

Use the information in the following setting to answer questions 1 and 2

A field wildlife biologist wants to estimate the total number of tufted titmice in a region in Connecticut. She captures 325 of these birds, marks them with a leg band, and then releases them. One year later she returns and captures 750 titmice and finds that 42 of them were wearing the leg band. Note: be sure to carry 3-digit accuracy. For example, 0.0027 is 2-digit accuracy while 0.00267 is 3-digit accuracy.

1) The estimated number of titmice in the entire population is:

- A) 243,750
- B) 102,375
- C) 5,804
- D) 4,621
- E) 97

2) The 90% CI for the number of titmice in the population is

- A) (4693, 9286)
- B) (2034, 3296)
- C) (4221, 9286)
- D) (4656, 7701)
- E) (10745, 17773)

Figure 1: Tufted Titmouse

**Use the information in the following setting to answer questions 3 and 4**

A recent lament published in *Ram Talk* dealt with the lack of sufficient numbers of desks designed to accommodate left handed students. In order to address this claim, facilities has surveyed a SRS of 360 CSU students and found that 45 of them wrote with their left hand. Records from the registrar's office put the total population of CSU students at 24,960. (Note: Carry at least 3 decimal accuracy in your calculations)

3) The point estimate for the true number of CSU students who write with their left hand is:

- A) $N = 3,120$
- B) $\hat{N} = 3,120$
- C) $N = 24,960$
- D) $\hat{p} = 0.0144$
- E) $\hat{p} = 0.125$

4) The 95% CI for the true number of CSU students who write with their left hand is:

- A) (2,266 to 4,423)
- B) (1,999 to 3,969)
- C) (2,266 to 3,969)
- D) (2,404 to 3,844)
- E) (1,999 to 4,423)

- 5) Faced with a crisis of depleting revenue the state board of tourism needs to decide where to allocate its resources. The board would like to estimate the proportion of vacationers who stop at state historic markers while traveling. In order to be useful, this estimate needs to be within 0.05 of the true value with a level of confidence set at 95%. Given these criteria, the number of travelers the board needs to survey is:
- A) 275
 - B) 384
 - C) 385
 - D) 541
 - E) 542

Use the information in the following setting to answer questions 6 through 9

A health care provider has designed a study to investigate the rate of cigarette smoking in college graduate versus that of the general population. In a survey of 785 randomly selected college graduates 144 indicated that they were regular smokers (of cigarettes). Can we conclude from this study that the smoking rate of college graduates is different than that of the general public. Note that the smoking rate for the general population is 27%. Hypothesis test and CI results for this study are provided in Output 3. Let the significance level equal 0.10.

- 6) The correct null/alternative hypothesis pair is:

- A) $H_0: p > 0.27$; $H_a: p \leq 0.27$
- B) $H_0: p = 0.27$; $H_a: p \neq 0.27$
- C) $H_0: \hat{p} = 0.27$; $H_a: \hat{p} \neq 0.27$
- D) $H_0: p \leq 0.27$; $H_a: p > 0.27$
- E) $H_0: p \neq 0.27$; $H_a: p = 0.27$

- 7) The critical value(s) is(are):

- A) - 2.576
- B) -1.96
- C) 1.65
- D) ± 1.96
- E) ± 1.65

Output 3: Hypothesis test results for the smoking study

Test and CI for One Proportion

Test of $p = 0.27$ vs $p \text{ not } = 0.27$

Sample	X	N	Sample p	95.0% CI	Z-Value	P-Value
smokers	144	785	0.183	(0.156, 0.210)	-5.46	0.000

- 8) The test statistic is:

- A) 5.46
- B) 0.183
- C) 0.27
- D) - 0.183
- E) - 5.46

- 9) The statistical decision and corresponding English interpretation are:

- A) FTR H_a : there is enough evidence to conclude that the proportion of college graduates who regularly smoke is different than 0.27. In fact it's likely less than 0.27
- B) FTR H_0 : there is not enough evidence to conclude that the proportion of college graduates who regularly smoke is different than 0.27.
- C) Reject H_0 : there is enough evidence to conclude that the proportion of college graduates who regularly smoke is different than 0.27. In fact it's likely more than 0.27
- D) Reject H_0 : there is enough evidence to conclude that the proportion of college graduates who regularly smoke is different than 0.27. In fact it's likely less than 0.27

- E) Reject H_0 : there is not enough evidence to conclude that the proportion of college graduates who regularly smoke is different than 0.27.
- 10) A personal trainer wants to determine if the proportion of males aged 30 - 44 who don't exercise regularly has decreased from 24.9%. This was the proportion of males in that age group who did have a regular exercise program when data was last collected in 1998. The hypotheses for this study are : $H_0: p \geq 0.249$ versus $H_a: p < 0.249$ and the significance level is 0.025. The test statistic, z_{calc} , is - 1.77. The approximate P-value for this study is:
Hint: z_{calc} is distributed as a standard normal
- A) 0.0196
 - B) 0.0250
 - C) 0.0384
 - D) 0.2490
 - E) 0.9616

Use the information in the following setting to answer questions 11 through 14

A sociologist believes that the proportion of unmarried couples who were living together has decreased since the mid 1980s. At that time, 8% of couples in committed relationships were living together but not married. A recent sample of 500 households across the country revealed that 32 were inhabited by unmarried couples. Let $\alpha = 0.05$.

