82418.1	394.076
76847.6	52573.5	24274.1
83579.7	82461.3	1118.36
42296.9	52782.6	-10485.8
49762.8	50710.7	-947.859

R-SQUARED = .59509

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.71429	.95119
22	69.8686	41.3251
1	62867.6	18583.1

CORRELATION COEFFICIENTS

.999999	7.60542E-02	.770126
7.60542E-02	1.	.617351
.770126	.617351	1.

COVARIANCE MATRIX

8.96568E+07	-2.30987E+07	-287528.
-2.30987E+07	8.91163E+06	-15600.4
-287529.	-15600.1	4721.32

INDEX	B	STD. ERROR	T-RATIO
0	6637.68	9468.73	.70101
12	14210.6	2985.24	4.76031
22	252.734	68.7119	3.67817

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-19552.8	32828.2
12	5953.48	22467.8
22	62.6772	442.791

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	6637.68
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	14210.6
22	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	252.734

STAND. ERROR OF EST. = 6935.24 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	60976.2	2255.01
41542.8	45484.2	-3941.45
82812.1	75993.1	6819.04
76847.6	71915.2	4932.43
83579.7	91526.2	-7946.45
42296.9	47571.8	-5274.96
49762.8	46606.4	3156.42

R-SQUARED = .907151

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
11	1378.57	1314.11
1	62867.6	18533.1

CORRELATION COEFFICIENTS

1.	-.288113	.720626
-.288113	1	.431948
.720626	.431948	1.

COVARIANCE MATRIX

2.35364E+07	-4423.82	-4050.61
-4423.82	1.10658	.416385
-4050.61	.416385	1.88747

INDEX	B	STD. ERROR	T-RATIO
0	14555.4	4851.44	3.00022
15	9.97856	1.05194	9.48584
11	9.86298	1.37385	7.17907

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1136.3	27974.4
15	7.06889	12.8882
11	6.0629	13.6631

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	14555.4
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	9.97856
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	9.86298

STAND. ERROR OF EST. = 4234.77 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	63808.6	-577.367
41542.8	41031.3	511.492
82812.1	80509.4	2302.73
76847.6	77721.6	-873.969
83579.7	84010.8	-431.068
42296.9	48439.6	-6142.72
49762.8	44551.9	5210.88

R-SQUARED = .965379

REGRESSION NUMBER = 13
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 13 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
13	1.42857	1.13389
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.359448	.720626
-.359447	1.	.331732
.720626	.331732	1.

COVARIANCE MATRIX

6.55986E+07	-11449.6	-1.38958E+07
-11449.6	2.69009	1463.56
-1.38958E+07	1463.56	6.16287E+06

INDEX	B	STD. ERROR	T-RATIO
0	10652.7	8099.3	1.31526
15	10.4431	1.64015	6.36717
13	11118.3	2482.51	4.47865

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-11749.9	33055.4
15	5.90646	14.9798
13	4251.67	17984.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	10652.7
15	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	10.4431
13	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	11118.3

STAND. ERROR OF EST. = 6434.25 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	65214.4	-1983.12
41542.8	43492.7	-1949.9
82812.1	81505.6	1306.5
76847.6	76847.6	0
83579.7	81505.6	2074.06
42296.9	50729.8	-8432.9
49762.8	40777.5	8985.32

R-SQUARED = .92008

REGRESSION NUMBER = 14
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 14 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
14	35257.1	45532.4
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.42117	.720626
-.42117	1.	.318291
.720626	.318291	1.

COVARIANCE MATRIX

7.56258E+06	-1539.4	-40.1445
-1539.4	.381161	6.05099E-03
-40.1445	6.05099E-03	5.41538E-04

INDEX	B	STD. ERROR	T-RATIO
0	12852.9	2750.02	4.67377
15	11.2498	.617383	18.2217
14	.308496	.023271	13.2567

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	5246.41	20459.5
15	9.5421	12.9575
14	.244128	.372863

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	12852.9
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.2498
14	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	.308496

STAND. ERROR OF EST. = 2354.01 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	63045.5	185.774
41542.8	38720.5	2822.34
82812.1	83371.6	-559.46
76847.6	76973.9	-126.297
83579.7	82446.1	1133.59
42296.9	45837.9	-3540.99
49762.8	49677.8	84.9922

R-SQUARED = .989305

REGRESSION NUMBER = 15
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 15 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
16	1.21429	.684954
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.459586	.720626
-.459586	1.	.244179
.720626	.244179	1.

COVARIANCE MATRIX

7.49894E+07	-11055.9	-2.63625E+07
-11055.9	2.2668	2610.34
-2.63625E+07	2610.35	1.42315E+07

INDEX	B	STD. ERROR	T-RATIO
0	-937.141	8659.64	-.108219
15	11.4326	1.50559	7.59345
16	19790.	3772.47	5.24589

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-24889.7	23015.4
15	7.26816	15.5971
16	9355.32	30224.6

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-937.141
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.4326
16	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	19790.

STAND. ERROR OF EST. = 5621.35 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	64037.7	-806.465
41542.8	44611.7	-3068.87
82812.1	83257.9	-445.758
76847.6	77265.1	-417.5
83579.7	80883.1	2696.6
42296.9	48576.5	-6279.6
49762.8	41441.3	8321.52

R-SQUARED = .938999

REGRESSION NUMBER = 16
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 16 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
17	1.57176E-02	1.45721E-02
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.570415	.720626
-.570415	1.	.127142
.720626	.127142	1.

COVARIANCE MATRIX

5.48274E+07	-10115.2	-1.00763E+09
-10115.2	2.23051	149849.
-1.00763E+09	149849.	3.09400E+10

INDEX	B	STD. ERROR	T-RATIO
0	2589.53	7404.55	.349721
15	12.73	1.49349	8.52366
17	1.01736E+06	175898.	5.7838

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-17891.5	23070.5
15	8.59901	16.861
17	530823.	1.50389E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2589.53
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	12.73
17	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	1.01736E+06

STAND. ERROR OF EST. = 5156.92 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	62109.9	1121.33
41542.8	35717.3	5825.48
82812.1	84026.8	-1214.66
76847.6	73300.8	3546.84
83579.7	82325.9	1253.78
42296.9	47767.1	-5470.19
49762.8	54825.4	-5062.63

R-SQUARED = .948661

REGRESSION NUMBER = 17
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 17 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
18	1.28286	.803237
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	7.82577E-02	.720626
7.82577E-02	1	.401239
.720626	.401239	1.

COVARIANCE MATRIX

2.19696E+08	-34758.9	-5.61653E+07
-34758.9	10.6476	-1780.38
-5.61653E+07	-1780.38	4.86096E+07

INDEX	B	STD. ERROR	T-RATIO
0	26446.9	14822.1	1.78429
15	7.50873	3.26306	2.30113
18	8027.23	6972.06	1.15134

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-14551.1	67445.
15	-1.51689	16.5344
18	-11257.5	27311.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	26446.9
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	7.50873
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8027.23

STAND. ERROR OF EST. = 13675.6 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	62258.8	972.47
41542.8	46881.4	-5338.64
82812.1	90187.4	-7375.27
76847.6	56353.6	20494.1
83579.7	74935.7	8644.03
42296.9	54011.5	-11714.6
49762.8	55444.8	-5682.03

R-SQUARED = .638953

REGRESSION NUMBER = 18
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 18 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
19	2.24286	1.63489
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-6.76616E-02	.720626
-6.76616E-02	1.	.450232
.720626	.450232	1.

COVARIANCE MATRIX

1.44389E+08	-24699.8	-1.84571E+07
-24699.8	6.78882	482.203
-1.84571E+07	482.203	7.48133E+06

INDEX	B	STD. ERROR	T-RATIO
0	21664.6	12016.2	1.80295
15	8.16999	2.60554	3.13563
19	5697.9	2735.2	2.08317

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-11572.2	54901.4
15	.96308	15.3769
19	-1867.67	13263.5

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	21664.6
15	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	8.16999
19	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	5697.9

STAND. ERROR OF EST. = 10928.4 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	65338.2	-2106.97
41542.8	41507.2	35.6421
82812.1	88339.6	-5527.5
76847.6	68287.3	8560.31
83579.7	73525.1	10054.6
42296.9	57995.	-15698.1
49762.8	45080.9	4681.95

R-SQUARED = .769439

REGRESSION NUMBER = 19
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 19 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
20	4.68614E-02	2.06612E-02
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	-.464239	.720626
-.464239	1.	3.66163E-02
.720626	3.66163E-02	1.

COVARIANCE MATRIX

4.76595E+08	-60256.3	-5.21508E+09
-60256.3	11.399	439575.
-5.21508E+09	439575.	7.86532E+10

INDEX	B	STD. ERROR	T-RATIO
0	7506.55	21831.1	.343847
15	10.181	3.37624	3.01548
20	425540.	280452.	1.51734

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-52878.1	67891.2
15	.842306	19.5197
20	-350190.	1.20127E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	7506.55
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.181
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	425540.

STAND. ERROR OF EST. = 12571.3 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	68688.7	-5457.41
41542.8	50962.6	-9419.79
82812.1	90921.7	-8109.52
76847.6	60204.5	16643.1
83579.7	71484.6	12095.1
42296.9	47177.7	-4880.79
49762.8	50633.6	-870.824

R-SQUARED = .694908

```
REGRESSION NUMBER =  20
NUMBER OF INDEPENDENT VARIABLES =  2
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  15
INDEPENDENT OR DEPENDENT VARIABLE -  21
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 20   :DEPENDENT VARIABLE IS  1

INDEX          MEANS          STANDARD DEVIATIONS
15              3479           1716.25
21              31.6857        47.8564
1               62867.6        18583.1

CORRELATION COEFFICIENTS
 1.            -.338186        .720626
-.338186        1.            -.255584
 .720626       -.255584        1.

COVARIANCE MATRIX
 2.91106E+08   -61439.8       -1.31912E+06
-61439.8        15.9035        192.88
-1.31912E+06    192.88         20453.7

INDEX          B              STD. ERROR      T-RATIO
0               36057.8        17061.8         2.11336
15              7.75362        3.98792         1.94428
21             -5.20832        143.017        -3.64176E-02

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT        U-LIMIT
0              -11135.3        83250.8
15             -3.27696        18.7842
21             -400.792        390.376

****** TEST OF HYPOTHESIS ******

INDEX
0              ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL      36057.8
15             ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL      7.75362
21             ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL     -5.20832

STAND. ERROR OF EST. = 15777.1               D.F.= 4

ACTUAL         PREDICTED      RESIDUAL
63231.3         67905.6       -4674.31
41542.8         52185.3       -10642.5
82812.1         80396          2416.14
76847.6         52099.4        24748.2
83579.7         80408.5        3171.2
42296.9         57533.1       -15236.2
49762.8         49545.4        217.392

R-SQUARED =     .519461
```

REGRESSION NUMBER = 21
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 21 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3479	1716.25
22	69.8686	41.3251
1	62867.6	18583.1

CORRELATION COEFFICIENTS

1.	4.39451E-02	.720626
4.39451E-02	1.	.617351
.720626	.617351	1.

COVARIANCE MATRIX

8.91451E+07	-13484.9	-459324.
-13484.9	4.02357	-7.34331
-459324.	-7.34331	6939.76

INDEX	B	STD. ERROR	T-RATIO
0	18256.4	9441.67	1.9336
15	7.52351	2.00588	3.75072
22	263.88	83.3052	3.16762

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-7859.25	44372.1
15	1.97524	13.0718
22	33.4574	494.302

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	18256.4
15	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	7.52351
22	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	263.88

STAND. ERROR OF EST. = 8424.45 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
63231.3	61777.1	1454.12
41542.8	44790.4	-3247.55
82812.1	74355.6	8456.55
76847.6	72386.9	4460.74
83579.7	90573.6	-6993.93
42296.9	52183.8	-9886.92
49762.8	44005.9	5756.94

R-SQUARED = .862991

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MULTIPLE LINEAR REGRESSION ANALYSIS

            TUE, JUN 12, 1979,  7:37 AM

DATA IS FROM FILE => DATA4

N =  5
V =  22
49564.5       6.2             .33           696           1000
250           .015            16.75         3             18000
1260          2               2             80000         2080
1.44          2.77778E-02     2.76          1.5           5.29101E-02
.8            31.67
40917.6       6.2             .33           696           1000
250           .015            16.75         3             18000
2400          1               3             184000        152
1.35          .714286         .89           1.1           8.13008E-02
2.4           115.45
33803.        6.2             .33           696           1000
250           .015            16.75         3             18000
2000          1               4             10000         1700
1             .000001         100           7.3           1.09529E-02
0             147.57
21377.4       6.2             .33           696           1000
250           .015            16.75         3             18000
300           1               2             14000         1700
.5            .001            20            0             .000001
0             19.1
22855.8       6.2             .33           696           1000
250           .015            16.75         3             18000
500           1               2             29000         1700
.8            .00125          20            0             .000001
0             16

NUMBER OF REGRESSION MODELS =  12

REGRESSION NUMBER =  1
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  11
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1    :DEPENDENT VARIABLE IS  1

INDEX         MEANS          STANDARD DEVIATIONS
11            1292            913.958
1             33703.6         11971.1

CORRELATION COEFFICIENTS
1.            .648356
.648356       1

COVARIANCE MATRIX
7.74820E+07   -42826.
-42826.       33.1471

INDEX         B              STD. ERROR     T-RATIO
0             22731.7        8802.38        2.58245
11            8.49222        5.75735        1.47502

****** CONFIDENCE INTERVALS ******
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INDEX	L-LIMIT	U-LIMIT
0	-5277.49	50740.9
11	-9.82767	26.8121

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	22731.7
11	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8.49222

STAND. ERROR OF EST. = 10524. D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	33431.9	16132.6
40917.6	43113.	-2195.46
33803.	39716.1	-5913.18
21377.4	25279.4	-3901.97
22855.8	26977.8	-4121.98

R-SQUARED = .420367

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.740656
.740656	1

COVARIANCE MATRIX

1.72513E+08	-1.29385E+08
-1.29385E+08	1.07820E+08

INDEX	B	STD. ERROR	T-RATIO
0	9912.41	13134.4	.75469
12	19826.	10383.7	1.90935

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-31881.3	51706.1
12	-13214.8	52866.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	9912.41
12	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	19826.

STAND. ERROR OF EST. = 9287.43 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-7.81250E-03
40917.6	29738.4	11179.1
33803.	29738.4	4064.52
21377.4	29738.4	-8361.04
22855.8	29738.4	-6882.61

R-SQUARED = .548573

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
13	2.6	.894427
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.173072
.173072	1

COVARIANCE MATRIX

4.28626E+08	-1.50598E+08
-1.50598E+08	5.79225E+07

INDEX	B	STD. ERROR	T-RATIO
0	27680.9	20703.3	1.33703
13	2316.42	7610.68	.304365

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-38196.9	93558.8
13	-21900.8	26533.6

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	27680.9
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2316.42

STAND. ERROR OF EST. = 13614.4 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	32313.8	17250.7
40917.6	34630.2	6287.35
33803.	36946.6	-3143.68
21377.4	32313.8	-10936.4
22855.8	32313.8	-9457.96

R-SQUARED = 2.99542E-02

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
14	63400	72964.4
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.603938
.603938	1

COVARIANCE MATRIX

4.71880E+07	-361.379
-361.379	5.69999E-03

INDEX	B	STD. ERROR	T-RATIO
0	27421.6	6869.35	3.99187
14	9.90866E-02	7.54983E-02	1.31243

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	5563.29	49279.8
14	-.141149	.339322

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	27421.6
14	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	9.90866E-02

STAND. ERROR OF EST. = 11017.4 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	35348.5	14216.
40917.6	45653.5	-4735.92
33803.	28412.4	5390.53
21377.4	28808.8	-7431.38
22855.8	30295.1	-7439.24

R-SQUARED = .36474

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	1466.4	752.971
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-.14256
-.14256	1

COVARIANCE MATRIX

2.14929E+08	-121039.
-121039.	82.5413

INDEX	B	STD. ERROR	T-RATIO
0	37027.2	14660.5	2.52565
15	-2.26648	9.08522	-.249469

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-9622.39	83676.8
15	-31.1757	26.6427

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	37027.2
15	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-2.26648

STAND. ERROR OF EST. = 13681.8 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	32312.9	17251.5
40917.6	36682.7	4234.86
33803.	33174.2	628.761
21377.4	33174.2	-11796.8
22855.8	33174.2	-10318.4

R-SQUARED = 2.03232E-02

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
16	1.018	.388742
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1	.958187
.958187	1

COVARIANCE MATRIX

2.99503E+07	-2.63471E+07
-2.63471E+07	2.58812E+07

INDEX	B	STD. ERROR	T-RATIO
0	3665.64	5472.68	.669807
16	29506.9	5087.36	5.80004

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-13748.4	21079.7
16	13318.9	45694.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	3665.64
16	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	29506.9

STAND. ERROR OF EST. = 3955.33 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	46155.5	3408.92
40917.6	43499.9	-2582.35
33803.	33172.5	630.441
21377.4	18419.1	2958.32
22855.8	27271.1	-4415.3

R-SQUARED = .918124

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
17	.148863	.316298
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.367595
.367595	1

COVARIANCE MATRIX

4.22024E+07	-6.14740E+07
-6.14740E+07	4.12958E+08

INDEX	B	STD. ERROR	T-RATIO
0	31632.6	6496.34	4.86929
17	13912.6	20321.4	.684628

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	10961.2	52303.9
17	-50750.	78575.1

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	31632.6
17	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	13912.6

STAND. ERROR OF EST. = 12855.2 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	32019.	17545.4
40917.6	41570.1	-652.561
33803.	31632.6	2170.36
21377.4	31646.5	-10269.1
22855.8	31650.	-8794 14

R-SQUARED = .135126

```
REGRESSION NUMBER =  8
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  18
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8    :DEPENDENT VARIABLE IS  1

INDEX          MEANS          STANDARD DEVIATIONS
18              28.73           40.8698
1               33703.6         11971.1

CORRELATION COEFFICIENTS
1              -.206106
-.206106        1

COVARIANCE MATRIX
5.91944E+07    -786728.
-786728         27383.5

INDEX          B               STD. ERROR     T-RATIO
0               35438.1         7693.79        4.60606
18             -60.3702         165.48        -.364819


****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT         U-LIMIT
0               10956.4         59919.7
18             -586.926         466.186

****** TEST OF HYPOTHESIS ******

INDEX
0              REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL      35438.1
18             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL     -60.3702

STAND. ERROR OF EST. = 13526.2             D.F.= 3

ACTUAL         PREDICTED       RESIDUAL
49564.5         35271.5         14293.
40917.6         35384.4         5533.21
33803.          29401.1         4401.89
21377.4         34230.7        -12853.3
22855.8         34230.7        -11374.8

R-SQUARED =     4.24795E-02
```

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
19	1.98	3.04746
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1	.222385
.222385	1

COVARIANCE MATRIX

5.54931E+07	-9.68073E+06
-9.68073E+06	4.88926E+06

INDEX	B	STD. ERROR	T-RATIO
0	31974.	7449.37	4.29217
19	873.575	2211.17	.395074

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	8270.08	55677.9
19	-6162.36	7909.51

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	31974.
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	873.575

STAND. ERROR OF EST. = 13476.9 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	33284.3	16280.1
40917.6	32934.9	7982.67
33803.	38351.1	-4548.11
21377.4	31974.	-10596.6
22855.8	31974.	-9118.13

R-SQUARED = 4.94549E-02

```
REGRESSION NUMBER =  10
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  20
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10   :DEPENDENT VARIABLE IS  1

INDEX          MEANS           STANDARD DEVIATIONS
20              2.90332E-02     3.64508E-02
1               33703.6         11971.1

CORRELATION COEFFICIENTS
1               .817429
.817429         1

COVARIANCE MATRIX
2.27358E+07    -3.46350E+08
-3.46350E+08    1.19295E+10

INDEX          B               STD. ERROR      T-RATIO
0               25909.5         4768.21         5.4338
20              268458.         109222.         2.45791

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT         U-LIMIT
0               10737.          41081.9
20             -79086.7         616003.

****** TEST OF HYPOTHESIS ******

INDEX
0              REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL      25909.5
20             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL      268458.

STAND. ERROR OF EST. = 7962.46             D.F.= 3

ACTUAL         PREDICTED       RESIDUAL
49564.5         40113.6         9450.88
40917.6         47735.3        -6817.75
33803.          28849.9         4953.1
21377.4         25909.7        -4532.34
22855.8         25909.7        -3053.9

R-SQUARED =     .66819
```

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
21	.64	1.04307
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.60068
.60068	1

COVARIANCE MATRIX

3.59212E+07	-1.79606E+07
-1.79606E+07	2.80634E+07

INDEX	B	STD. ERROR	T-RATIO
0	29291.6	5993.43	4.88728
21	6893.86	5297.49	1.30134

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	10220.5	48362.7
21	-9962.77	23750.5

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	29291.6
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6893.86

STAND. ERROR OF EST. = 11051.3 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	34806.7	14757.8
40917.6	45836.8	-4919.27
33803.	29291.6	4511.38
21377.4	29291.6	-7914.18
22855.8	29291.6	-6435.75

R-SQUARED = .360817

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
22	65.958	61.1905
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1	.321091
.321091	1

COVARIANCE MATRIX

8.40553E+07	-754725
-754725.	11442.5

INDEX	B	STD. ERROR	T-RATIO
0	29560.4	9168.17	3.22424
22	62.8171	106.97	.587243

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	387.242	58733.5
22	-277.56	403.195

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	29560.4
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	62.8171

STAND. ERROR OF EST. = 13091.1 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
49564.5	31549.8	18014.7
40917.6	36812.6	4104.98
33803.	38830.3	-5027.32
21377.4	30760.2	-9382.76
22855.8	30565.4	-7709.59

R-SQUARED = .1031

```
MULTIPLE LINEAR REGRESSION ANALYSIS

              TUE, JUN 12, 1979, 11:35 AM

DATA IS FROM FILE => DATA4

N =  5
V =  22
49564.5        6.2            .33            696            1000
250            .015           16.75          3              18000
1260           2              2              80000          2080
1.44           2.77778E-02    2.76           1.5            5.29101E-02
.8             31.67
40917.6        6.2            .33            696            1000
250            .015           16.75          3              18000
2400           1              3              184000         152
1.35           .714286        .89            1.1            8.13008E-02
2.4            115.45
33803.         6.2            .33            696            1000
250            .015           16.75          3              18000
2000           1              4              10000          1700
1              .000001        100            7.3            1.09529E-02
0              147.57
21377.4        6.2            .33            696            1000
250            .015           16.75          3              18000
300            1              2              14000          1700
.5             .001           20             0              .000001
0              19.1
22855.8        6.2            .33            696            1000
250            .015           16.75          3              18000
500            1              2              29000          1700
.8             .00125         20             0              .000001
0              16

NUMBER OF REGRESSION MODELS =  11

REGRESSION NUMBER =  1
NUMBER OF INDEPENDENT VARIABLES =  2
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  12
INDEPENDENT OR DEPENDENT VARIABLE -  11
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1    :DEPENDENT VARIABLE IS  1

INDEX          MEANS          STANDARD DEVIATIONS
12             1.2            .447214
11             1292           913.958
1              33703.6        11971.1

CORRELATION COEFFICIENTS
1.             -1.95726E-02   .740656
-1.95726E-02   1.             .648356
.740656        .648356        1

COVARIANCE MATRIX
8.64102E+06    -5.16243E+06   -1366.15
-5.16243E+06   4.25812E+06    40.7807
-1366.15       40.7807        1.01952

INDEX          B              STD. ERROR     T-RATIO
0              -1726.06       2939.56        -.587183
12             20173.5        2063.52        9.77623
11             8.68542        1.00971        8.60189

****** CONFIDENCE INTERVALS ******
```

INDEX	L-LIMIT	U-LIMIT
0	-14375.	10922.9
12	11294.1	29052.8
11	4.34064	13.0302

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1726.06
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	20173.5
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	8.68542

STAND. ERROR OF EST. = 1845.31 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-7.81250E-03
40917.6	39292.4	1625.16
33803.	35818.2	-2015.28
21377.4	21053.	324.381
22855.8	22790.1	65.7334

R-SQUARED = .988116

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
13	2.6	.894427
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-.375	.740656
-.375	1.	.173072
.740656	.173072	1

COVARIANCE MATRIX

3.97612E+08	-1.51205E+08	-7.84022E+07
-1.51205E+08	8.96027E+07	1.68005E+07
-7.84022E+07	1.68005E+07	2.24006E+07

INDEX	B	STD. ERROR	T-RATIO
0	-14661.6	19940.2	-.73528
12	25091.9	9465.87	2.65078
13	7021.15	4732.93	1.48347

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-100464.	71141.1
12	-15639.7	65823.6
13	-13344.6	27386.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-14661.6
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	25091.9
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	7021.15

STAND. ERROR OF EST. = 7848.68 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-1.17188E-02
40917.6	31493.7	9423.84
33803.	38514.9	-4711.91
21377.4	24472.6	-3095.18
22855.8	24472.6	-1616.74

R-SQUARED = .785068

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
14	63400	72964.4
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.127181	.740656
.127181	1.	.603938
.740656	.603938	1

COVARIANCE MATRIX

1.11175E+08	-7.84850E+07	-98.6594
-7.84850E+07	6.82135E+07	-53.1737
-98.6594	-53.1737	2.56258E-03

INDEX	B	STD. ERROR	T-RATIO
0	6639.65	10543.9	.629712
12	18062.1	8259.15	2.18693
14	8.50068E-02	.050622	1.67925

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-38730.9	52010.2
12	-17477.	53601.3
14	-.13282	.302833

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6639.65
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	18062.1
14	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8.50068E-02

STAND. ERROR OF EST. = 7327.21 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-1.17188E-02
40917.6	40343.	574.527
33803.	25551.9	8251.1
21377.4	25891.9	-4514.49
22855.8	27167.	-4311.15

R-SQUARED = .812679

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
15	1466.4	752.971
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.455546	.740656
.455546	1.	-.14256
.740656	-.14256	1

COVARIANCE MATRIX

9.97792E+07	-5.83684E+07	-13995.7
-5.83684E+07	7.26657E+07	-19660.7
-13995.7	-19660.7	25.6332

INDEX	B	STD. ERROR	T-RATIO
0	15169.8	9988.96	1.51865
12	27211.4	8524.42	3.19217
15	-9.62889	5.06292	-1.90184

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-27812.7	58152.3
12	-9469.19	63892.
15	-31.4147	12.1569

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	15169.8
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	27211.4
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-9.62889

STAND. ERROR OF EST. = 6787.4 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-1.17188E-02
40917.6	40917.6	-7.08008E-03
33803.	26012.1	7790.9
21377.4	26012.1	-4634.67
22855.8	26012.1	-3156.23

R-SQUARED = .839261

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
16	1.018	.388742
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.606843	.740656
.606843	1	.958187
.740656	.958187	1

COVARIANCE MATRIX

2.85875E+07	-1.15897E+07	-1.20685E+07
-1.15897E+07	2.36857E+07	-1.65355E+07
-1.20685E+07	-1.65355E+07	3.13468E+07

INDEX	B	STD. ERROR	T-RATIO
0	365.188	5346.73	6.83011E-02
12	6745.08	4866.79	1.38594
16	24798.	5598.82	4.42914

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-22641.8	23372.2
12	-14196.7	27686.9
16	706.254	48889.7

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	365.188
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6745.08
16	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	24798.

STAND. ERROR OF EST. = 3459.85 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	0
40917.6	40587.6	330.016
33803.	31908.3	1894.7
21377.4	19509.3	1868.13
22855.8	26948.7	-4092.83

R-SQUARED = .958237

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
17	.148863	.316298
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-.214003	.740656
-.214003	1.	.367595
.740656	.367595	1

COVARIANCE MATRIX

1.05726E+08	-7.54314E+07	-4.00281E+07
-7.54314E+07	6.05854E+07	1.83319E+07
-4.00281E+07	1.83319E+07	1.21117E+08

INDEX	B	STD. ERROR	T-RATIO
0	3016.	10282.3	.293319
12	22984.4	7783.66	2.9529
17	20867.2	11005.3	1.8961

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-41228.8	47260.8
12	-10508.7	56477.5
17	-26488.7	68223.1

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	3016.
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	22984.4
17	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	20867.2

STAND. ERROR OF EST. = 6800.63 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-.010498
40917.6	40905.5	12.041
33803.	26000.4	7802.52
21377.4	26021.3	-4643.89
22855.8	26026.5	-3170.67

R-SQUARED = .838636

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
18	28.73	40.8698
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-.355218	.740656
-.355218	1	-.206106
.740656	-.206106	1

COVARIANCE MATRIX

3.57331E+08	-2.40772E+08	-1.48765E+06
-2.40772E+08	1.83561E+08	713492.
-1.48765E+06	713492.	21979.

INDEX	B	STD. ERROR	T-RATIO
0	8619.43	18903.2	.455977
12	20446.2	13548.5	1.50911
18	19.1029	148.253	.128853

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-72721.	89959.9
12	-37853.	78745.3
18	-618.83	657.036

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8619.43
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	20446.2
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	19.1029

STAND. ERROR OF EST. = 11327.8 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-1.30005E-02
40917.6	29082.6	11835.
33803.	30975.9	2827.08
21377.4	29447.6	-8070.25
22855.8	29447.6	-6591.81

R-SQUARED = .552289

AD-A082 431 HUGHES AIRCRAFT CO FULLERTON CALIF FIELD SERVICE AND--ETC F/G 5/1
OPERATIONS AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST--ETC(U)
JAN 80 D R BOGARD, T H HSU, R KIRKPATRICK F30602-78-C-0150

UNCLASSIFIED RADC -TR-79-334 NL

3 OF 4
AD
A082431

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
19	1.98	3.04746
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-8.80496E-02	.740656
-8.80496E-02	1	.222385
.740656	.222385	1

COVARIANCE MATRIX

2.31849E+08	-1.62875E+08	-7.72734E+06
-1.62875E+08	1.32896E+08	1.71719E+06
-7.72734E+06	1.71718E+06	2.86198E+06

INDEX	B	STD. ERROR	T-RATIO
0	6838.24	15226.6	.449099
12	20509.2	11528.1	1.77907
19	1138.58	1691.74	.673023

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-58681.8	72358.3
12	-29096.1	70114.4
19	-6140.97	8418.13

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6838.24
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	20509.2
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1138.58

STAND. ERROR OF EST. = 10271. D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-9.03320E-03
40917.6	28599.9	12317.7
33803.	35659.1	-1856.09
21377.4	27347.4	-5970.03
22855.8	27347.4	-4491.59

R-SQUARED = .631932

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
20	2.90332E-02	3.64508E-02
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	.366181	.740656
.366181	1	.817429
.740656	.817429	1

COVARIANCE MATRIX

6.15709E+07	-4.72959E+07	4.51442E+07
-4.72959E+07	4.42198E+07	-1.98665E+08
4.51446E+07	-1.98665E+08	6.65629E+09

INDEX	B	STD. ERROR	T-RATIO
0	11317.4	7846.71	1.44232
12	13643.	6649.8	2.05164
20	207165.	81586.1	2.53921

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-22447.	45081.8
12	-14971.1	42257.1
20	-143900.	558230.

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	11317.4
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	13643.
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	207165.

STAND. ERROR OF EST. = 5534.65 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-9.76563E-03
40917.6	41803.1	-885.494
33803.	27229.5	6573.5
21377.4	24960.6	-3583.22
22855.8	24960.6	-2104.78

R-SQUARED = .893124

```
REGRESSION NUMBER =  10
NUMBER OF INDEPENDENT VARIABLES =  2
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  12
INDEPENDENT OR DEPENDENT VARIABLE -  21
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10   :DEPENDENT VARIABLE IS  1

INDEX          MEANS          STANDARD DEVIATIONS
12              1.2            .447214
21              .64            1.04307
1               33703.6        11971.1

CORRELATION COEFFICIENTS
1.             8.57492E-02     .740656
8.57492E-02    1.              .60068
.740656         .60068         1

COVARIANCE MATRIX
9.38455E+07    -6.82513E+07   -4.26571E+06
-6.82513E+07    5.80136E+07   -2.13284E+06
-4.26571E+06   -2.13284E+06    1.06643E+07

INDEX          B              STD. ERROR     T-RATIO
0               7428.15        9687.39        .766786
12              18583.9        7616.67       2.4399
21              6210.63        3265.62        1.90182

****** CONFIDENCE INTERVALS ******

INDEX          L-LIMIT        U-LIMIT
0              -34256.7        49113.
12             -14190.6        51358.4
21             -7841.32        20262.6

****** TEST OF HYPOTHESIS ******

INDEX
0              ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL     7428.15
12             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL     18583.9
21             ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL     6210.63

STAND. ERROR OF EST. = 6787.46               D.F.= 2

ACTUAL         PREDICTED      RESIDUAL
49564.5         49564.5       -7.81250E-03
40917.6         40917.6        3.90625E-03
33803.          26012.1        7790.89
21377.4         26012.1       -4634.67
22855.8         26012.1       -3156.23

R-SQUARED =     .839261
```

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	1.2	.447214
22	65.958	61.1905
1	33703.6	11971.1

CORRELATION COEFFICIENTS

1.	-.313244	.740656
-.313244	1	.321091
.740656	.321091	1

COVARIANCE MATRIX

9.71456E+07	-6.02289E+07	-279539.
-6.02289E+07	4.45810E+07	102062.
-279539.	102062.	2381.28

INDEX	B	STD. ERROR	T-RATIO
0	-4171.87	9856.25	-.423272
12	24968.3	6676.9	3.73951
22	119.979	48.7984	2.45866

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-46583.3	38239.6
12	-3762.38	53699.
22	-90.0009	329.958

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-4171.87
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	24968.3
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	119.979

STAND. ERROR OF EST. = 5671.44 D.F.= 2

ACTUAL	PREDICTED	RESIDUAL
49564.5	49564.5	-8.30078E-03
40917.6	34648.	6269.61
33803.	38501.7	-4698.71
21377.4	23088.	-1710.63
22855.8	22716.1	139.738

R-SQUARED = .887773

MULTIPLE LINEAR REGRESSION ANALYSIS

TUE, JUN 12, 1979, 7:39 AM

DATA IS FROM FILE => DATA5

N = 7
V = 22

171448.	6.2	.33	696	1000
250	.015	16.75	3	18000
1250	5	4	1.28700E+06	7200
11.28	8.47458E-03	500	0	.000001
0	250			
173314.	6.2	.33	696	1000
250	.015	16.75	3	18000
1200	5	4	1.38700E+06	7200
10.17	8.84956E-03	500	0	.000001
0	250			
163882.	6.2	.33	696	1000
250	.015	16.75	3	18000
1300	5	4	1.21300E+06	7200
11.8	8.19672E-03	400	0	.000001
0	250			
113810	6.2	.33	696	1000
250	.015	16.75	3	18000
3000	4	5	512000	5400
12.2	1.30890E-03	200	0	.000001
0	382.81			
109094.	6.2	.33	696	1000
250	.015	16.75	3	18000
13158	1	3	500000	1040
1	.001	50	4	5.47945E-03
1	15.83			
35521.7	6.2	.33	696	1000
250	.015	16.75	3	18000
1316	1	2	500000	1040
1	.001	192	2	2.73973E-03
5	135			
30416.8	6.2	.33	696	1000
250	.015	16.75	3	18000
484	1	3	500000	200
4	3.59066E-04	200	1	5.47945E-03
1	33.25			

NUMBER OF REGRESSION MODELS = 12

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
11	3101.14	4499.48
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	3.46343E-04
3.46343E-04	1

COVARIANCE MATRIX

9.98047E+08	-114759.
-114759.	37.0055

INDEX	B	STD. ERROR	T-RATIO
0	113912.	31591.9	3.60574
11	4.70811E-03	6.08322	7.73951E-04

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	32689.3	195135.
11	-15.6352	15.6447

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	113912.
11	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	4.70811E-03

STAND. ERROR OF EST. = 67045.8 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	113918.	57530.2
173314.	113918.	59395.9
163882.	113918.	49964.1
113810	113926.	-116.156
109094.	113974.	-4879.93
35521.7	113918.	-78396.6
30416.8	113914.	-83497.5

R-SQUARED = 0

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
14	842714.	426708.
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.852358
.852358	1

COVARIANCE MATRIX

9.74772E+08	-948.302
-948.302	1.12530E-03

INDEX	B	STD. ERROR	T-RATIO
0	10899.5	31221.3	.349105
14	.122256	3.35454E-02	3.6445

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-69370.5	91169.6
14	.036011	.208502

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	10899.5
14	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	.122256

STAND. ERROR OF EST. = 35062.3 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	168243.	3204.78
173314.	180469.	-7155.44
163882.	159196.	4685.88
113810	73494.8	40315.3
109094.	72027.7	37066.4
35521.7	72027.7	-36506
30416.8	72027.7	-41610.9

R-SQUARED = .726513

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.912186
.912186	1

COVARIANCE MATRIX

3.12869E+08	-49018.9
-49018.9	11.719

INDEX	B	STD. ERROR	T-RATIO
0	42651.3	17688.1	2.4113
15	17.0399	3.4233	4.97761

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-2824.8	88127.5
15	8.23855	25.8412

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	42651.3
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17.0399

STAND. ERROR OF EST. = 27473.8 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	165338.	6109.81
173314.	165338.	7975.22
163882.	165338.	-1456.06
113810	134667.	-20856.6
109094.	60372.8	48721.3
35521.7	60372.8	-24851.1
30416.8	46059.3	-15642.5

R-SQUARED = .832082

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
16	7.35	5.14117
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.754031
.754031	1

COVARIANCE MATRIX

9.37686E+08	-8.98820E+07
-8.98820E+07	1.22288E+07

INDEX	B	STD. ERROR	T-RATIO
0	47949.2	30621.7	1.56586
16	8976.52	3496.98	2.56694

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-30779.	126677.
16	-14.209	17967.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	47949.2
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8976.52

STAND. ERROR OF EST. = 44038.3 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	149204.	22243.8
173314.	139240.	34073.1
163882.	153872.	10010.1
113810	157463.	-43652.7
109094.	56925.7	52168.3
35521.7	56925.7	-21404.1
30416.8	83855.3	-53438.5

R-SQUARED = .568562

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
17	4.16983E-03	4.07122E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.87563
.87563	1

COVARIANCE MATRIX

3.33131E+08	-4.39666E+10
-4.39666E+10	1.05440E+13

INDEX	B	STD. ERROR	T-RATIO
0	59036.4	18251.9	3.23453
17	1.31637E+07	3.24715E+06	4.05392

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	12110.8	105962.
17	4.81525E+06	2.15121E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	59036.4
17	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	1.31637E+07

STAND. ERROR OF EST. = 32381.9 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	170593.	855.281
173314.	175529	-2215.45
163882.	166935.	-3053
113810	76266.3	37543.7
109094.	72200.	36894.
35521.7	72200.	-36678.4
30416.8	63763.	-33346.2

R-SQUARED = .766729

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
18	291.714	174.968
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.722394
.722394	1

COVARIANCE MATRIX

1.30280E+09	-3.41344E+06
-3.41344E+06	11701.3

INDEX	B	STD. ERROR	T-RATIO
0	40212.	36094.3	1.11408
18	252.694	108.173	2.33603

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-52586.3	133010.
18	-25.4172	530.806

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	40212.
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	252.694

STAND. ERROR OF EST. = 46360.9 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	166559.	4888.84
173314.	166559.	6754.25
163882.	141290.	22592.4
113810	90750.9	23059.1
109094.	52846.8	56247.3
35521.7	88729.4	-53207.7
30416.8	90750.9	-60334.2

R-SQUARED = .521853

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
19	1	1.52753
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.46288
-.46288	1

COVARIANCE MATRIX

7.56862E+08	-2.52287E+08
-2.52287E+08	2.52287E+08

INDEX	B	STD. ERROR	T-RATIO
0	132473.	27511.1	4.81526
19	-18546.4	15883.6	-1.16765

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	61742.	203204.
19	-59383.1	22290.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	132473.
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-18546.4

STAND. ERROR OF EST. = 59430.8 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	132473.	38975.1
173314.	132473.	40840.5
163882.	132473.	31409.2
113810	132473.	-18663.1
109094.	58287.3	50806.7
35521.7	95380.2	-59858.5
30416.8	113927.	-83509.9

R-SQUARED = .214257

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
20	1.95752E-03	2.60550E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1	-.730254
-.730254	1

COVARIANCE MATRIX

4.97089E+08	-1.00828E+11
-1.00828E+11	5.15081E+13

INDEX	B	STD. ERROR	T-RATIO
0	147506.	22295.5	6.61595
20	-1.71539E+07	7.17691E+06	-2.39015

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	90184.1	204828.
20	-3.56058E+07	1.29791E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	147506.
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1.71539E+07

STAND. ERROR OF EST. = 45804.1 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	147489.	23959.5
173314.	147489.	25824.9
163882.	147489.	16393.6
113810	147489.	-33678.6
109094.	53511.6	55582.4
35521.7	100509.	-64987.
30416.8	53511.6	-23094.9

R-SQUARED = .53327

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
21	1	1.82574
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.716476
-.716476	1

COVARIANCE MATRIX

4.21896E+08	-1.09380E+08
-1.09380E+08	1.09380E+08

INDEX	B	STD. ERROR	T-RATIO
0	137945	20540.1	6.71588
21	-24018.4	10458.5	-2.29654

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	85136.4	190754.
21	-50907.2	2870.47

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	137945
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-24018.4

STAND. ERROR OF EST. = 46771.9 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	137945	33503.1
173314.	137945	35368.5
163882.	137945	25937.3
113810	137945	-24135
109094.	113927.	-4832.59
35521.7	17853.2	17668.5
30416.8	113927.	-83509.9

R-SQUARED = .513338

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
22	188.127	132.842
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.578758
.578758	1

COVARIANCE MATRIX

1.42631E+09	-5.31154E+06
-5.31154E+06	28233.8

INDEX	B	STD. ERROR	T-RATIO
0	63762.4	37766.5	1.68833
22	266.651	168.029	1.58693

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-33335.3	160860.
22	-165.352	698.653

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	63762.4
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	266.651

STAND. ERROR OF EST. = 54675.8 D.F.= 5

ACTUAL	PREDICTED	RESIDUAL
171448.	130425.	41023.1
173314.	130425.	42888.5
163882.	130425.	33457.2
113810	165839.	-52028.9
109094.	67983.5	41110.5
35521.7	99760.3	-64238.6
30416.8	72628.6	-42211.8

R-SQUARED = .334961

MULTIPLE LINEAR REGRESSION ANALYSIS

TUE, JUN 12, 1979, 7:40 AM

DATA IS FROM FILE => DATA5

N = 7
V = 22

171448.	6.2	.33	696	1000
250	.015	16.75	3	18000
1250	5	4	1.28700E+06	7200
11.28	8.47458E-03	500	0	.000001
0	250			
173314.	6.2	.33	696	1000
250	.015	16.75	3	18000
1200	5	4	1.38700E+06	7200
10.17	8.84956E-03	500	0	.000001
0	250			
163882.	6.2	.33	696	1000
250	.015	16.75	3	18000
1300	5	4	1.21300E+06	7200
11.8	8.19672E-03	400	0	.000001
0	250			
113810	6.2	.33	696	1000
250	.015	16.75	3	18000
3000	4	5	512000	5400
12.2	1.30890E-03	200	0	.000001
0	382.81			
109094.	6.2	.33	696	1000
250	.015	16.75	3	18000
13158	1	3	500000	1040
1	.001	50	4	5.47945E-03
1	15.83			
35521.7	6.2	.33	696	1000
250	.015	16.75	3	18000
1316	1	2	500000	1040
1	.001	192	2	2.73973E-03
5	135			
30416.8	6.2	.33	696	1000
250	.015	16.75	3	18000
484	1	3	500000	200
4	3.59066E-04	200	1	5.47945E-03
1	33.25			

NUMBER OF REGRESSION MODELS = 21

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
11	3101.14	4499.48
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.409779	.89251
-.409779	1.	3.46343E-04
.89251	3.46343E-04	1

COVARIANCE MATRIX

2.11949E+08	-4.27925E+07	-14010.3
-4.27925E+07	1.15104E+07	2133.68
-14010.3	2133.68	2.35541

INDEX	B	STD. ERROR	T-RATIO
0	-6016.54	14558.5	-.413267
12	32258.7	3392.7	9.50826
11	5.98447	1.53474	3.89935

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-46285.3	34252.2
12	22874.5	41642.9
11	1.73939	10.2295

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-6016.54
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	32258.7
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	5.98447

STAND. ERROR OF EST. = 15429.6 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	162758.	8690.6
173314.	162458.	10855.2
163882.	163057.	825.502
113810	140972.	-27161.6
109094.	104986.	4108.25
35521.7	34117.7	1403.95
30416.8	29138.6	1278.13

R-SQUARED = .957631

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
13	3.57143	.9759
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.791114	.89251
.791114	1.	.683744
.89251	.683744	1

COVARIANCE MATRIX

3.62033E+09	3.35782E+08	-1.26376E+09
3.35782E+08	1.22102E+08	-2.01469E+08
-1.26376E+09	-2.01469E+08	5.31145E+08

INDEX	B	STD. ERROR	T-RATIO
0	38487.3	60169.2	.639652
12	28257.6	11050.	2.55725
13	-3743.69	23046.6	-.16244

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-127941.	204915.
12	-2306.64	58821.9
13	-67490.5	60003.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	38487.3
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	28257.6
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-3743.69

STAND. ERROR OF EST. = 33697.9 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	164801.	6647.5
173314.	164801.	8512.91
163882.	164801.	-918.355
113810	132799.	-18989.3
109094.	55513.8	53580.2
35521.7	59257.5	-23735.9
30416.8	55513.9	-25097.1

R-SQUARED = .797907

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
14	842714.	426708.
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.852652	.89251
.852652	1.	.852358
.89251	.852358	1

COVARIANCE MATRIX

7.81700E+08	4.07345E+07	-914.87
4.07344E+07	1.43133E+08	-582.145
-914.869	-582.145	3.25670E-03

INDEX	B	STD. ERROR	T-RATIO
0	16095.4	27958.9	.57568
12	18257.2	11963.8	1.52603
14	4.80014E-02	5.70675E-02	.841134

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-61239.	93429.7
12	-14834.7	51349.1
14	-.109847	.20585

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	16095.4
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	18257.2
14	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	4.80014E-02

STAND. ERROR OF EST. = 31164.8 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	169159.	2288.91
173314.	173959.	-645.828
163882.	165607.	-1724.86
113810	113701.	109.094
109094.	58353.3	50740.8
35521.7	58353.3	-22831.6
30416.8	58353.3	-27936.5

R-SQUARED = .827147

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
15	4182.86	3276.41
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.996109	.89251
.996109	1.	.912186
.89251	.912186	1

COVARIANCE MATRIX

1.51587E+09	-2.16927E+09	1.29331E+06
-2.16927E+09	3.91243E+09	-2.42106E+06
1.29331E+06	-2.42106E+06	1509.91

INDEX	B	STD. ERROR	T-RATIO
0	77268.1	38934.1	1.98459
12	-62433.9	62549.4	-.998153
15	55.6747	38.8575	1.43279

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-30423.7	184960.
12	-235446.	110578.
15	-51.8052	163.155

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	77268.1
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-62433.9
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	55.6747

STAND. ERROR OF EST. = 27484.1 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	165956.	5491.69
173314.	165956.	7357.06
163882.	165956.	-2074.19
113810	128176.	-14365.9
109094.	72735.9	36358.1
35521.7	72735.9	-37214.2
30416.8	25969.2	4447.6

R-SQUARED = .865563

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
16	7.35	5.14117
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.945273	.89251
.945273	1.	.754031
.89251	.754031	1

COVARIANCE MATRIX

3.89424E+08	-1.06566E+08	6.55904E+06
-1.06566E+08	2.71696E+08	-1.01678E+08
6.55908E+06	-1.01679E+08	4.25853E+07

INDEX	B	STD. ERROR	T-RATIO
0	28036.1	19733.8	1.42071
12	50769.7	16483.2	3.08008
16	-10023.3	6525.74	-1.53596

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-26547.7	82619.9
12	5177.11	96362.3
16	-28073.5	8026.89

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	28036.1
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	50769.7
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-10023.3

STAND. ERROR OF EST. = 26813.8 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	168822.	2626.55
173314.	179947.	-6633.94
163882.	163609.	272.781
113810	108830.	4979.55
109094.	68782.5	40311.6
35521.7	68782.5	-33260.8
30416.8	38712.5	-8295.78

R-SQUARED = .872044

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
17	4.16983E-03	4.07122E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.874158	.89251
.874158	1.	.87563
.89251	.87563	1

COVARIANCE MATRIX

5.69641E+08	-2.08586E+08	5.23314E+10
-2.08588E+08	1.57961E+08	-6.90345E+10
5.23315E+10	-6.90345E+10	3.94822E+13

INDEX	B	STD. ERROR	T-RATIO
0	37642.9	23867.2	1.57719
12	16201.	12568.3	1.28904
17	6.08326E+06	6.28349E+06	.968134

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-28373.6	103659.
12	-18562.8	50964.9
17	-1.12969E+07	2.34634E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	37642.9
12	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	16201.
17	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	6.08326E+06

STAND. ERROR OF EST. = 30431. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	170201.	1246.98
173314.	172482.	831.281
163882.	168511.	-4628.64
113810	110409.	3400.54
109094.	59927.2	49166.8
35521.7	59927.2	-24405.6
30416.8	56028.3	-25611.5

R-SQUARED = .835191

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
18	291.714	174.968
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.853753	.89251
.853753	1.	.722394
.89251	.722394	1

COVARIANCE MATRIX

6.83096E+08	-4.04811E+07	-1.36167E+06
-4.04815E+07	1.64797E+08	-1.63672E+06
-1.36167E+06	-1.63672E+06	22301.4

INDEX	B	STD. ERROR	T-RATIO
0	32698.7	26136.1	1.25109
12	30586.4	12837.3	2.38261
18	-51.0802	149.336	-.342048

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-39593.7	104991.
12	-4921.69	66094.5
18	-464.145	361.984

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	32698.7
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	30586.4
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-51.0802

STAND. ERROR OF EST. = 33325. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	160091.	11357.4
173314.	160091.	13222.8
163882.	165199.	-1316.46
113810	144828.	-31018.3
109094.	60731.1	48362.9
35521.7	53477.8	-17956.1
30416.8	53069.1	-22652.3

R-SQUARED = .802354

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
19	1	1.52753
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.804084	.89251
-.804084	1.	-.46288
.89251	-.46288	1

COVARIANCE MATRIX

2.48490E+08	-5.33124E+07	-6.50592E+07
-5.33124E+07	1.26504E+07	1.35540E+07
-6.50592E+07	1.35540E+07	2.24609E+07

INDEX	B	STD. ERROR	T-RATIO
0	-54076.9	15763.6	-3.4305
12	44266.1	3556.74	12.4457
19	28881.5	4739.3	6.09405

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-97679.	-10474.9
12	34428.2	54104.
19	15772.6	41990.4

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	-54076.9
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	44266.1
19	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	28881.5

STAND. ERROR OF EST. = 10542.4 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	167254.	4194.56
173314.	167254.	6059.97
163882.	167254.	-3371.31
113810	122987.	-9177.47
109094.	105715.	3378.78
35521.7	47952.2	-12430.6
30416.8	19070.7	11346.1

R-SQUARED = .98022

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
20	1.95752E-03	2.60550E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.922323	.89251
-.922323	1	-.730254
.89251	-.730254	1

COVARIANCE MATRIX

4.76337E+09	-1.00357E+09	-7.62403E+11
-1.00357E+09	2.20406E+08	1.58806E+11
-7.62403E+11	1.58806E+11	1.34506E+14

INDEX	B	STD. ERROR	T-RATIO
0	-53283.5	69017.2	-.772032
12	44097.8	14846.1	2.97033
20	1.46191E+07	1.15977E+07	1.26052

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-244185.	137618
12	3033.47	85162.
20	-1.74601E+07	4.66983E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-53283.5
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	44097.8
20	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	1.46191E+07

STAND. ERROR OF EST. = 28602. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	167220.	4228.22
173314.	167220.	6093.63
163882.	167220.	-3337.65
113810	123122.	-9312.15
109094.	70919.	38175.1
35521.7	30866.6	4655.04
30416.8	70919	-40502.2

R-SQUARED = .854407

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 2
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
2	777	726.86
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.212459	.999937
-.212459	1	-.209013
.999937	-.209013	1.

COVARIANCE MATRIX

1.86519E+08	-3859.17	-106824.
-3859.17	.216751	1.07528
-106824.	1.07528	118.177

INDEX	B	STD. ERROR	T-RATIO
0	8793.1	13657.2	.643844
10	74.2135	.465565	159.405
2	6.22424	10.8709	.572558

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-34664.1	52250.3
10	72.732	75.6949
2	-28.3671	40.8156

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8793.1
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.2135
2	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6.22424

STAND. ERROR OF EST. = 17265.3 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73678E+06	-20269.
2.55721E+06	2.53554E+06	21670.9
5528	9427.97	-3899.97
170590	170291.	299.09
90958	89230.8	1727.21
752644	752173.	471.526

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	3.14286	2.0354
22	188.127	132.842
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.817671	.89251
.817671	1.	.578758
.89251	.578758	1

COVARIANCE MATRIX

4.17581E+08	-7.21589E+07	-439835.
-7.21590E+07	9.18126E+07	-1.15026E+06
-439833.	-1.15026E+06	21554.2

INDEX	B	STD. ERROR	T-RATIO
0	33864.1	20434.8	1.65718
12	38041.6	9581.89	3.97016
22	-209.948	146.814	-1.43003

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-22658.5	90386.7
12	11538.1	64545.1
22	-616.034	196.139

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	33864.1
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	38041.6
22	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-209.948

STAND. ERROR OF EST. = 27501.9 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	171585.	-137.188
173314.	171585.	1728.22
163882.	171585.	-7703.06
113810	105661.	8149.44
109094.	68582.3	40511.8
35521.7	43562.8	-8041.13
30416.8	64925.	-34508.2

R-SQUARED = .865391

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
11	3101.14	4499.48
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.366881	.912186
-.366881	1.	3.46343E-04
.912186	3.46343E-04	1

COVARIANCE MATRIX

1.44473E+08	-19312.3	-10643.2
-19312.3	3.85372	1.02954
-10643.2	1.02954	2.04339

INDEX	B	STD. ERROR	T-RATIO
0	15224.	12019.7	1.26659
15	19.6929	1.96309	10.0316
11	5.26575	1.42947	3.6837

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-18022.5	48470.5
15	14.263	25.1228
11	1.31183	9.21967

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	15224.
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	19.6929
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	5.26575

STAND. ERROR OF EST. = 14656.2 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	163595.	7852.75
173314.	163332.	9981.44
163882.	163859.	23.584
113810	137363.	-23553.2
109094.	104991.	4102.59
35521.7	42634.4	-7112.74
30416.8	21711.2	8705.54

R-SQUARED = .96177

REGRESSION NUMBER = 13
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 13 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
13	3.57143	.9759
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.762513	.912186
.762513	1.	.683744
.912186	.683744	1

COVARIANCE MATRIX

3.09568E+09	173240.	-1.03202E+09
173240.	34.9275	-89414.4
-1.03202E+09	-89414.3	3.93689E+08

INDEX	B	STD. ERROR	T-RATIO
0	47289.7	55638.8	.84994
15	17.4417	5.90995	2.95125
13	-1769.41	19841.6	-8.91767E-02

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-106607.	201187.
15	1.09481	33.7886
13	-56651.3	53112.4

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	47289.7
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17.4417
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1769.41

STAND. ERROR OF EST. = 30686.2 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	165793.	5655.63
173314.	165793.	7521.04
163882.	165793.	-1910.25
113810	132628.	-18818.
109094.	60120.9	48973.2
35521.7	61890.3	-26368.6
30416.8	45469.8	-15053.

R-SQUARED = .832415

REGRESSION NUMBER = 14
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 14 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
14	842714.	426708.
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.860296	.912186
.860296	1.	.852358
.912186	.852358	1

COVARIANCE MATRIX

7.66388E+08	69828.1	-1112.83
69828.3	50.4611	-.333327
-1112.83	-.333327	2.97502E-03

INDEX	B	STD. ERROR	T-RATIO
0	28694.2	27683.7	1.0365
15	12.8593	7.10359	1.81025
14	3.73126E-02	5.45438E-02	.684086

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-47878.9	105267.
15	-6.78926	32.5078
14	-.113555	.188181

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	28694.2
15	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	12.8593
14	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	3.73126E-02

STAND. ERROR OF EST. = 29063.5 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	169302.	2145.75
173314.	173034.	279.891
163882.	166541.	-2658.99
113810	117238.	-3428.38
109094.	60724.2	48369.9
35521.7	60724.2	-25202.5
30416.8	49922.4	-19505.6

R-SQUARED = .849669

REGRESSION NUMBER = 15
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 15 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
16	7.35	5.14117
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.919702	.912186
.919702	1.	.754031
.912186	.754031	1

COVARIANCE MATRIX

3.30199E+08	8576.35	-3.65752E+07
8576.54	68.5615	-40184.9
-3.65753E+07	-40184.9	2.78453E+07

INDEX	B	STD. ERROR	T-RATIO
0	51264.5	18171.4	2.82117
15	26.5031	8.28019	3.20079
16	-6557.36	5276.87	-1.24266

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1002.47	101527.
15	3.60012	49.4061
16	-21153.2	8038.45

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	51264.5
15	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	26.5031
16	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-6557.36

STAND. ERROR OF EST. = 26090.5 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	168120.	3328.27
173314.	175399.	-2085
163882.	164710.	-827.797
113810	114382.	-571.5
109094.	72270.4	36823.7
35521.7	72270.4	-36748.7
30416.8	30335.7	81.0742

R-SQUARED = .878852

REGRESSION NUMBER = 16
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 16 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
17	4.16983E-03	4.07122E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.885592	.912186
.885592	1.	.87563
.912186	.87563	1

COVARIANCE MATRIX

3.48651E+08	-71795.8	1.66291E+10
-71795.8	59.2855	-4.22528E+07
1.66291E+10	-4.22528E+07	3.83968E+13

INDEX	B	STD. ERROR	T-RATIO
0	44697.7	18672.2	2.39381
15	11.8401	7.69971	1.53774
17	4.72519E+06	6.19652E+06	.762556

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-6949.58	96345.1
15	-9.45725	33.1375
17	-1.24144E+07	2.18648E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	44697.7
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.8401
17	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	4.72519E+06

STAND. ERROR OF EST. = 28701.3 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	169991.	1457.35
173314.	171763.	1550.89
163882.	168678.	-4795.61
113810	114819.	-1009.33
109094.	61736.7	47357.4
35521.7	61736.7	-26215.
30416.8	48762.4	-18345.7

R-SQUARED = .853395

REGRESSION NUMBER = 17
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 17 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
18	291.714	174.968
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.84611	.912186
.84611	1.	.722394
.912186	.722394	1

COVARIANCE MATRIX

5.52058E+08	21480.9	-1.76207E+06
21481.	48.9231	-775.14
-1.76207E+06	-775.14	17155.

INDEX	B	STD. ERROR	T-RATIO
0	48900.9	23495.9	2.08125
15	19.7891	6.99451	2.82923
18	-60.8442	130.977	-.46454

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-16088.8	113891.
15	.442265	39.1359
18	-423.127	301.439

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	48900.9
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	19.7891
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-60.8442

STAND. ERROR OF EST. = 29920.2 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	160960.	10488.
173314.	160960.	12353.4
163882.	167045.	-3162.27
113810	143593.	-29783.
109094.	66439.3	42654.7
35521.7	57799.5	-22277.8
30416.8	40689.9	-10273.1

R-SQUARED = .840677

REGRESSION NUMBER = 18
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 18 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
19	1	1.52753
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.760603	.912186
-.760603	1.	-.46288
.912186	-.46288	1

COVARIANCE MATRIX

3.39430E+08	-49807.8	-9.78690E+07
-49807.8	8.56645	13975.5
-9.78690E+07	13975.6	3.94113E+07

INDEX	B	STD. ERROR	T-RATIO
0	-11864.5	18423.6	-.643982
15	24.8246	2.92685	8.48169
19	21953.2	6277.84	3.49693

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-62824.3	39095.3
15	16.729	32.9203
19	4588.69	39317.7

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-11864.5
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	24.8246
19	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	21953.2

STAND. ERROR OF EST. = 15249.8 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	166873.	4575.22
173314.	166873.	6440.63
163882.	166873.	-2990.66
113810	122189.	-8378.58
109094.	101766.	7328.14
35521.7	57859.5	-22337.9
30416.8	15053.6	15363.1

R-SQUARED = .95861

REGRESSION NUMBER = 19
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 19 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
20	1.95752E-03	2.60550E-03
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.930207	.912186
-.930207	1	-.730254
.912186	-.730254	1

COVARIANCE MATRIX

1.82403E+09	-268625.	-3.31526E+11
-268625.	41.5016	4.85459E+07
-3.31526E+11	4.85459E+07	6.56266E+13

INDEX	B	STD. ERROR	T-RATIO
0	-61529.	42708.7	-1.44067
15	32.2952	6.44218	5.01308
20	2.06228E+07	8.10102E+06	2.54571

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-179661.	56603.2
15	14.4761	50.1142
20	-1.78460E+06	4.30303E+07

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-61529.
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	32.2952
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2.06228E+07

STAND. ERROR OF EST. = 18976.3 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	171017.	431.377
173314.	171017.	2296.78
163882.	171017.	-7134.5
113810	112885.	924.533
109094.	85059.8	24034.3
35521.7	28558.9	6962.8
30416.8	57931.8	-27515.1

R-SQUARED = .935912

REGRESSION NUMBER = 20
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 20 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
21	1	1.82574
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	-.636366	.912186
-.636366	1.	-.716476
.912186	-.716476	1

COVARIANCE MATRIX

7.17110E+08	-106825.	-1.60438E+08
-106825.	20.0615	22910.3
-1.60438E+08	22910.3	6.46073E+07

INDEX	B	STD. ERROR	T-RATIO
0	61676.8	26778.9	2.30318
15	14.3231	4.47901	3.19782
21	-7661.43	8037.87	-.953168

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-12393.7	135747.
15	1.93411	26.712
21	-29894.2	14571.3

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	61676.8
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	14.3231
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-7661.43

STAND. ERROR OF EST. = 27728.6   D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	164803.	6645.38
173314.	164803.	8510.78
163882.	164803.	-920.5
113810	139021.	-25211.3
109094.	68911.3	40182.7
35521.7	38265.6	-2743.91
30416.8	56880.	-26463.2

R-SQUARED = .863162

REGRESSION NUMBER = 21
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 21 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	4182.86	3276.41
22	188.127	132.842
1	113927.	61204.1

CORRELATION COEFFICIENTS

1.	.812694	.912186
.812694	1.	.578758
.912186	.578758	1

COVARIANCE MATRIX

2.45413E+08	-9535.11	-708158.
-9535.04	23.1442	-463.909
-708160.	-463.909	14078.9

INDEX	B	STD. ERROR	T-RATIO
0	53747.5	15665.7	3.43091
15	24.3089	4.81085	5.05293
22	-220.603	118.655	-1.8592

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	10416.3	97078.7
15	11.0021	37.6157
22	-548.802	107.595

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	53747.5
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	24.3089
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-220.603

STAND. ERROR OF EST. = 22497.4 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
171448.	173621.	-2172.52
173314.	173621.	-307.109
163882.	173621.	-9738.39
113810	100566.	13243.6
109094.	75536.6	33557.5
35521.7	49247.3	-13725.6
30416.8	51274.2	-20857.4

R-SQUARED = .909922

MULTIPLE LINEAR REGRESSION ANALYSIS

TUE, JUN 12, 1979, 7:43 AM

DATA IS FROM FILE => DATA6

N = 13
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250	.015	16.75	3	18000
600	2	1	5000	2080
.96	1.72414E-02	1.04	1.9	1.09529E-02
10	39.72			
68068.2	6.2	.33	696	1000
250	.015	16.75	3	18000
2000	2	2	508000	3240
11.8	1.40845E-02	0	0	.000001
0	208.33			
59987.5	6.2	.33	696	1000
250	.015	16.75	3	18000
1500	2	2	465000	3240
11.91	7.24638E-03	0	0	.000001
0	208.33			
62286.5	6.2	.33	696	1000
250	.015	16.75	3	18000
1200	2	3	502000	3240
11	.0125	0	0	.000001
0	110.42			
73819.	6.2	.33	696	1000
250	.015	16.75	3	18000
2700	2	2	1.11200E+06	2880
7.38	4.76190E-03	0	0	.000001
0	100			
65042.8	6.2	.33	696	1000
250	.015	16.75	3	18000
2300	2	2	440000	2880
11.6	9.43396E-03	0	0	.000001
0	166.67			
100164.	6.2	.33	696	1000
250	.015	16.75	3	18000
2300	4	2	436000	5400
6.68	3.61011E-03	0	0	.000001
0	125			
68914.4	6.2	.33	696	1000
250	.015	16.75	3	18000
1600	3	2	51000	5040
5.5	1.02041E-03	0	0	.000001
0	50			
44240.6	6.2	.33	696	1000
250	.015	16.75	3	18000
450	2	2	181000	2520
2.92	6.23441E-04	0	0	.000001
0	85			
62333.6	6.2	.33	696	1000
250	.015	16.75	3	18000
1900	2	2	581000	2880
10.31	5.64972E-03	0	0	.000001

0	208.33			
48960.3	6.2	.33	696	1000
250	.015	16.75	3	18000
450	2	2	210000	3240
10.93	7.35294E-03	0	0	.000001
0	85			
74498.1	6.2	.33	696	1000
250	.015	16.75	3	18000
4200	2	2	285000	2880
7.8	1.36986E-02	0	0	.000001
0	208.33			
55649.2	6.2	.33	696	1000
250	.015	16.75	3	18000
1600	2	2	270000	2520
8.6	8.19672E-03	0	0	.000001
0	100			

NUMBER OF REGRESSION MODELS = 12

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
11	1753.85	1029.05
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1	.692262
.692262	1.

COVARIANCE MATRIX

4.14769E+07	-17946.2
-17946.2	10.2325

INDEX	B	STD. ERROR	T-RATIO
0	45684.7	6440.25	7.09362
11	10.1773	3.19882	3.18157

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	31509.7	59859.7
11	3.13668	17.2179

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	45684.7
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.1773

STAND. ERROR OF EST. = 11402.9 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	51791.1	-9811.42
68068.2	66039.3	2028.93
59987.5	60950.7	-963.205
62286.5	57897.5	4389.
73819.	73163.4	655.617
65042.8	69092.5	-4049.66
100164.	69092.5	31071.2
68914.4	61968.4	6945.97
44240.6	50264.5	-6023.95
62333.6	65021.6	-2687.95
48960.3	50264.5	-1304.24
74498.1	88429.3	-13931.2
55649.2	61968.4	-6319.21

R-SQUARED = .479226

```
REGRESSION NUMBER =  2
NUMBER OF INDEPENDENT VARIABLES =  1
COVARIANCE MATRIX CONTROL NUMBER =  1
RESIDUAL CONTROL NUMBER =  1
INDEPENDENT OR DEPENDENT VARIABLE -  12
INDEPENDENT OR DEPENDENT VARIABLE -  1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2    :DEPENDENT VARIABLE IS  1

INDEX         MEANS          STANDARD DEVIATIONS
12              2.23077       .599145
1               63534.1       15128.6

CORRELATION COEFFICIENTS
.999999        .722985
.722985        1.

COVARIANCE MATRIX
1.46836E+08    -6.17137E+07
-6.17137E+07    2.76648E+07

INDEX         B              STD. ERROR      T-RATIO
0               22810.2       12117.6          1.88241
12              18255.5       5259.73          3.47081

****** CONFIDENCE INTERVALS ******

INDEX         L-LIMIT        U-LIMIT
0             -3860.58        49481.1
12              6678.87       29832.2

****** TEST OF HYPOTHESIS ******

INDEX
0             ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL      22810.2
12            REJECT HO (COEFFICIENT = 0) AT 95% LEVEL      18255.5

STAND. ERROR OF EST. = 10916.6               D.F.= 11

ACTUAL        PREDICTED      RESIDUAL
41979.7         59321.3       -17341.6
68068.2         59321.3        8746.93
59987.5         59321.3        666.148
62286.5         59321.3        2965.16
73819.          59321.3        14497.7
65042.8         59321.3        5721.52
100164.         95832.4        4331.31
68914.4         77576.8       -8662.48
44240.6         59321.3       -15080.7
62333.6         59321.3        3012.32
48960.3         59321.3       -10361.
74498.1         59321.3        15176.8
55649.2         59321.3       -3672.13

R-SQUARED =     .522709
```

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
13	2	.408249
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999998	.273992
.273992	1.

COVARIANCE MATRIX

4.79637E+08	-2.30936E+08
-2.30936E+08	1.15468E+08

INDEX	B	STD. ERROR	T-RATIO
0	43227.4	21900.6	1.9738
13	10153.4	10745.6	.944886

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-4975.9	91430.6
13	-13497.7	33804.5

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	43227.4
13	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	10153.4

STAND. ERROR OF EST. = 15196.6 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	53380.7	-11401.1
68068.2	63534.1	4534.12
59987.5	63534.1	-3546.66
62286.5	73687.5	-11401.
73819.	63534.1	10284.9
65042.8	63534.1	1508.71
100164.	63534.1	36629.6
68914.4	63534.1	5380.24
44240.6	63534.1	-19293.6
62333.6	63534.1	-1200.49
48960.3	63534.1	-14573.8
74498.1	63534.1	10964.
55649.2	63534.1	-7884.94

R-SQUARED = 7.50716E-02

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
14	388154.	282707.
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	.428876
.428876	1.

COVARIANCE MATRIX

4.76818E+07	-82.4629
-82.4629	2.12449E-04

INDEX	B	STD. ERROR	T-RATIO
0	54625.8	6905.2	7.91082
14	2.29505E-02	1.45756E-02	1.57458

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	39427.5	69824.2
14	-9.13049E-03	5.50314E-02

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	54625.8
14	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2.29505E-02

STAND. ERROR OF EST. = 14274.3 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	54740.6	-12760.9
68068.2	66284.6	1783.59
59987.5	65297.8	-5310.32
62286.5	66146.9	-3860.47
73819.	80146.7	-6327.71
65042.8	64724.	318.816
100164.	64632.2	35531.5
68914.4	55796.3	13118.1
44240.6	58779.8	-14539.3
62333.6	67960.	-5626.4
48960.3	59445.4	-10485.1
74498.1	61166.7	13331.4
55649.2	60822.4	-5173.25

R-SQUARED = .183932

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	.729162
.729162	1.

COVARIANCE MATRIX

1.22158E+08	-34993.4
-34993.4	10.821

INDEX	B	STD. ERROR	T-RATIO
0	25941.6	11052.5	2.34712
15	11.6247	3.28953	3.53385

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1615.03	50268.2
15	4.38445	18.865

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	25941.6
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.6247

STAND. ERROR OF EST. = 10813.5 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	50121	-8141.31
68068.2	63605.6	4462.59
59987.5	63605.6	-3618.2
62286.5	63605.6	-1319.18
73819.	59420.8	14398.3
65042.8	59420.8	5622.07
100164.	88715.	11448.7
68914.4	84530.1	-15615.8
44240.6	55235.9	-10995.3
62333.6	59420.8	2912.87
48960.3	63605.6	-14645.4
74498.1	59420.8	15077.4
55649.2	55235.9	413.316

R-SQUARED = .531678

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
16	8.26077	3.52219
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	.20992
.20992	1.

COVARIANCE MATRIX

1.27767E+08	-1.32442E+07
-1.32442E+07	1.60327E+06

INDEX	B	STD. ERROR	T-RATIO
0	56085.8	11303.4	4.96185
16	901.646	1266.2	.712088

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	31207.	80964.7
16	-1885.26	3688.56

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	56085.8
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	901.646

STAND. ERROR OF EST. = 15449.2 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	569[illegible] 4	-14971.7
68068.2	66725.3	1342.99
59987.5	66824.4	-6836.98
62286.5	66003.9	-3717.46
73819.	62740.	11079.
65042.8	66544.9	-1502.09
100164.	62108.8	38054.9
68914.4	61044.9	7869.48
44240.6	58718.6	-14478.1
62333.6	65381.8	-3048.17
48960.3	65940.8	-16980.5
74498.1	63118.7	11379.5
55649.2	63840.	-8190.8

R-SQUARED = 4.40665E-02

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
17	8.10924E-03	5.13553E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1	-.202227
-.202227	1.

COVARIANCE MATRIX

6.81782E+07	-6.13590E+09
-6.13590E+09	7.56655E+11

INDEX	B	STD. ERROR	T-RATIO
0	68365.	8257.01	8.27964
17	-595731	869859.	-.684859

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	50191.4	86538.7
17	-2.51029E+06	1.31883E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	68365.
17	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-595731

STAND. ERROR OF EST. = 15474.8 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	58093.8	-16114.1
68068.2	59974.5	8093.77
59987.5	64048.2	-4060.7
62286.5	60918.4	1368.06
73819.	65528.2	8290.78
65042.8	62744.9	2297.88
100164.	66214.4	33949.3
68914.4	67757.2	1157.2
44240.6	67993.6	-23753.1
62333.6	64999.3	-2665.71
48960.3	63984.7	-15024.4
74498.1	60204.4	14293.8
55649.2	63482.	-7832.83

R-SQUARED = 4.08949E-02

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
18	.08	.288444
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1	-.428084
-.428084	1.

COVARIANCE MATRIX

1.69937E+07	-1.63401E+07
-1.63401E+07	2.04252E+08

INDEX	B	STD. ERROR	T-RATIO
0	65330.3	4122.34	15.8479
18	-22452.5	14291.7	-1.57102

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	56257.	74403.6
18	-53908.5	9003.42

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	65330.3
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-22452.5

STAND. ERROR OF EST. = 14280.2 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	3.90625E-03
68068.2	65330.3	2737.91
59987.5	65330.3	-5342.87
62286.5	65330.3	-3043.85
73819.	65330.3	8488.7
65042.8	65330.3	-287.492
100164.	65330.3	34833.4
68914.4	65330.3	3584.04
44240.6	65330.3	-21089.8
62333.6	65330.3	-2996.7
48960.3	65330.3	-16370.
74498.1	65330.3	9167.8
55649.2	65330.3	-9681.14

R-SQUARED = .183256

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
19	.146154	.526965
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	-.428085
-.428084	1.

COVARIANCE MATRIX

1.69937E+07	-8.94407E+06
-8.94407E+06	6.11962E+07

INDEX	B	STD. ERROR	T-RATIO
0	65330.3	4122.34	15.8479
19	-12289.8	7822.8	-1.57102

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	56257.	74403.6
19	-29507.8	4928.19

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	65330.3
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-12289.8

STAND. ERROR OF EST. = 14280.2 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	0
68068.2	65330.3	2737.91
59987.5	65330.3	-5342.87
62286.5	65330.3	-3043.85
73819.	65330.3	8488.7
65042.8	65330.3	-287.492
100164.	65330.3	34833.4
68914.4	65330.3	3584.04
44240.6	65330.3	-21089.8
62333.6	65330.3	-2996.7
48960.3	65330.3	-16370.
74498.1	65330.3	9167.8
55649.2	65330.3	-9681.14

R-SQUARED = .183256

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
20	8.43454E-04	3.03751E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	-.428085
-.428085	1.

COVARIANCE MATRIX

1.69968E+07	-1.55351E+09
-1.55351E+09	1.84184E+12

INDEX	B	STD. ERROR	T-RATIO
0	65332.5	4122.72	15.8469
20	-2.13211E+06	1.35715E+06	-1.57102

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	56258.3	74406.6
20	-5.11919E+06	854969.

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	65332.5
20	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-2.13211E+06

STAND. ERROR OF EST. = 14280.2 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	2.34375E-02
68068.2	65330.3	2737.91
59987.5	65330.3	-5342.87
62286.5	65330.3	-3043.85
73819.	65330.3	8488.7
65042.8	65330.3	-287.493
100164.	65330.3	34833.4
68914.4	65330.3	3584.04
44240.6	65330.3	-21089.8
62333.6	65330.3	-2996.7
48960.3	65330.3	-16370.
74498.1	65330.3	9167.8
55649.2	65330.3	-9681.14

R-SQUARED = .183256

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
21	.769231	2.7735
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	-.428084
-.428084	1.

COVARIANCE MATRIX

1.69937E+07	-1.69937E+06
-1.69937E+06	2.20918E+06

INDEX	B	STD. ERROR	T-RATIO
0	65330.3	4122.34	15.8479
21	-2335.06	1486.33	-1.57102

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	56257.	74403.6
21	-5606.48	936.355

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	65330.3
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-2335.06

STAND. ERROR OF EST. = 14280.2 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	-7.81250E-03
68068.2	65330.3	2737.91
59987.5	65330.3	-5342.87
62286.5	65330.3	-3043.85
73819.	65330.3	8488.7
65042.8	65330.3	-287.492
100164.	65330.3	34833.4
68914.4	65330.3	3584.04
44240.6	65330.3	-21089.8
62333.6	65330.3	-2996.7
48960.3	65330.3	-16370.
74498.1	65330.3	9167.8
55649.2	65330.3	-9681.14

R-SQUARED = .183256

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
22	130.395	62.3791
1	63534.1	15128.6

CORRELATION COEFFICIENTS

1.	.327278
.327278	1.

COVARIANCE MATRIX

9.83279E+07	-622563
-622563.	4774.45

INDEX	B	STD. ERROR	T-RATIO
0	53184.2	9916.04	5.36345
22	79.3737	69.0974	1.14872

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	31359.	75009.4
22	-72.7097	231.457

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	53184.2
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	79.3737

STAND. ERROR OF EST. = 14931.1 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
41979.7	56336.9	-14357.2
68068.2	69720.1	-1651.9
59987.5	69720.1	-9732.68
62286.5	61948.7	337.814
73819.	61121.6	12697.4
65042.8	66413.4	-1370.6
100164.	63105.9	37057.8
68914.4	57152.9	11761.5
44240.6	59931.	-15690.4
62333.6	69720.1	-7386.51
48960.3	59931.	-10970.7
74498.1	69720.1	4777.99
55649.2	61121.6	-5472.4

R-SQUARED = .107113

MULTIPLE LINEAR REGRESSION ANALYSIS

TUE, JUN 12, 1979, 7:46 AM

DATA IS FROM FILE => DATA6

N = 13
V = 22

41979.7	6.2	.33	696	1000
250	.015	16.75	3	18000
600	2	1	5000	2080
.96	1.72414E-02	1.04	1.9	1.09529E-02
10	39.72			
60068.2	6.2	.33	696	1000
250	.015	16.75	3	18000
2000	2	2	508000	3240
11.8	1.40845E-02	0	0	.000001
0	208.33			
59987.5	6.2	.33	696	1000
250	.015	16.75	3	18000
1500	2	2	465000	3240
11.91	7.24638E-03	0	0	.000001
0	208.33			
62286.5	6.2	.33	696	1000
250	.015	16.75	3	18000
1200	2	3	502000	3240
11	.0125	0	0	.000001
0	110.42			
73819.	6.2	.33	696	1000
250	.015	16.75	3	18000
2700	2	2	1.11200E+06	2880
7.38	4.76190E-03	0	0	.000001
0	100			
65042.8	6.2	.33	696	1000
250	.015	16.75	3	18000
2300	2	2	440000	2880
11.6	9.43396E-03	0	0	.000001
0	166.67			
100164.	6.2	.33	696	1000
250	.015	16.75	3	18000
2300	4	2	436000	5400
6.68	3.61011E-03	0	0	.000001
0	125			
68914.4	6.2	.33	696	1000
250	.015	16.75	3	18000
1600	3	2	51000	5040
5.5	1.02041E-03	0	0	.000001
0	50			
44240.6	6.2	.33	696	1000
250	.015	16.75	3	18000
450	2	2	181000	2520
2.92	6.23441E-04	0	0	.000001
0	85			
62333.6	6.2	.33	696	1000
250	.015	16.75	3	18000
1900	2	2	581000	2880
10.31	5.64972E-03	0	0	.000001

0	208.33			
48960.3	6.2	.33	696	1000
250	.015	16.75	3	18000
450	2	2	210000	3240
10.93	7.35294E-03	0	0	.000001
0	85			
74498.1	6.2	.33	696	1000
250	.015	16.75	3	18000
4200	2	2	285000	2880
7.8	1.36986E-02	0	0	.000001
0	208.33			
55649.2	6.2	.33	696	1000
250	.015	16.75	3	18000
1600	2	2	270000	2520
8.6	8.19672E-03	0	0	.000001
0	100			

NUMBER OF REGRESSION MODELS = 21

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
11	1753.85	1029.05
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	.126843	.722985
.126843	1	.692262
.722985	.692262	1.

COVARIANCE MATRIX

4.13816E+07	-1.50771E+07	-3083.92
-1.50771E+07	7.17532E+06	-529.912
-3083.92	-529.912	2.43239

INDEX	B	STD. ERROR	T-RATIO
0	11433.2	6432.85	1.77731
12	16300.6	2678.68	6.08532
11	8.97345	1.55961	5.75364

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-2899.22	25765.6
12	10332.5	22268.7
11	5.49863	12.4483

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	11433.2
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	16300.6
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	8.97345

STAND. ERROR OF EST. = 5514.69   D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	49418.5	-7438.78
68068.2	61981.3	6086.95
59987.5	57494.6	2492.89
62286.5	54802.5	7483.94
73819.	68262.7	5556.31
65042.8	64673.3	369.504
100164.	97274.5	2889.16
68914.4	74692.5	-5778.16
44240.6	48072.4	-3831.88
62333.6	61083.9	1249.68
48960.3	48072.4	887.828
74498.1	81722.9	-7224.75
55649.2	58391.9	-2742.73

R-SQUARED = .889274

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
13	2	.408249
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	0	.722985
0	.999998	.273992
.722985	.273992	1.

COVARIANCE MATRIX

3.57055E+08	-5.72077E+07	-1.10470E+08
-5.72077E+07	2.56448E+07	0
-1.10470E+08	0	5.52351E+07

INDEX	B	STD. ERROR	T-RATIO
0	2503.48	18895.9	.132488
12	18255.5	5064.07	3.60491
13	10153.4	7432.03	1.36616

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-39596.6	44603.6
12	6972.78	29538.3
13	-6405.19	26711.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	2503.48
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	18255.5
13	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	10153.4

STAND. ERROR OF EST. = 10510.5 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	49167.9	-7188.24
68068.2	59321.3	8746.93
59987.5	59321.3	666.148
62286.5	69474.7	-7188.21
73819.	59321.3	14497.7
65042.8	59321.3	5721.52
100164.	95832.4	4331.31
68914.4	77576.8	-8662.48
44240.6	59321.3	-15080.7
62333.6	59321.3	3012.32
48960.3	59321.3	-10361.
74498.1	59321.3	15176.8
55649.2	59321.3	-3672.13

R-SQUARED = .59778

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
14	388154.	282707.
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.118795	.722985
-.118795	1.	.428876
.722985	.428876	1.

COVARIANCE MATRIX

8.65168E+07	-3.14000E+07	-31.0834
-3.14000E+07	1.34851E+07	3.39507
-31.0834	3.39507	6.05682E-05

INDEX	B	STD. ERROR	T-RATIO
0	8471.08	9301.44	.910728
12	19821.7	3672.21	5.39776
14	2.79409E-02	7.78256E-03	3.59019

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-12252.5	29194.7
12	11640.	28003.4
14	1.06013E-02	4.52804E-02

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8471.08
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	19821.7
14	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	2.79409E-02

STAND. ERROR OF EST. = 7567.7 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	48254.2	-6274.54
68068.2	62308.5	5759.75
59987.5	61107.	-1119.57
62286.5	62140.8	145.633
73819.	79184.8	-5365.75
65042.8	60408.5	4634.33
100164.	99940.2	223.504
68914.4	69361.2	-446.875
44240.6	53171.8	-8931.26
62333.6	64348.2	-2014.54
48960.3	53982.1	-5021.83
74498.1	56077.7	18420.5
55649.2	55658.6	-9.37598

R-SQUARED = .79148

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
15	3233.85	948.944
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	.899717	.722985
.899717	.999999	.729162
.722985	.729162	1.

COVARIANCE MATRIX

1.50701E+08	-5.86115E+07	-3264.14
-5.86121E+07	1.48861E+08	-84562.4
-3263.67	-84562.6	59.3421

INDEX	B	STD. ERROR	T-RATIO
0	22448.1	12276.1	1.82861
12	8872.91	12200.9	.727237
15	6.58431	7.70339	.854729

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-4902.98	49799.1
12	-18310.6	36056.4
15	-10.5788	23.7475

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	22448.1
12	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8872.91
15	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6.58431

STAND. ERROR OF EST. = 11052.7 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	53889.3	-11909.6
68068.2	61527.	6541.19
59987.5	61527.	-1539.59
62286.5	61527.	759.422
73819.	59156.7	14662.3
65042.8	59156.7	5886.13
100164.	93495.	6668.71
68914.4	82251.7	-13337.4
44240.6	56786.3	-12545.8
62333.6	59156.7	3176.93
48960.3	61527.	-12566.8
74498.1	59156.7	15341.4
55649.2	56786.3	-1137.16

R-SQUARED = .555203

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
16	8.26077	3.52219
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.233864	.722985
-.233864	1.	.20992
.722985	.20992	1.

COVARIANCE MATRIX

1.91571E+08	-5.61612E+07	-7.19246E+06
-5.61612E+07	2.19431E+07	872935.
-7.19246E+06	872935.	634945.

INDEX	B	STD. ERROR	T-RATIO
0	3303.2	13840.9	.238655
12	20623.1	4684.35	4.40255
16	1722.07	796.835	2.16114

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-27534.4	34140.8
12	10186.3	31059.8
16	-53.2795	3497.42

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	3303.2
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	20623.1
16	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	1722.07

STAND. ERROR OF EST. = 9452.75 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	46202.5	-4222.84
68068.2	64869.8	3198.49
59987.5	65059.2	-5071.72
62286.5	63492.1	-1205.63
73819.	57258.2	16560.8
65042.8	64525.3	517.492
100164.	97298.9	2864.79
68914.4	74643.8	-5729.43
44240.6	49577.8	-5337.22
62333.6	62303.9	29.7617
48960.3	63371.5	-14411.3
74498.1	57981.5	16516.7
55649.2	59359.1	-3709.95

R-SQUARED = .674661

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
17	8.10924E-03	5.13553E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.435691	.722985
-.435691	1	-.202227
.722985	-.202227	1.

COVARIANCE MATRIX

2.89841E+08	-9.60085E+07	-8.12857E+09
-9.60085E+07	3.63260E+07	1.84647E+09
-8.12857E+09	1.84647E+09	4.94438E+11

INDEX	B	STD. ERROR	T-RATIO
0	16069.	17024.7	.943865
12	19786.9	6027.11	3.28298
17	410047	703163.	.583147

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-21862.	54000.1
12	6358.46	33215.3
17	-1.15660E+06	1.97669E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	16069.
12	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	19786.9
17	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	410047

STAND. ERROR OF EST. = 11259.5 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	62712.5	-20732.8
68068.2	61418.1	6650.17
59987.5	58614.1	1373.35
62286.5	60768.3	151P.13
73819.	57595.4	16223.7
65042.8	59511.1	5531.71
100164.	96696.8	3466.92
68914.4	75848.	-6933.66
44240.6	55898.4	-11657.8
62333.6	57959.4	4374.23
48960.3	58657.8	-9697.53
74498 1	61259.8	13238.3
55649.2	59003.8	-3354.61

R-SQUARED = .538407

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
18	.08	.288444
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.115727	.722985
-.115727	1	-.428084
.722985	-.428084	1.

COVARIANCE MATRIX

1.24987E+08	-5.19176E+07	-2.03381E+07
-5.19176E+07	2.30745E+07	5.54675E+06
-2.03381E+07	5.54674E+06	9.95570E+07

INDEX	B	STD. ERROR	T-RATIO
0	26550.6	11179.7	2.37488
12	17235.4	4803.59	3.58803
18	-18309.4	9977.83	-1.83501

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1642.11	51459.1
12	6533.04	27937.8
18	-40540.	3921.2

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	26550.6
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17235.4
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-18309.4

STAND. ERROR OF EST. = 9902.86 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	7.81250E-03
68068.2	61021.5	7046.77
59987.5	61021.5	-1034.01
62286.5	61021.5	1265.01
73819.	61021.5	12797.6
65042.8	61021.5	4021.37
100164.	95492.3	4671.36
68914.4	78256.9	-9342.54
44240.6	61021.5	-16780.9
62333.6	61021.5	1312.16
48960.3	61021.5	-12061.2
74498.1	61021.5	13476.7
55649.2	61021.5	-5372.28

R-SQUARED = .642941

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
19	.146154	.526965
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.115728	.722985
-.115728	1.	-.428085
.722985	-.428084	1.

COVARIANCE MATRIX

1.24987E+08	-5.19175E+07	-1.11324E+07
-5.19175E+07	2.30745E+07	3.03612E+06
-1.11324E+07	3.03611E+06	2.98285E+07

INDEX	B	STD. ERROR	T-RATIO
0	26550.6	11179.7	2.37488
12	17235.4	4803.59	3.58803
19	-10022.	5461.55	-1.83501

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1642.11	51459.1
12	6533.04	27937.8
19	-22190.3	2146.34

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	26550.6
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17235.4
19	ACCEPT H0 (COEFFICIENT = 0) .T 95% LEVEL	-10022.

STAND. ERROR OF EST. = 9902.85 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	3.90625E-03
68068.2	61021.5	7046.77
59987.5	61021.5	-1034.01
62286.5	61021.5	1265.01
73819.	61021.5	12797.6
65042.8	61021.5	4021.37
100164.	95492.3	4671.36
68914.4	78256.9	-9342.54
44240.6	61021.5	-16780.9
62333.6	61021.5	1312.16
48960.3	61021.5	-12061.2
74498.1	61021.5	13476.7
55649.2	61021.5	-5372.28

R-SQUARED = .642941

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
20	8.43454E-04	3.03751E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.115727	.722985
-.115727	1.	-.428085
.722985	-.428085	1.

COVARIANCE MATRIX

1.24990E+08	-5.19180E+07	-1.93221E+09
-5.19180E+07	2.30744E+07	5.26723E+08
-1.93221E+09	5.26723E+08	8.97757E+11

INDEX	B	STD. ERROR	T-RATIO
0	26552.3	11179.9	2.375
12	17235.4	4803.59	3.58804
20	-1.73867E+06	947501.	-1.83501

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1643.48	51461.2
12	6533.04	27937.8
20	-3.84971E+06	372357.

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	26552.3
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17235.4
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1.73867E+06

STAND. ERROR OF EST. = 9902.85 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	.015625
68068.2	61021.5	7046.77
59987.5	61021.5	-1034.01
62286.5	61021.5	1265.
73819.	61021.5	12797.6
65042.8	61021.5	4021.36
100164.	95492.3	4671.35
68914.4	78256.9	-9342.54
44240.6	61021.5	-16780.9
62333.6	61021.5	1312.16
48960.3	61021.5	-12061.2
74498.1	61021.5	13476.7
55649.2	61021.5	-5372.29

R-SQUARED = .642941

REGRESSION NUMBER = 10
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 10 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
21	.769231	2.7735
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.115727	.722985
-.115727	1.	-.428084
.722985	-.428084	1.

COVARIANCE MATRIX

1.24987E+08	-5.19175E+07	-2.11516E+06
-5.19175E+07	2.30745E+07	576861.
-2.11516E+06	576862.	1.07681E+06

INDEX	B	STD. ERROR	T-RATIO
0	26550.6	11179.7	2.37488
12	17235.4	4803.59	3.58804
21	-1904.18	1037.69	-1.83501

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1642.11	51459.
12	6533.05	27937.8
21	-4216.16	407.805

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	26550.6
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	17235.4
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1904.18

STAND. ERROR OF EST. = 9902.85 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	-7.81250E-03
68068.2	61021.5	7046.77
59987.5	61021.5	-1034.01
62286.5	61021.5	1265.01
73819.	61021.5	12797.6
65042.8	61021.5	4021.37
100164.	95492.3	4671.34
68914.4	78256.9	-9342.55
44240.6	61021.5	-16780.9
62333.6	61021.5	1312.16
48960.3	61021.5	-12061.2
74498.1	61021.5	13476.7
55649.2	61021.5	-5372.28

R-SQUARED = .642941

REGRESSION NUMBER = 11
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 12
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 11 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
12	2.23077	.599145
22	130.395	62.3791
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.203313	.722985
-.203313	1.	.327278
.722985	.327278	1.

COVARIANCE MATRIX

1.29088E+08	-4.01112E+07	-264444.
-4.01112E+07	1.61387E+07	31515.8
-264444.	31515.7	1488.86

INDEX	B	STD. ERROR	T-RATIO
0	1499.5	11361.7	.131979
12	20795.3	4017.3	5.17644
22	119.983	38.5858	3.10951

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-23814.3	26813.3
12	11844.8	29745.8
22	34.0137	205.952

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1499.5
12	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	20795.3
22	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	119.983

STAND. ERROR OF EST. = 8163.75 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	47855.8	-5876.12
68068.2	68086.1	-17.8672
59987.5	68086.1	-8098.65
62286.5	56338.6	5947.88
73819.	55088.4	18730.6
65042.8	63087.6	1955.2
100164.	99678.5	485.154
68914.4	69884.5	-970.17
44240.6	53288.6	-9048.07
62333.6	68086.1	-5752.48
48960.3	53288.6	-4328.36
74498.1	68086.1	6412.02
55649.2	55088.4	560.809

R-SQUARED = .757343

REGRESSION NUMBER = 12
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 11
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 12 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
11	1753.85	1029.05
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	.155341	.729162
.155341	1	.692262
.729162	.692262	1.

COVARIANCE MATRIX

3.98497E+07	-9694.84	-3342.04
-9694.83	3.25045	-.465623
-3342.04	-.465623	2.76409

INDEX	B	STD. ERROR	T-RATIO
0	15395.3	6312.66	2.43879
15	10.1554	1.8029	5.63278
11	8.72254	1.66256	5.24647

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	1330.66	29459.9
15	6.13849	14.1722
11	5.01837	12.4267

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	15395.3
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.1554
11	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	8.72254

STAND. ERROR OF EST. = 5854.62 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41751.9	227.76
68068.2	65743.7	2324.54
59987.5	61382.4	-1394.98
62286.5	58765.7	3520.8
73819.	68193.5	5625.46
65042.8	64704.5	338.293
100164.	90296.	9867.65
68914.4	80534.3	-11620.
44240.6	44911.9	-671.339
62333.6	61215.5	1118.11
48960.3	52223.8	-3263.49
74498.1	81277.4	-6779.23
55649.2	54942.8	706.352

R-SQUARED = .8752

REGRESSION NUMBER = 13
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 13
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 13 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
13	2	.408249
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	.249524	.729162
.249524	.999998	.273992
.729162	.273992	1.

COVARIANCE MATRIX

3.15528E+08	-25816.4	-1.11169E+08
-25816.4	12.4486	-7220.17
-1.11169E+08	-7220.17	6.72592E+07

INDEX	B	STD. ERROR	T-RATIO
0	19929.3	17763.1	1.12195
15	11.2342	3.52825	3.18407
13	3637.53	8201.17	.443538

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-19646.9	59505.6
15	3.37327	19.0952
13	-14634.7	21909.7

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT h0 (COEFFICIENT = 0) AT 95% LEVEL	19929.3
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.2342
13	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	3637.53

STAND. ERROR OF EST. = 11231.3 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	46934.	-4954.34
68068.2	63603.2	4464.99
59987.5	63603.2	-3615.79
62286.5	67240.8	-4954.3
73819.	59558.9	14260.1
65042.8	59558.9	5483.91
100164.	87869.2	12294.5
68914.4	83824.8	-14910.5
44240.6	55514.6	-11274.
62333.6	59558.9	2774.7
48960.3	63603.3	-14643.
74498.1	59558.9	14939.2
55649.2	55514.6	134.578

R-SQUARED = .540713

REGRESSION NUMBER = 14
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 14
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 14 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
14	388154.	282707.
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-4.23644E-02	.729162
-4.23644E-02	1.	.428876
.729162	.428876	1.

COVARIANCE MATRIX

8.71568E+07	-21485.7	-31.5727
-21485.7	6.53251	9.28944E-04
-31.5727	9.28944E-04	7.36014E-05

INDEX	B	STD. ERROR	T-RATIO
0	15368.5	9335.78	1.64619
15	11.9358	2.55588	4.66994
14	2.46478E-02	8.57913E-03	2.87299

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-5431.64	36168.6
15	6.2413	17.6303
14	5.53349E-03	4.37621E-02

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	15368.5
15	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	11.9358
14	REJECT HO (COEFFICIENT = 0) AT 95% LEVEL	2.46478E-02

STAND. ERROR OF EST. = 8394.23 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	40318.2	1661.53
68068.2	66561.5	1506.73
59987.5	65501.6	-5514.19
62286.5	66413.6	-4127.15
73819.	77151.9	-3332.86
65042.8	60588.6	4454.26
100164.	90568.2	9595.51
68914.4	76781.9	-7867.54
44240.6	49907.9	-5667.35
62333.6	64063.9	-1730.28
48960.3	59216.5	-10256.2
74498.1	56768.2	17730.
55649.2	52101.6	3547.62

R-SQUARED = .743442

REGRESSION NUMBER = 15
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 16
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 15 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
16	8.26077	3.52219
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	5.55803E-02	.729162
5.55803E-02	1.	.20992
.729162	.20992	1.

COVARIANCE MATRIX

1.73020E+08	-34852.9	-6.17680E+06
-34852.9	11.2062	-167.802
-6.17680E+06	-167.802	813416.

INDEX	B	STD. ERROR	T-RATIO
0	20399.5	13153.7	1.55086
15	11.4741	3.34756	3.42761
16	729.832	901.896	.80922

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-8906.95	49706.
15	4.01577	18.9325
16	-1279.59	2739.26

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	20399.5
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	11.4741
16	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	729.832

STAND. ERROR OF EST. = 10987.2 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	44966.4	-2986.69
68068.2	66187.8	1880.47
59987.5	66268.	-6280.6
62286.5	65603.9	-3317.43
73819.	58831.2	14987.8
65042.8	61911.1	3131.72
100164.	87235.2	12928.5
68914.4	82243.3	-13328.9
44240.6	51445.5	-7204.91
62333.6	60969.6	1364.
48960.3	65552.8	-16592.5
74498.1	59137.7	15360.4
55649.2	55590.9	58.2617

R-SQUARED = .560461

REGRESSION NUMBER = 16
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 17
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 16 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
17	8.10924E-03	5.13553E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.481244	.729162
-.481244	1	-.202227
.729162	-.202227	1.

COVARIANCE MATRIX

2.61786E+08	-57501.5	-8.20656E+09
-57501.5	14.5391	1.29288E+06
-8.20656E+09	1.29288E+06	4.96419E+11

INDEX	B	STD. ERROR	T-RATIO
0	16518.7	16179.8	1.02094
15	13.1092	3.81302	3.43802
17	569999.	704570.	.809003

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-19530.	52567.3
15	4.61382	21.6046
17	-999783	2.13978E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	16518.7
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	13.1092
17	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	569999.

STAND. ERROR OF EST. = 10987.4 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	53613.4	-11633.7
68068.2	67020.7	1047.55
59987.5	63123.	-3135.5
62286.5	66117.5	-3831.04
73819.	56987.5	16831.5
65042.8	59650.6	5392.27
100164.	89366.2	10797.5
68914.4	83170.8	-14256.4
44240.6	49909.3	-5668.69
62333.6	57493.5	4840.09
48960.3	63183.7	-14223.4
74498.1	62081.4	12416.7
55649.2	54226.	1423.17

R-SQUARED = .560447

REGRESSION NUMBER = 17
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 18
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 17 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
18	.08	.288444
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.365341	.729162
-.365341	1	-.428084
.729162	-.428084	1.

COVARIANCE MATRIX

1.52538E+08	-42795.9	-6.10798E+07
-42795.9	12.8516	15446.6
-6.10798E+07	15446.6	1.39096E+08

INDEX	B	STD. ERROR	T-RATIO
0	30239.2	12350.6	2.44839
15	10.5379	3.58491	2.93951
18	-9786.82	11793.9	-.829821

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	2721.96	57756.4
15	2.55069	18.5251
18	-36063.6	16490.

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	30239.2
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.5379
18	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-9786.82

STAND. ERROR OF EST. = 10969.8 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	5.85938E-03
68068.2	64381.9	3686.33
59987.5	64381.9	-4394.46
62286.5	64381.9	-2095.44
73819.	60588.3	13230.7
65042.8	60588.3	4454.56
100164.	87143.7	13020.
68914.4	83350.1	-14435.7
44240.6	56794.6	-12554.1
62333.6	60588.3	1745.35
48960.3	64381.9	-15421.6
74498.1	60588.3	13909.9
55649.2	56794.6	-1145.46

R-SQUARED = .561849

REGRESSION NUMBER = 18
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 19
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 18 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
19	.146154	.526965
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.365341	.729162
-.365341	1.	-.428085
.729162	-.428084	1.

COVARIANCE MATRIX

1.52538E+08	-42795.7	-3.34330E+07
-42795.7	12.8516	8454.98
-3.34330E+07	8454.98	4.16747E+07

INDEX	B	STD. ERROR	T-RATIO
0	30239.2	12350.6	2.44839
15	10.5379	3.58491	2.93951
19	-5357.	6455.6	-.829822

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	2722.	57756.4
15	2.5507	18.5251
19	-19740.1	9026.08

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	30239.2
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.5379
19	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-5357.

STAND. ERROR OF EST. = 10969.8 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	1.95313E-03
68068.2	64381.9	3686.32
59987.5	64381.9	-4394.46
62286.5	64381.9	-2095.45
73819.	60588.3	13230.7
65042.8	60588.3	4454.55
100164.	87143.7	13020.
68914.4	83350.1	-14435.7
44240.6	56794.6	-12554.1
62333.6	60588.3	1745.35
48960.3	64381.9	-15421.6
74498.1	60588.3	13909.8
55649.2	56794.6	-1145.46

R-SQUARED = .561849

REGRESSION NUMBER = 19
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 20
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 19 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
20	8.43454E-04	3.03751E-03
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.365341	.729162
-.365341	1.	-.428085
.729162	-.428085	1.

COVARIANCE MATRIX

1.52550E+08	-42797.3	-5.80143E+09
-42797.3	12.8516	1.46682E+06
-5.80143E+09	1.46682E+06	1.25430E+12

INDEX	B	STD. ERROR	T-RATIO
0	30240.1	12351.1	2.44837
15	10.5379	3.58491	2.93951
20	-929364.	1.11996E+06	-.829822

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	2721.87	57758.4
15	2.55069	18.5251
20	-3.42463E+06	1.56590E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	30240.1
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.5379
20	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-929364.

STAND. ERROR OF EST. = 10969.8 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	1.36719E-02
68068.2	64381.9	3686.33
59987.5	64381.9	-4394.46
62286.5	64381.9	-2095.44
73819.	60588.3	13230.7
65042.8	60588.3	4454.55
100164.	87143.7	13020.
68914.4	83350.1	-14435.7
44240.6	56794.6	-12554.1
62333.6	60588.3	1745.35
48960.3	64381.9	-15421.6
74498.1	60588.3	13909.9
55649.2	56794.6	-1145.46

R-SQUARED = .561849

REGRESSION NUMBER = 20
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 21
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 20 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
21	.769231	2.7735
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-.365341	.729162
-.365341	1.	-.428084
.729162	-.428084	1.

COVARIANCE MATRIX

1.52539E+08	-42796	-6.35232E+06
-42796.	12.8517	1606.46
-6.35232E+06	1606.46	1.50447E+06

INDEX	B	STD. ERROR	T-RATIO
0	30239.2	12350.7	2.44839
15	10.5379	3.58492	2.9395
21	-1017.83	1226.57	-.829818

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	2721.91	57756.5
15	2.55067	18.5251
21	-3750.62	1714.96

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	30239.2
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	10.5379
21	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-1017.83

STAND. ERROR OF EST. = 10969.9 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41979.7	1.95313E-03
68068.2	64381.9	3686.33
59987.5	64381.9	-4394.45
62286.5	64381.9	-2095.44
73819.	60588.3	13230.7
65042.8	60588.3	4454.56
100164.	87143.7	13020.
68914.4	83350.1	-14435.7
44240.6	56794.6	-12554.1
62333.6	60588.3	1745.36
48960.3	64381.9	-15421.6
74498.1	60588.3	13909.9
55649.2	56794.6	-1145.46

R-SQUARED = .561849

REGRESSION NUMBER = 21
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 15
INDEPENDENT OR DEPENDENT VARIABLE - 22
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 21 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
15	3233.85	948.944
22	130.395	62.3791
1	63534.1	15128.6

CORRELATION COEFFICIENTS

.999999	-7.72095E-02	.729162
-7.72095E-02	1.	.327278
.729162	.327278	1.

COVARIANCE MATRIX

1.32754E+08	-27739.4	-278249.
-27739.4	8.18996	9.61949
-278249.	9.61949	1895.33

INDEX	B	STD. ERROR	T-RATIO
0	12202.6	11521.9	1.05908
15	12.0997	2.86181	4.22798
22	93.5853	43.5354	2.14964

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-13468.2	37873.4
15	5.72357	18.4758
22	-3.41148	190.582

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	12202.6
15	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	12.0997
22	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	93.5853

STAND. ERROR OF EST. = 9379.36 D.F.= 10

ACTUAL	PREDICTED	RESIDUAL
41979.7	41087.1	892.567
68068.2	70902.2	-2833.95
59987.5	70902.2	-10914.7
62286.5	61739.2	547.229
73819.	56408.2	17410.8
65042.8	62647.5	2395.3
100164.	89239.	10924.7
68914.4	77864.3	-8949.88
44240.6	50648.5	-6407.96
62333.6	66546.3	-4212.66
48960.3	59360.3	-10400.
74498.1	66546.3	7951.84
55649.2	52052.3	3596.87

R-SQUARED = .679691

MULTIPLE LINEAR REGRESSION ANALYSIS

TUE, JUN 12, 1979, 7:48 AM

DATA IS FROM FILE => DATA7

N = 6
V = 10

2.71652E+06	700	5	1.5	1600
10776	2386	1	191	36700
2.55721E+06	560	4	1.5	1600
13508	2123	1	170	34000
5528	102	6	.2	8760
9533	39879	3	20	0
170590	2100	4	1.4	8760
1850	5000	4	300	2000
90958	1000	4	4	7536
5950	1000	2	240	1000
752644	200	3	.4	8760
5000	1666	3	60	10000

NUMBER OF REGRESSION MODELS = 9

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 2
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
2	777	726.86
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1	-.209013
-.209013	1.

COVARIANCE MATRIX

7.48465E+11	-5.57046E+08
-5.57046E+08	716920.

INDEX	B	STD. ERROR	T-RATIO
0	1.33014E+06	865139.	1.53748
2	-361.942	846.711	-.427469

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-1.06284E+06	3.72311E+06
2	-2703.94	1980.06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	1.33014E+06
2	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-361.942

STAND. ERROR OF EST. = 1.37617E+06 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.07678E+06	1.63974E+06
2.55721E+06	1.12745E+06	1.42976E+06
5528	1.29322E+06	-1.28769E+06
170590	570057.	-399467.
90958	968194.	-877236.
752644	1.25775E+06	-505104.

R-SQUARED = 4.36866E-02

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 3
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
3	4.33333	1.0328
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.018906
-.018906	1.

COVARIANCE MATRIX

7.29992E+12	-1.60846E+12
-1.60846E+12	3.71182E+11

INDEX	B	STD. ERROR	T-RATIO
0	1.14875E+06	2.70184E+06	.425175
3	-23041.5	609248.	-3.78195E-02

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-6.32453E+06	8.62203E+06
3	-1.70822E+06	1.66214E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1.14875E+06
3	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-23041.5

STAND. ERROR OF EST. = 1.40700E+06 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.03355E+06	1.68297E+06
2.55721E+06	1.05659E+06	1.50062E+06
5528	1.01050E+06	-1.00498E+06
170590	1.05659E+06	-885997.
90958	1.05659E+06	-965629.
752644	1.07963E+06	-326985.

R-SQUARED = 3.57509E-04

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 4
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
4	1.5	1.35351
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-7.33435E-02
-7.33435E-02	1.

COVARIANCE MATRIX

8.12106E+11	-3.22549E+11
-3.22549E+11	2.15033E+11

INDEX	B	STD. ERROR	T-RATIO
0	1.15121E+06	901169.	1.27747
4	-68205.	463716	-.147084

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-1.34142E+06	3.64385E+06
4	-1.35084E+06	1.21443E+06

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1.15121E+06
4	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-68205.

STAND. ERROR OF EST. = 1.40346E+06 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.04891E+06	1.66761E+06
2.55721E+06	1.04891E+06	1.50830E+06
5528	1.13757E+06	-1.13205E+06
170590	1.05573E+06	-885138.
90958	878395.	-787437.
752644	1.12393E+06	-371289.

R-SQUARED = 5.37920E-03

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 5
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
5	6169.33	3571.
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.959652
-.959652	1.

COVARIANCE MATRIX

1.19567E+11	-1.51507E+07
-1.51507E+07	2455.81

INDEX	B	STD. ERROR	T-RATIO
0	3.13570E+06	345784.	9.06836
5	-338.252	49.5561	-6.82563

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	2.17926E+06	4.09214E+06
5	-475.324	-201.18

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	3.13570E+06
5	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	-338.252

STAND. ERROR OF EST. = 395705. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.59449E+06	122022.
2.55721E+06	2.59449E+06	-37286.3
5528	172609	-167081
170590	172609	-2019
90958	586630.	-495672.
752644	172609	580035

R-SQUARED = .920932

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 6
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
6	7769.5	4268.5
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	.729308
.729308	1.

COVARIANCE MATRIX

7.68768E+11	-7.90610E+07
-7.90610E+07	10175.8

INDEX	B	STD. ERROR	T-RATIO
0	-621970	876794.	-.709368
6	215.056	100.875	2.1319

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-3.04718E+06	1.80324E+06
6	-63.9649	494.077

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	-621970
6	ACCEPT HO (COEFFICIENT = 0) AT 95% LEVEL	215.056

STAND. ERROR OF EST. = 962820. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.69547E+06	1.02104E+06
2.55721E+06	2.28301E+06	274202
5528	1.42816E+06	-1.42263E+06
170590	-224117.	394707.
90958	657613.	-566655.
752644	453310.	299335.

R-SQUARED = .531891

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 7
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
7	8675.67	15347.4
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.416939
-.416939	1.

COVARIANCE MATRIX

3.77244E+11	-1.20524E+07
-1.20524E+07	1389.22

INDEX	B	STD. ERROR	T-RATIO
0	1.34557E+06	614202.	2.19075
7	-34.1944	37.2722	-.917424

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-353317.	3.04445E+06
7	-137.289	68.9005

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	1.34557E+06
7	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-34.1944

STAND. ERROR OF EST. = 1.27910E+06 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.26398E+06	1.45254E+06
2.55721E+06	1.27297E+06	1.28424E+06
5528	-18072.5	23600.5
170590	1.17459E+06	-1.00400E+06
90958	1.31137E+06	-1.22041E+06
752644	1.28860E+06	-535954.

R-SQUARED = .173838

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 8
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
8	2.33333	1.21106
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.822938
-.822938	1.

COVARIANCE MATRIX

5.81094E+11	-2.03383E+11
-2.03383E+11	8.71642E+10

INDEX	B	STD. ERROR	T-RATIO
0	3.04460E+06	762295.	3.99399
8	-855298.	295236.	-2.897

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	936095.	5.15311E+06
8	-1.67192E+06	-38676.1

****** TEST OF HYPOTHESIS ******

INDEX		
0	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	3.04460E+06
8	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	-855298.

STAND. ERROR OF EST. = 799502. D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.18931E+06	527210.
2.55721E+06	2.18931E+06	367902.
5528	478709.	-473181.
170590	-376590	547180
90958	1.33401E+06	-1.24305E+06
752644	478709.	273936.

R-SQUARED = .677227

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 9
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
9	163.5	106.384
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	6.40429E-02
6.40429E-02	1.

COVARIANCE MATRIX

1.26040E+12	-5.69842E+09
-5.69842E+09	3.48527E+07

INDEX	B	STD. ERROR	T-RATIO
0	925019.	1.12267E+06	.823943
9	757.726	5903.62	.128349

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-2.18030E+06	4.03033E+06
9	-15571.7	17087.1

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	925019.
9	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	757.726

STAND. ERROR OF EST. = 1.40436E+06 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	1.06974E+06	1.64677E+06
2.55721E+06	1.05383E+06	1.50337E+06
5528	940173.	-934645.
170590	1.15234E+06	-981747.
90958	1.10687E+06	-1.01592E+06
752644	970482.	-217838.

R-SQUARED = 4.10175E-03

REGRESSION NUMBER = 9
NUMBER OF INDEPENDENT VARIABLES = 1
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLE - 10
INDEPENDENT OR DEPENDENT VARIABLE - 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 9 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	.999937
.999937	1.

COVARIANCE MATRIX

7.49965E+07	-2407.
-2407.	.172545

INDEX	B	STD. ERROR	T-RATIO
0	14419.4	8660.05	1.66505
10	74.1568	.415386	178.525

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-9534.32	38373.1
10	73.0079	75.3058

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	14419.4
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1568

STAND. ERROR OF EST. = 15764.3 D.F.= 4

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73597E+06	-19459.5
2.55721E+06	2.53575E+06	21456
5528	14419.4	-8891.38
170590	162733	7857
90958	88576.2	2381.81
752644	755988.	-3343.5

R-SQUARED = .999874

MULTIPLE LINEAR REGRESSION ANALYSIS

MON, SEP 24, 1979, 2:54 PM

DATA IS FROM FILE => DATA7

N = 6
V = 10

2.71652E+06	700	5	1.5	1600
10776	2386	1	191	36700
2.55721E+06	560	4	1.5	1600
13508	2123	1	170	34000
5528	102	6	.2	8760
9533	39879	3	20	0
170590	2100	4	1.4	8760
1850	5000	4	300	2000
90958	1000	4	4	7536
5950	1000	2	240	1000
752644	200	3	.4	8760
5000	1666	3	60	10000

NUMBER OF REGRESSION MODELS = 8

REGRESSION NUMBER = 1
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 2
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 1 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
2	777	726.86
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.212459	.999937
-.212459	1	-.209013
.999937	-.209013	1.

COVARIANCE MATRIX

1.86519E+08	-3859.17	-106824.
-3859.17	.216751	1.07528
-106824.	1.07528	118.177

INDEX	B	STD. ERROR	T-RATIO
0	8793.1	13657.2	.643844
10	74.2135	.465565	159.405
2	6.22424	10.8709	.572558

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-34664.1	52250.3
10	72.732	75.6949
2	-28.3671	40.8156

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	8793.1
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.2135
2	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	6.22424

STAND. ERROR OF EST. = 17265.3 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73678E+06	-20269.
2.55721E+06	2.53554E+06	21670.9
5528	9427.97	-3899.97
170590	170291.	299.09
90958	89230.8	1727.21
752644	752173.	471.526

R-SQUARED = .999887

REGRESSION NUMBER = 2
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 3
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 2 ;DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
3	4.33333	1.0328
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-1.36918E-02	.999937
-1.36918E-02	1.	-.018906
.999937	-.018906	1.

COVARIANCE MATRIX

9.95748E+08	-2686.1	-2.11173E+08
-2686.1	.179973	40.4939
-2.11173E+08	40.4938	4.86019E+07

INDEX	B	STD. ERROR	T-RATIO
0	42042.	31555.5	1.33232
10	74.1515	.424232	174.79
3	-6357.4	6971.51	-.911911

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-58367.6	142452.
10	72.8016	75.5014
3	-28540.7	15825.9

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	42042.
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1515
3	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-6357.4

STAND. ERROR OF EST. = 16098.5 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73162E+06	-15101.
2.55721E+06	2.53776E+06	19443.1
5528	3897.6	1630.4
170590	164915.	5674.57
90958	90763.9	194.09
752644	764485	-11841.1

R-SQUARED = .999901

REGRESSION NUMBER = 3
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 4
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 3 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
4	1.5	1.35351
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-7.57441E-02	.999937
-7.57441E-02	1.	-7.33435E-02
.999937	-7.33435E-02	1.

COVARIANCE MATRIX

1.82658E+08	-3396.6	-5.50322E+07
-3396.6	.220922	209.827
-5.50322E+07	209.827	3.47367E+07

INDEX	B	STD. ERROR	T-RATIO
0	10869.7	13515.1	.80426
10	74.1703	.470023	157.801
4	2240.61	5893.79	.380165

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-32135.4	53874.7
10	72.6747	75.666
4	-16513.4	20994.6

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	10869.7
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1703
4	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	2240.61

STAND. ERROR OF EST. = 17786.6 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73628E+06	-19767.4
2.557[illegible]1E+06	2.53602E+06	21184.6
5528	11317.8	-5789.77
170590	162347.	8242.8
90958	94002.5	-3044.45
752644	753469.	-825.37

R-SQUARED = .99988

REGRESSION NUMBER = 4
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 5
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 4 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
5	6169.33	3571.
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.958946	.999937
-.958946	1.	-.959652
.999937	-.959652	1.

COVARIANCE MATRIX

5.01287E+09	-113490.	-547483.
-113490.	2.69778	12.2956
-547483.	12.2956	60.9401

INDEX	B	STD. ERROR	T-RATIO
0	44574.4	70801.6	.629567
10	73.4796	1.64249	44.7366
5	-3.35654	7.80642	-.429972

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-180716.	269865.
10	68.2532	78.706
5	-28.1966	21.4835

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	44574.4
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	73.4796
5	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-3.35654

STAND. ERROR OF EST. = 17677.2 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73590E+06	-19389.5
2.55721E+06	2.53751E+06	19697.
5528	15171.1	-9643.09
170590	162130.	8459.77
90958	92759.1	-1801.07
752644	749967	2677.03

R-SQUARED = .999882

REGRESSION NUMBER = 5
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 6
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 5 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
6	7769.5	4268.5
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	.72908	.999937
.72908	1.	.729308
.999937	.729308	1.

COVARIANCE MATRIX

3.11060E+08	4212.87	-40488.2
4212.87	.491399	-1.42453
-40488.2	-1.42453	7.76889

INDEX	B	STD. ERROR	T-RATIO
0	13520.5	17636.9	.766603
10	74.1252	.700999	105.742
6	.172477	2.78727	6.18801E-02

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-42600.1	69641.1
10	71.8946	76.3558
6	-8.69662	9.04158

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	13520.5
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1252
6	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	.172477

STAND. ERROR OF EST. = 18208.3 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73577E+06	-19258.1
2.55721E+06	2.53611E+06	21100.7
5528	15164.7	-9636.72
170590	162090.	8500.04
90958	88671.9	2286.08
752644	755635.	-2990.76

R-SQUARED = .999874

REGRESSION NUMBER = 6
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 7
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 6 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
7	8675.67	15347.4
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.413658	.999937
-.413658	1.	-.416939
.999937	-.416939	1.

COVARIANCE MATRIX

1.48163E+08	-4451.91	-4221.51
-4451.91	.24845	.113654
-4221.51	.113654	.303842

INDEX	B	STD. ERROR	T-RATIO
0	18964.8	12172.2	1.55804
10	74.0344	.498448	148.53
7	-.327156	.551219	-.593514

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-19767.2	57696.8
10	72.4484	75.6205
7	-2.08113	1.42682

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	18964.8
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.0344
7	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	-.327156

STAND. ERROR OF EST. = 17222.3 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73525E+06	-18733.4
2.55721E+06	2.53544E+06	21765.6
5528	5918.15	-390.146
170590	165398.	5192.09
90958	92672.1	-1714.08
752644	758764.	-6120.08

R-SQUARED = .999887

REGRESSION NUMBER = 7
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 8
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 7 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
8	2.33333	1.21106
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	-.823184	.999937
-.823184	1.	-.822938
.999937	-.822938	1.

COVARIANCE MATRIX

1.48869E+09	-29078.1	-4.40569E+08
-29078.1	.71151	8208.24
-4.40569E+08	8208.24	1.39742E+08

INDEX	B	STD. ERROR	T-RATIO
0	12441.6	38583.6	.322459
10	74.1937	.843511	87.9582
8	627.319	11821.2	5.30671E-02

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-110331.	135215.
10	71.5096	76.8777
8	-36987.8	38242.5

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	12441.6
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1937
8	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	627.319

STAND. ERROR OF EST. = 18175.6 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73598E+06	-19461.3
2.55721E+06	2.53565E+06	21553.7
5528	14323.6	-8795.56
170590	163338.	7251.79
90958	87889.9	3068.1
752644	756260.	-3616.21

R-SQUARED = .999874

REGRESSION NUMBER = 8
NUMBER OF INDEPENDENT VARIABLES = 2
COVARIANCE MATRIX CONTROL NUMBER = 1
RESIDUAL CONTROL NUMBER = 1
INDEPENDENT OR DEPENDENT VARIABLES = 10
INDEPENDENT OR DEPENDENT VARIABLES = 9
INDEPENDENT OR DEPENDENT VARIABLES = 1

****** REGRESSION ANALYSIS ******

**REGRESSION NUMBER 8 :DEPENDENT VARIABLE IS 1

INDEX	MEANS	STANDARD DEVIATIONS
10	13950	16972.2
9	163.5	106.384
1	1.04891E+06	1.25868E+06

CORRELATION COEFFICIENTS

1.	6.03414E-02	.999937
6.03414E-02	1.	6.40429E-02
.999937	6.40429E-02	1.

COVARIANCE MATRIX

2.20304E+08	-2547.51	-828955.
-2547.51	.205842	-1.98158
-828955.	-1.98158	5239.13

INDEX	B	STD. ERROR	T-RATIO
0	7457.22	14842.6	.502419
10	74.1402	.453698	163.413
9	44.002	72.3819	.607915

****** CONFIDENCE INTERVALS ******

INDEX	L-LIMIT	U-LIMIT
0	-39772.	54686.5
10	72.6965	75.5838
9	-186.317	274.321

****** TEST OF HYPOTHESIS ******

INDEX		
0	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	7457.22
10	REJECT H0 (COEFFICIENT = 0) AT 95% LEVEL	74.1402
9	ACCEPT H0 (COEFFICIENT = 0) AT 95% LEVEL	44.002

STAND. ERROR OF EST. = 17186.9 D.F.= 3

ACTUAL	PREDICTED	RESIDUAL
2.71652E+06	2.73681E+06	-20290.4
2.55721E+06	2.53570E+06	21504.2
5528	8337.26	-2809.26
170590	168938.	1651.84
90958	92157.9	-1199.87
752644	751499	1145.01

R-SQUARED = .999888

PREDICTION CONFIDENCE INTERVAL RESULTS

This section contains a complete set of confidence intervals for each data set shown in Section 1 of this appendix. Again, only 73 out of 150 were chosen, in correspondence with Section 1, as the most useful confidence intervals to be summarized in Section 4 of the main body of this report. The total results are included here if the reader wishes to develop additional confidence intervals. The computer printout shows the appropriate data file set, the number of regression models (which shows the number regressions for that data set), the regression number (a sequence number), the number of independent variables (usually 1 or 2), the number assigned to the independent or dependent variable as defined in Table B-1, the constant, mean and multiplier. The constant, mean and multiplier are part of the confidence interval equation as shown below:

SINGLE VARIABLES

$$\hat{y} \pm \text{multiplier} \sqrt{\text{constant} + (\text{variable} - \text{mean})^2}$$

MULTIPLE VARIABLES

$$\hat{y} \pm \text{multiplier} \sqrt{1 + \frac{1}{N} + (\text{variable 1} - \text{mean 1}, \text{variable 2} - \text{mean 2})\,(\text{A Inverse}) \begin{pmatrix}\text{variable 1} - \text{mean 1} \\ \text{variable 2} - \text{mean 2}\end{pmatrix}}$$

```
ENTER DATA FILE NAME - DATA1
ENTER NUMBER OF REGRESSION MODELS - 12

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      11303.7
MEAN =          5190
MULTIPLIER =     59.0958

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      1.5396
MEAN =          1.66667
MULTIPLIER =     392470.

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      14.1107
MEAN =          8
MULTIPLIER =     23301.

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      887778.
MEAN =          516667.
MULTIPLIER =     1.12287

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      2823.44
MEAN =          1343.33
MULTIPLIER =     151.512

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      4.53791
MEAN =          2.08333
MULTIPLIER =     334128

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      2.83827E-02
MEAN =          8.91534E-03
MULTIPLIER =     5.02253E+07


ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      127.192
MEAN =          55
MULTIPLIER =     302.229


ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      5.33333
MEAN =          8
MULTIPLIER =     33134.1


ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      4.21808E-03
MEAN =          4.56621E-03
MULTIPLIER =     1.43251E+08


ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      55.5111
MEAN =          33.3333
MULTIPLIER =     16624.1


ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      531.114
MEAN =          265.047
MULTIPLIER =     1071.16

    *****PROBLEM COMPLETED*****
```

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OPERATIONS AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST--ETC(U)
JAN 80 D R BOGARD, T H HSU, R KIRKPATRICK F30602-78-C-0150

UNCLASSIFIFD RADC -TR-79-334 NL

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```
ENTER DATA FILE NAME - DATA2
ENTER NUMBER OF REGRESSION MODELS - 12

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      9011.05
MEAN =          1378.57
MULTIPLIER =     14.6643

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      6.52245
MEAN =          2.71429
MULTIPLIER =     14328.9

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      7.77527
MEAN =          1.42857
MULTIPLIER =     17776.5

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      312222.
MEAN =          35257.1
MULTIPLIER =     .444856

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      11768.6
MEAN =          3479
MULTIPLIER =     8.6316

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      4.69683
MEAN =          1.21429
MULTIPLIER =     30249.9

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      9.99231E-02
MEAN =          1.57176E-02
MULTIPLIER =     1.45437E+06

ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      5.50791
MEAN =          1.28286
MULTIPLIER =     24365.4

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      11.2107
MEAN =          2.24286
MULTIPLIER =     11669.6

ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      .141677
MEAN =          4.68614E-02
MULTIPLIER =     1.03345E+06

ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      328.158
MEAN =          31.6857
MULTIPLIER =     431.644

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      283.372
MEAN =          69.8686
MULTIPLIER =     406.746

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA2
ENTER NUMBER OF REGRESSION MODELS - 21

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         1378.57
A INVERSE
.195442         3.39123E-05

3.39123E-05     1.02397E-07


MULTIPLIER =    3765.14


ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         1.42857
A INVERSE
.206897         5.74713E-02

5.74713E-02     .145594


MULTIPLIER =    8955.04


ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         35257.1
A INVERSE
.210143         1.54215E-06

1.54215E-06     9.17083E-11


MULTIPLIER =    6714.24


ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         3479
A INVERSE
```

```
6.06621        -3.31061E-03

-3.31061E-03    1.86334E-06

MULTIPLIER =    37774.5

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         1.21429
A INVERSE
.223061         .129276

.129276         .430166

MULTIPLIER =    8803.27

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         1.57176E-02
A INVERSE
.245611         8.01596

8.01596         1046.5

MULTIPLIER =    15044.2

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         2.71429         1.28286
A INVERSE
.188813        -3.49086E-02

-3.49086E-02    .264776

MULTIPLIER =    35942.2
```

```
ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          2.71429          2.24286
A INVERSE
.185296          8.25301E-03

8.25301E-03      6.27228E-02


MULTIPLIER =     24062.9


ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          2.71429          4.68614E-02
A INVERSE
.215166          3.75723

3.75723          456.034


MULTIPLIER =     33352.2


ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          2.71429          31.6857
A INVERSE
.19942           1.09465E-03

1.09465E-03      7.87814E-05


MULTIPLIER =     40058.6


ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          2.71429          69.8686
A INVERSE
.185282         -3.24346E-04
```

```
-3.24346E-04     9.81614E-05

MULTIPLIER =     19182.9

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479            1378.57
A INVERSE
6.17055E-08      2.32185E-08

2.32185E-08      1.05249E-07

MULTIPLIER =     11713.4

ENTER REGRESSION NUMBER - 13
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479            1.42857
A INVERSE
6.49788E-08      3.53520E-05

3.53520E-05      .148863

MULTIPLIER =     17797.1

ENTER REGRESSION NUMBER - 14
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479            35257.1
A INVERSE
6.87847E-08      1.09197E-09

1.09197E-09      9.77263E-11

MULTIPLIER =     6511.2

ENTER REGRESSION NUMBER - 15
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
```

```
MEANS =          3479          1.21429
A INVERSE
7.17352E-08    8.26072E-05

8.26072E-05    .45037

MULTIPLIER =   15548.7

ENTER REGRESSION NUMBER - 16
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479          1.57176E-02
A INVERSE
8.38735E-08    5.63473E-03

5.63473E-03    1163.43

MULTIPLIER =   14264.

ENTER REGRESSION NUMBER - 17
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479          1.28286
A INVERSE
5.69320E-08   -9.51970E-06


-9.51970E-06    .259913

MULTIPLIER =   37826.7

ENTER REGRESSION NUMBER - 18
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.14286
MEANS =          3479          2.24286
A INVERSE
5.68436E-08    4.03753E-06

4.03753E-06    .062642

MULTIPLIER =   30227.9
```

```
ENTER REGRESSION NUMBER - 19
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3479            4.68614E-02
A INVERSE
7.21284E-08    2.78147E-03

2.78147E-03    497.687


MULTIPLIER =   34772.3


ENTER REGRESSION NUMBER - 20
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3479            31.6857
A INVERSE
6.38905E-08    7.74876E-07

7.74876E-07    8.21706E-05


MULTIPLIER =   43639.6


ENTER REGRESSION NUMBER - 21
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3479            69.8686
A INVERSE
5.66928E-08   -1.03470E-07



-1.03470E-07    9.77825E-05


MULTIPLIER =   23302.

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA4
ENTER NUMBER OF REGRESSION MODELS - 12

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      4387.
MEAN =          1292
MULTIPLIER =     18.3199

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      2.14663
MEAN =          1.2
MULTIPLIER =     33040.8

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      4.29325
MEAN =          2.6
MULTIPLIER =     24217.2

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      350229
MEAN =          63400
MULTIPLIER =     .240236

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      3614.26
MEAN =          1466.4
MULTIPLIER =     28.9092

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      1.86596
MEAN =          1.018
MULTIPLIER =     16188.

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      1.51823
MEAN =          .148863
MULTIPLIER =     64662.6

ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      196.175
MEAN =          28.73
MULTIPLIER =     526.556

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      14.6278
MEAN =          1.98
MULTIPLIER =     7035.93

ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      .174964
MEAN =          2.90332E-02
MULTIPLIER =     347545.

ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      5.00675
MEAN =          .64
MULTIPLIER =     16856.6

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      293.715
MEAN =          65.958
MULTIPLIER =     340.378

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA4
ENTER NUMBER OF REGRESSION MODELS - 21

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.2
MEANS =        1.2            1292
A INVERSE
1.25048        1.19761E-05

1.19761E-05    2.99401E-07


MULTIPLIER =   7940.39


ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.2
MEANS =        1.2            2.6
A INVERSE
1.45455        .272727

.272727        .363636


MULTIPLIER =   33772.9


ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.2
MEANS =        1.2            63400
A INVERSE
1.27055       -9.90418E-07


-9.90418E-07   4.77310E-11


MULTIPLIER =   31529.


ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.2
```

```
MEANS =         1.2             1466.4
A INVERSE
1.57733       -4.26768E-04


4.26768E-04    5.56412E-07


MULTIPLIER =   29206.2


ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1.2             1.018
A INVERSE
1.97866       -1.38134


-1.38134        2.61866


MULTIPLIER =   14887.7


ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1.2             .148863
A INVERSE
1.30999         .396376

.396376         2.61883


MULTIPLIER =   29263.1


ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1.2             28.73
A INVERSE
1.4305          5.56027E-03

-5.56027E-03    1.71283E-04


MULTIPLIER =   48743.6
```

```
ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.2
MEANS =          1.2             1.98
A INVERSE
1.25977          1.62778E-02

1.62778E-02      2.71297E-02

MULTIPLIER =     44195.9

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.2
MEANS =          1.2             2.90332E-02
A INVERSE
1.44357         -6.48545

-6.48545         217.296

MULTIPLIER =     23815.6

ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.2
MEANS =          1.2             .64
A INVERSE
1.25926         -4.62963E-02

-4.62963E-02     .231481

MULTIPLIER =     29206.4

ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.2
```

```
MEANS =         1.2           65.958
A INVERSE
1.386           3.17304E-03

3.17304E-03     7.40328E-05


MULTIPLIER =    24404.2


ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4        1292
A INVERSE
7.27340E-07     3.76013E-07

3.76013E-07     4.93674E-07


MULTIPLIER =    49645.1


ENTER REGRESSION NUMBER - 13
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4        2.6
A INVERSE
4.89341E-07     1.29553E-04

1.29553E-04     .346799


MULTIPLIER =    71429.5


ENTER REGRESSION NUMBER - 14
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4        63400
A INVERSE
1.35145E-06     1.14475E-08

1.14475E-08     1.43925E-10


MULTIPLIER =    36642.5


ENTER REGRESSION NUMBER - 15
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4          1.018
A INVERSE
4.85191E-07    2.83801E-04

2.83801E-04    1.82032


MULTIPLIER =   17569.1


ENTER REGRESSION NUMBER - 16
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4          .148863
A INVERSE
6.80846E-06    1.56744E-02

1.56744E-02    38.5844


MULTIPLIER =   29572.7


ENTER REGRESSION NUMBER - 17
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4          28.73
A INVERSE
4.75599E-07   -2.36525E-06


-2.36525E-06    1.61433E-04


MULTIPLIER =   70980.2


ENTER REGRESSION NUMBER - 18
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.2
MEANS =         1466.4          1.98
A INVERSE
4.48353E-07   -1.42399E-05
```

```
-1.42399E-05    2.73716E-02

 MULTIPLIER =   69902.5

 ENTER REGRESSION NUMBER - 19
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =        1.2
 MEANS =        1466.4         2.90332E-02
 A INVERSE
 7.71100E-07    1.04228E-02

 1.04228E-02    329.043

 MULTIPLIER =   18234.8

 ENTER REGRESSION NUMBER - 20
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =        1.2
 MEANS =        1466.4         .64
 A INVERSE
 1.56855E-06    9.60046E-04

 9.60046E-04    .817384

 MULTIPLIER =   29206.7

 ENTER REGRESSION NUMBER - 21
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =        1.2
 MEANS =        1466.4         65.958
 A INVERSE
 5.77596E-07    3.45710E-06

-3.45710E-06    8.74604E-05

 MULTIPLIER =   68981.5

     *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA5
ENTER NUMBER OF REGRESSION MODELS - 12

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      30853.6
MEAN =          3101.14
MULTIPLIER =     15.6399

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      13.957
MEAN =          3.14286
MULTIPLIER =     15593.8

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      6.69189
MEAN =          3.57143
MULTIPLIER =     52620.

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      2.92600E+06
MEAN =          842714.
MULTIPLIER =     8.62453E-02

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      22466.8
MEAN =          4182.86
MULTIPLIER =     8.80131

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      35.2537
MEAN =          7.35
MULTIPLIER =     8990.73

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      2.79169E-02
MEAN =          4.16983E-03
MULTIPLIER =     8.34841E+06

ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      1199.78
MEAN =          291.714
MULTIPLIER =     278.112

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      10.4745
MEAN =          1
MULTIPLIER =     40836.6

ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      1.78663E-02
MEAN =          1.95752E-03
MULTIPLIER =     1.84518E+07

ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      12.5194
MEAN =          1
MULTIPLIER =     26888.8

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      910.916
MEAN =          188.127
MULTIPLIER =     432.003

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA5
ENTER NUMBER OF REGRESSION MODELS - 21

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286          3101.14
A INVERSE
4.83485E-02     8.96232E-06

8.96232E-06     9.89369E-09

MULTIPLIER =    42678.3

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286          3.57143
A INVERSE
.107527        -.177419

.177419         .467742

MULTIPLIER =    93208.3

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286          842714.
A INVERSE
.147371        -5.99380E-07

-5.99380E-07    3.35312E-12

MULTIPLIER =    86201.9

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286         4182.86
A INVERSE
5.17948        -3.20512E-03


-3.20512E-03    1.99889E-06

MULTIPLIER =    76021.

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286         7.35
A INVERSE
.377895        -.141422


-.141422        5.92308E-02

MULTIPLIER =    74166.9

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286         4.16983E-03
A INVERSE
.170577        -74.5479


-74.5479        42635.4

MULTIPLIER =    84172.2

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         3.14286         291.714
A INVERSE
.148392        -1.47378E-03
```

```
- 1.47378E-03    2.00813E-05

 MULTIPLIER =    92177.

 ENTER REGRESSION NUMBER - 8
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =         1.14286
 MEANS =         3.14286         1
 A INVERSE
 .113821         .121951

 .121951         .202091

 MULTIPLIER =    29160.4

 ENTER REGRESSION NUMBER - 9
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =         1.14286
 MEANS =         3.14286         1.95752E-03
 A INVERSE
 .269421         194.122

 194.122         164418.

 MULTIPLIER =    79113.2

 ENTER REGRESSION NUMBER - 10
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =         1.14286
 MEANS =         3.14286         1
 A INVERSE
 7.34908E-02     5.51181E-02

 5.51181E-02     9.13386E-02

 MULTIPLIER =    87678.8

 ENTER REGRESSION NUMBER - 11
 ENTER NUMBER OF INDEPENDENT VARIABLES - 2
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
 ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
 1+1/N =         1.14286
```

```
MEANS =         3.14286        188.127
A INVERSE
.121388       -1.52079E-03


-1.52079E-03    2.84975E-05

MULTIPLIER =    76070.3

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        3101.14
A INVERSE
1.79406E-08     4.79290E-09

4.79290E-09     9.51279E-09

MULTIPLIER =    40539.1

ENTER REGRESSION NUMBER - 13
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        3.57143
A INVERSE
3.70920E-08    -9.49555E-05


- 9.49555E-05    .418086

MULTIPLIER =    84878.1

ENTER REGRESSION NUMBER - 14
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        842714.
A INVERSE
5.97394E-08    -3.94617E-10


-3.94617E-10    3.52205E-12
```

```
MULTIPLIER =   80389.7

ENTER REGRESSION NUMBER - 15
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        7.35
A INVERSE
1.00720E-07   -5.90338E-05


-5.90338E-05    4.09062E-02

MULTIPLIER =   72166.4

ENTER REGRESSION NUMBER - 16
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        4.16983E-03
A INVERSE
7.19692E-08   -5.12924E-02


-5.12924E-02    46611.5

MULTIPLIER =   79387.7

ENTER REGRESSION NUMBER - 17
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        291.714
A INVERSE
5.46493E-08   -8.65866E-07


-8.65866E-07    1.91630E-05

MULTIPLIER =   82759.2

ENTER REGRESSION NUMBER - 18
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        1
A INVERSE
3.68361E-08    6.00954E-05

6.00954E-05    .16947


MULTIPLIER =    42180.9


ENTER REGRESSION NUMBER - 19
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        1.95752E-03
A INVERSE
1.15250E-07    .134812

.134812        182245.


MULTIPLIER =    52488.5


ENTER REGRESSION NUMBER - 20
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        1
A INVERSE
2.60920E-08    2.97971E-05

2.97971E-05    8.40283E-02


MULTIPLIER =    76697.3


ENTER REGRESSION NUMBER - 21
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.14286
MEANS =         4182.86        188.127
A INVERSE
4.57274E-08   -9.16572E-07


-9.16572E-07   2.78165E-05

MULTIPLIER =    62227.9

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA6
ENTER NUMBER OF REGRESSION MODELS - 12

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      13298.5
MEAN =          1753.85
MULTIPLIER =     7.04061

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      7.74279
MEAN =          2.23077
MULTIPLIER =     11576.7

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      5.27583
MEAN =          2
MULTIPLIER =     23651.1

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      3.65345E+06
MEAN =          388154.
MULTIPLIER =     .032081

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      12263.3
MEAN =          3233.85
MULTIPLIER =     7.24025

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      45.5175
MEAN =          8.26077
MULTIPLIER =     2786.91

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      6.63668E-02
MEAN =          8.10924E-03
MULTIPLIER =     1.91456E+06

ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      3.72759
MEAN =          .08
MULTIPLIER =     31455.9

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      6.81001
MEAN =          .146154
MULTIPLIER =     17218.

ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      .039254
MEAN =          8.43454E-04
MULTIPLIER =     2.98708E+06

ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      35.8422
MEAN =          .769231
MULTIPLIER =     3271.42

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      806.13
MEAN =          130.395
MULTIPLIER =     152.083

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA6
ENTER NUMBER OF REGRESSION MODELS - 21

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        2.23077        1753.85
A INVERSE
.235939       -1.74246E-05


-1.74246E-05   7.99817E-08

MULTIPLIER =   12286.7

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        2.23077        2
A INVERSE
.232143        0

0              .5

MULTIPLIER =   23417.3

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        2.23077        388154.
A INVERSE
.235466        5.92816E-08

5.92816E-08    1.05759E-12

MULTIPLIER =   16860.8

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
```

```
MEANS =          2.23077          3233.85
A INVERSE
1.21856         -6.92220E-04

-6.92220E-04     4.85768E-07

MULTIPLIER =     24625.5

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          2.23077          8.26077
A INVERSE
.245574          9.76937E-03

9.76937E-03      7.10592E-03

MULTIPLIER =     21060.7

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          2.23077          8.10924E-03
A INVERSE
.286535          14.5648

14.5648          3900.06

MULTIPLIER =     25086.2

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          2.23077          .08
A INVERSE
.235294          5.65611E-02

5.65611E-02      1.0152

MULTIPLIER =     22063.6
```

```
ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         2.23077         .146154
A INVERSE
.235294         3.09598E-02

3.09598E-02     .304166


MULTIPLIER =    22063.6


ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         2.23077         8.43454E-04
A INVERSE
.235294         5.37108

5.37108         9154.59


MULTIPLIER =    22063.5


ENTER REGRESSION NUMBER - 10
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         2.23077         .769231
A INVERSE
.235294         5.88235E-03

5.88235E-03     1.09804E-02


MULTIPLIER =    22063.6


ENTER REGRESSION NUMBER - 11
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 12
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         2.23077         130.395
A INVERSE
.242153         4.72876E-04

4.72876E-04     2.23395E-05
```

```
MULTIPLIER =   18188.8

ENTER REGRESSION NUMBER - 12
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 11
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        3233.85       1753.85
A INVERSE
9.48303E-08   -1.35843E-08


-1.35843E-08   8.06408E-08

MULTIPLIER =   13044.1

ENTER REGRESSION NUMBER - 13
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 13
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        3233.85       2
A INVERSE
9.86864E-08   -5.72381E-05


- 5.72381E-05   .533198

MULTIPLIER =   25023.4

ENTER REGRESSION NUMBER - 14
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 14
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =        1.07692
MEANS =        3233.85       368154.
A INVERSE
9.27084E-08    1.31837E-11

1.31837E-11    1.04454E-12

MULTIPLIER =   18702.3

ENTER REGRESSION NUMBER - 15
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 16
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         3233.85         8.26077
A INVERSE
9.28287E-08   -1.39007E-06

- 1.39007E-06    6.73809E-03

MULTIPLIER =    24479.5

ENTER REGRESSION NUMBER - 16
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 17
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         3233.85         8.10924E-03
A INVERSE
1.20434E-07    1.07095E-02

1.07095E-02    4112.06

MULTIPLIER =    24479.9

ENTER REGRESSION NUMBER - 17
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 18
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         3233.85         .08
A INVERSE
1.06797E-07    1.28361E-04

1.28361E-04    1.15588

MULTIPLIER =    24440.8

ENTER REGRESSION NUMBER - 18
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 19
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.07692
MEANS =         3233.85         .146154
A INVERSE
1.06797E-07    7.02609E-05

-7.02609E-05    .346317

MULTIPLIER =    24440.8
```

```
ENTER REGRESSION NUMBER - 19
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 20
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          3233.85         8.43454E-04
A INVERSE
1.06797E-07      1.21893E-02

1.21893E-02      10423.2


MULTIPLIER =     24440.8


ENTER REGRESSION NUMBER - 20
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 21
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          3233.85         .769231
A INVERSE
1.06797E-07      1.33496E-05

1.33496E-05      .012502


MULTIPLIER =     24440.9


ENTER REGRESSION NUMBER - 21
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 15
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 22
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.07692
MEANS =          3233.85         130.395
A INVERSE
9.30969E-08      1.09343E-07

1.09343E-07      2.15445E-05


MULTIPLIER =     20897.2

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA7
ENTER NUMBER OF REGRESSION MODELS - 9

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     4240.02
MEAN =         777
MULTIPLIER =    2342.

ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 3
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     6.02464
MEAN =         4.33333
MULTIPLIER =    1.68518E+06

ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 4
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     7.8955
MEAN =         1.5
MULTIPLIER =    1.28264E+06

ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 5
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     20830.8
MEAN =         6169.33
MULTIPLIER =    137.072

ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 6
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     24899.6
MEAN =         7769.5
MULTIPLIER =    279.021

ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 7
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =     89526.3
MEAN =         8675.67
MULTIPLIER =    103.095

ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 8
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      7.06452
MEAN =          2.33333
MULTIPLIER =     816622.

ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 9
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      620.572
MEAN =          163.5
MULTIPLIER =     16329.4

ENTER REGRESSION NUMBER - 9
ENTER NUMBER OF INDEPENDENT VARIABLES - 1
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
CONSTANT =      99004.4
MEAN =          13950
MULTIPLIER =     1.14896

    *****PROBLEM COMPLETED*****
```

```
ENTER DATA FILE NAME - DATA7
ENTER NUMBER OF REGRESSION MODELS - 8

ENTER REGRESSION NUMBER - 1
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950           777
A INVERSE
7.27134E-10     3.60725E-09

3.60725E-09     3.96449E-07


MULTIPLIER =    54938.1


ENTER REGRESSION NUMBER - 2
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 3
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950           4.33333
A INVERSE
6.94442E-10     1.56249E-07

1.56249E-07     .187535


MULTIPLIER =    51225.5


ENTER REGRESSION NUMBER - 3
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 4
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950           1.5
A INVERSE
6.98318E-10     6.63250E-07

6.63250E-07     .1098


MULTIPLIER =    56596.9


ENTER REGRESSION NUMBER - 4
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 5
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950           6169.33
A INVERSE
```

```
8.63345E-09    3.93484E-08

3.93484E-08    1.95021E-07


MULTIPLIER =    56248.9


ENTER REGRESSION NUMBER - 5
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 6
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950          7769.5
A INVERSE
1.48217E-09   -4.29672E-09

-4.29672E-09   2.34328E-08


MULTIPLIER =    57938.7


ENTER REGRESSION NUMBER - 6
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 7
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950          8675.67
A INVERSE
8.37644E-10    3.83182E-10

3.83182E-10    1.02440E-09


MULTIPLIER =    54801.3


ENTER REGRESSION NUMBER - 7
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 8
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =         1.16667
MEANS =         13950          2.33333
A INVERSE
2.15379E-09    2.48468E-05

2.48468E-05    .423006


MULTIPLIER =    57834.8


ENTER REGRESSION NUMBER - 8
ENTER NUMBER OF INDEPENDENT VARIABLES - 2
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 10
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 9
```

```
ENTER INDEPENDENT OR DEPENDENT VARIABLE - 1
1+1/N =          1.16667
MEANS =          13950          163.5
A INVERSE
6.96849E-10   -6.70835E-09

-6.70835E-09   1.77363E-05

MULTIPLIER =   54688.8

    *****PROBLEM COMPLETED*****
```

APPENDIX C – SENSITIVITY RESULTS

This section includes the computer printout results of the sensitivity analysis. The constants and their values used in this analysis are shown below. The following pages include the input variable values for each tester group and then tester samples. Page C-8 includes the input variable values for each test subsystem sample. Also, the calculated O&S cost for each tester and test subsystem is shown. The sensitivity computer program varies each tester and test subsystem input variables one at a time, +100% and -50% and calculates the resulting new O&S cost which is shown on the printout. The percent change of the O&S cost for each variable variation is also shown. In this way the most O&S cost sensitive parameters can be identified.

The constants for calculating O&S costs are:
(For details see Section 2.5)

RFM = 6.20
RA = 0.33
RT = 696.0
DT = 1000.0
BTS = 250.0
RSF = 0.015
RDL = 16.75
CSFAS = 3.0
RO = 18000

ANALOG TESTERS: TO MODULE/CARD
DATA IS IN FILE-->DATA1

THE INPUTS ARE:

COST	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
123468	10000	2	12	600000	2080	.75	180	100.00	10.0	182.5	40.0	385.00
34069	2000	1	2	150000	130	1.50	2800	5.00	6.0	365.0	10.0	35.14
87801	3570	2	10	800000	1820	4.00	48	60.00	8.0	182.5	50.0	375.00

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	113957	120499	90361	89529	89529	82675	80760	82923	82014
% CHANGE -->	39.35	47.35	10.49	9.48	9.48	1.10	-1.25	1.40	.29
COST -50% -->	65690	62420	77489	77904	77904	81332	83819	81208	81662
% CHANGE -->	-19.67	-23.67	-5.25	-4.74	-4.74	-.55	2.49	-.70	-.14

CALR	CDM	PSOS
81631	81843	82575
-.18	.08	.97
82077	81748	81382
.36	-.04	-.49

ANALOG TESTERS: TO COMPONENT
DATA IS IN FILE-->DATA2

THE INPUTS ARE:

COST	NI	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
63231	785	3	1	11000	4160	.88	155	.57	1.7	22.6	78.2	46.32
41543	580	2	1	8000	2080	1.10	153	.60	.5	19.1	.0	41.25
82812	900	4	1	20000	5720	.95	118	2.59	3.5	16.9	2.4	49.51
76848	4300	2	4	132000	2080	2.75	23	1.78	5.2	13.5	16.5	145.83
83580	1255	4	1	17000	5720	.83	147	.69	.9	74.[illegible]	.0	110.97
42297	630	2	1	5800	2773	.90	103	.84	2.4	37.2	4.9	49.51
49763	1200	2	1	53000	1820	1.09	35	1.91	1.5	17.3	119.8	45.69

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	71415	113948	64866	63396	63396	63936	62301	62933	63616
% CHANGE -->	13.60	81.25	3.18	.84	.84	1.70	-.90	.10	1.19
COST -50% -->	58594	37328	61868	62603	62603	62333	64002	62835	62493
% CHANGE -->	-6.80	-40.63	-1.59	-.42	-.42	-.85	1.80	-.05	-.60

CALR	CDM	PSOS
62184	63487	63077
-1.09	.99	.33
64236	62558	62763
2.18	-.49	-.17

DIGITAL TESTERS: TO MODULE/CARD
DATA IS IN FILE-->DATA3

THE INPUTS ARE:

COST	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
109163	2150	4	4	704000	6840	17.48	903	200.00	.0	999999.0	.0	85.00

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	122493	190448	118118	119723	119723	111380	107296	110678	109163
% CHANGE -->	12.21	74.46	8.20	9.67	9.67	2.03	-1.71	1.39	.00
COST -50% -->	102498	68520	104685	103883	103883	108054	112895	108405	109163
% CHANGE -->	-6.11	-37.23	-4.10	-4.84	-4.84	-1.02	3.42	-.69	.00

	CALR	CDM	PSOS
COST +100% -->	109163	109163	109418
% CHANGE -->	.00	.00	.23
COST -50% -->	109163	109163	109035
% CHANGE -->	.00	.00	-.12

DIGITAL TESTERS: TO COMPONENT
DATA IS IN FILE-->DATA4

THE INPUTS ARE:

COST	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
49564	1260	2	2	80000	2080	1.44	36	2.76	1.5	18.9	.8	31.67
40918	2400	1	3	184000	152	1.35	1	.89	1.1	12.3	2.4	115.45
33803	2000	1	4	10000	1700	1.00	999999	100.00	7.3	91.3	.0	147.57
21377	300	1	2	14000	1700	.50	1000	20.00	.0	999999.0	.0	19.10
22856	500	1	2	29000	1700	.80	800	20.00	.0	999999.0	.0	16.00

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	41714	57082	35383	34655	34655	34482	33281	33770	34008
% CHANGE -->	23.77	69.36	4.98	2.82	2.82	2.31	-1.25	.20	.90
COST -50% -->	29698	22015	32864	33228	33228	33315	34548	33670	33552
% CHANGE -->	-11.88	-34.68	-2.49	-1.41	-1.41	-1.15	2.51	-.10	-.45

	CALR	CDM	PSOS
	33543	33721	33902
	-.48	.05	.59
	34025	33695	33605
	.95	-.03	-.29

HYBRID TESTERS: TO MODULE/CARD
DATA IS IN FILE-->DATA5

THE INPUTS ARE:

COST	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
171448	1250	5	4	1287000	7200	11.28	118	500.00	.0	999999.0	.0	250.00
173314	1200	5	4	1387000	7200	10.17	113	500.00	.0	999999.0	.0	250.00
163882	1300	5	4	1213000	7200	11.80	122	400.00	.0	999999.0	.0	250.00
113810	3000	4	5	512000	5400	12.20	764	200.00	.0	999999.0	.0	382.81
109094	13158	1	3	500000	1040	1.00	1000	50.00	4.0	182.5	1.0	15.83
35522	1316	1	2	500000	1040	1.00	1000	192.00	2.0	365.0	5.0	135.00
30417	484	1	3	500000	200	4.00	2785	200.00	1.0	182.5	1.0	33.25

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	133154	177793	120963	126567	126567	119002	105128	126448	113955
% CHANGE -->	16.88	56.06	6.18	11.10	11.10	4.46	-7.72	10.99	.03
COST -50% -->	104313	81993	110409	107606	107606	111389	131524	107666	113912
% CHANGE -->	-8.44	-28.03	-3.09	-5.55	-5.55	-2.23	15.45	-5.50	-.01

CALR	CDM	PSOS
113912	113928	114491
-.01	.00	.50
113957	113926	113644
.03	-.00	-.25

HYBRID TESTERS: TO COMPONENT
DATA IS IN FILE-->DATA6

THE INPUTS ARE:

COST	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC	CALR	CDM	PSOS
41980	600	2	1	5000	2080	.96	58	1.04	1.9	91.3	10.0	39.72
68068	2000	2	2	508000	3240	11.80	71	.00	.0	999999.0	.0	208.33
59987	1500	2	2	465000	3240	11.91	138	.00	.0	999999.0	.0	208.33
62286	1200	2	3	502000	3240	11.00	80	.00	.0	999999.0	.0	110.42
73819	2700	2	2	1112000	2880	7.38	210	.00	.0	999999.0	.0	100.00
65043	2300	2	2	440000	2880	11.60	106	.00	.0	999999.0	.0	166.67
100164	2300	4	2	436000	5400	6.68	277	.00	.0	999999.0	.0	125.00
68914	1600	3	2	51000	5040	5.50	980	.00	.0	999999.0	.0	50.00
44241	450	2	2	181000	2520	2.92	1604	.00	.0	999999.0	.0	85.00
62334	1900	2	2	581000	2880	10.31	177	.00	.0	999999.0	.0	208.33
48960	450	2	2	210000	3240	10.93	136	.00	.0	999999.0	.0	85.00
74498	4200	2	2	285000	2880	7.80	73	.00	.0	999999.0	.0	208.33
55649	1600	2	2	270000	2520	8.60	122	.00	.0	999999.0	.0	100.00

SENSITIVITY ANALYSIS

PARAMETER -->	ND	LP	TTL	PROC	NH	LDR	R	DDM	LDC
COST +100% -->	74408	106369	66031	69356	69356	67130	61735	63537	63544
% CHANGE -->	17.11	67.42	3.93	9.16	9.16	5.66	-2.83	.00	.02
COST -50% -->	58097	42117	62286	60623	60623	61736	67133	63533	63529
% CHANGE -->	-8.56	-33.71	-1.97	-4.58	-4.58	-2.83	5.66	-.00	-.01

CALR	CDM	PSOS
63528	63537	63925
-.01	.00	.62
63547	63533	63339
.02	-.00	-.31

Data: file DATA 7

Parameter ⟶ Cost		ND	LP	TTL	NH	R	UC	LDR	DDM	NI
TPQ-37	2716515	700	5	1.5	1600	10776	2386	1	191	36700
TPQ-36	2557207	560	4	1.5	1600	13508	2123	1	170	34000
U.S. ROLAND	5528	102	6	.2	8760	9533	39879	3	20	0
IPD/TAS	170590	2100	4	1.4	8760	1850	5000	4	300	2000
SID	90958	1000	4	4	7536	5950	1000	2	240	1000
JTID	752644	200	3	.4	8760	5000	1666	3	60	10000

Sensitivity Analysis

Cost + 100%	1061224	1060263	1059905	1057891	1055665	1057492	1056490	1056732	2102657
% Change	0.46	0.37	0.33	0.14	-0.07	0.10	0.01	0.03	99.04
Cost -50%	1053999	1054479	1054658	1055665	1057891	1055865	1056366	1056249	533282
% Change	-0.23	-0.18	-0.17	-0.07	0.14	-0.05	-0.004	-0.01	-49.52

LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS (Continued)

RSF	- Replenishment Spares Factor
RT	- Wkly Student Pay and Allowance During the Training Course
SA-ALC	- San Antonio Air Logistics Command
SALC	- Sacramento Air Logistics Center
SAMSO	- Space and Missile Systems Organization
SID	- Standard Information Display
TM	- Technical Manuals
TTL	- Length of Training Course
UC	- Unit Reorder Cost
UUT	- Unit Unde Test
wks	- Weeks
WRA	- Weapon Replaceable Assembly
yr	- Year

LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

AF	- Air Force
ATE	- Automatic Test Equipment
BIT	- Built-In Test
BITE	- Built-In Test Equipment
BTS	- Student Travel Cost
CALR	- Average Number of Days Between Calibrations
CCA	- Circuit Card Assembly
CDM	- Average Cost of Material Consumed Per Calibration
CER	- Cost Estimating Relationship
COND	- Condemnation Rate
CSFAS	- Annual Cost of Item Operational Floor Space
DDM	- Material Cost for Repair
DLSIE	- Defense Logistics Studies Information Exchange
DT	- Cost Per Man/Week for Conducting Training Course
dy	- Day
ESA	Engineering Support Activity
ETN	- Electronic Technician, Navy
FAR	- False Alarm Rate
GIDEP	- Government Industrial Data Exchange Program
IPD/TAS	Intercept Position Display/Target Acquisition System
JTIDS(HIT)	- Joint Tactical Information Distribution System (Hughes Improved Terminal)
LCC	- Life Cycle Cost
LDC	- Average Labor Time Per Calibration
LDR	- Average Labor Time for Repair
LORA	- Level of Repair Analysis
LP	- Required Manning Level for Maintenance/Operator Personnel
LRU	- Lowest Replaceable Assembly
NAEC	- Naval Air Engineering Center
NAV SEC	- Navy
NAV SHIP ENG CENTER	- Navy Ship Engineering Center
ND	- Annual Number of TM Pages
NH	- Annual Operating Hours
NI	- Annual Number of BIT Instructions
NOSC	- Naval Ocean Systems Center
O&S	- Operations and Support
ORLA	- Optimum Repair Level Analysis
PROC	- System Procurement Cost
PSOS	- Annual Operational Floor Space
R	- Mean Time between Failure
RA	- Oper/Maint Personnel Turnover Factor
RDL	- Hourly Cost of Maintenance Labor
RFM	- Average Annual Cost Per Page of TM Maintenance
R/M	- Reliability/Maintainability
RO	- Average Annual Cost for Operations Personnel
ROM	- Average Annual Cost Per Instruction for Software Program Maintenance

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