- 11) The correct null/alternative hypothesis pair is:
- A) $H_0: p \geq 0.08$; $H_a: p < 0.08$
 - B) $H_0: p = 0.08$; $H_a: p \neq 0.08$
 - C) $H_0: p < 0.08$; $H_a: p \geq 0.08$
 - D) $H_0: p \leq 0.08$; $H_a: p > 0.08$
 - E) $H_0: \hat{p} \geq 0.08$; $H_a: \hat{p} < 0.08$
- 12) The critical value(s) is(are):
- A) - 2.58
 - B) - 1.96
 - C) - 1.65
 - D) 1.65
 - E) 1.96
- 13) The test statistic is:
- A) 1.65
 - B) 0.080
 - C) 0.050
 - D) - 0.064
 - E) - 1.32
- 14) The statistical decision and corresponding English interpretation are:
- A) Reject H_0 : there is enough evidence to conclude that the proportion of couples in committed relationships who are unmarried and living together has decreased
 - B) Reject H_0 : there is enough evidence to conclude that the proportion of couples in committed relationships who are unmarried and living together is different than 0.08.
 - C) Reject H_0 : there is not enough evidence to conclude that the proportion of couples in committed relationships who are unmarried and living together has decreased.
 - D) FTR H_0 : there is not enough evidence to conclude that the proportion of couples in committed relationships who are unmarried and living together has decreased.

- E) FTR H_a : there is enough evidence to conclude that the proportion of couples in committed relationships who are unmarried and living together has decreased.

Use the information in the following setting to answer questions 15 through 18

In a study designed to test the effectiveness of hypnosis in reducing pain Price and Barber looked at responses from randomly selected patients before and after hypnosis. The raw data and some summary statistics follow in Table 2.

[Price; Barber; Jour. Abnormal. Psychology, 96(1)]

Patient	1	2	3	4	5
Before	6.6	9.0	10.3	11.3	8.1
After	6.8	7.4	8.5	8.1	6.1
diff	0.2	1.6	1.6	3.2	2.0

$\Sigma \text{diff} = 8.4$; $s_{\text{diff}}^2 = 1.49$; $\text{diff} = \text{Before} - \text{After}$

- 15) The point estimate for the true average effect of the strength program is:
- 1.68
 - 1.22
 - 9.06
 - 8.40
 - 7.38
- 16) The 98% CI for the true average difference in pain levels before versus after hypnosis is (- 0.365, 3.73). From the choices below, the best interpretation of this interval is:
- We are confident that 98% of the patients receiving hypnosis will experience a reduction in pain of between - 0.365 and 3.73
 - We are 98% confident that the true average pain reducing effect of hypnosis is between - 0.365 and 3.73
 - We are 98% confident that 98% of the patients receiving hypnosis will experience a reduction in pain of between - 0.365 and 3.73
 - We are 98% confident that the sample average pain reducing effect of hypnosis is between - 0.365 and 3.73
 - None of these choices is good interpretation of the CI
- 17) The automatic null/alternate hypothesis pair for testing that hypnosis had no effect on pain levels is:
- $H_0: \mu_d \leq 0$; $H_a: \mu_d > 0$
 - $H_0: \mu_d \neq 0$; $H_a: \mu_d = 0$
 - $H_0: \mu_d = 0$; $H_a: \mu_d \neq 0$
 - $H_0: \mu = 0$; $H_a: \mu \neq 0$
 - $H_0: \bar{x}_d = 0$; $H_a: \bar{x}_d \neq 0$

- 18) Based on the 98% CI reported in Problem 16, the statistical decision and corresponding English interpretation for the hypothesis that hypnosis had no effect on pain are:
- A) Reject H_0 : conclude that hypnosis has an effect on pain levels, in fact at $\alpha = 0.02$ we can conclude that pain decreases
 - B) Reject H_0 : There is not enough evidence to conclude that hypnosis has an effect on pain levels
 - C) FTR H_0 : conclude that hypnosis has an effect on pain levels, in fact at $\alpha = 0.01$ we can conclude that pain decreases
 - D) FTR H_0 : conclude that hypnosis has an effect on pain levels, in fact at $\alpha = 0.02$ we can conclude that pain decreases
 - E) FTR H_0 : conclude that hypnosis has no significant effect on pain levels

Use the information in the following setting to answer questions 19 and 20

Cel-Com-Link is a cellular communications network provider. The sales department at this company would like to estimate the average amount of time (minutes) its customers use their phone per month. A SRS of 5 customers provided the results found in Output 6.

Output 6: Descriptive statistics for the cell phone usage study

Descriptive Statistics: celltime

Variable	N	Mean	Median	TrMean	StDev	SE Mean
celltime	5	316.4	336.0	316.4	75.4	33.7
Variable	Minimum	Maximum	Q1	Q3		
celltime	210.0	414.0	247.0	376.0		

- 19) The point estimate for the true average monthly cell phone usage for Cel-Com-Link's customers is:
- A) 75.4 min
 - B) 336.0 min
 - C) 316.4 min
 - D) 376.0 min
 - E) 414.0 min
- 20) The t-value used to compute a 99% CI for the true average monthly cell phone usage is:
- A) 4.60
 - B) 4.03
 - C) 3.71
 - D) 2.58
 - E) 1.96
- 21) The 99% CI for the true average monthly cell phone usage is:
- A) (200.5, 472.3) min
 - B) (161.2, 471.6) min
 - C) (180.5, 452.3) min
 - D) (255.6, 377.2) min
 - E) (200.5, 377.2) min

- 22) A software design team would like to estimate the average time required for a new client to become proficient at working with one of their recently developed software products. Furthermore, they would like the resulting 90% confidence interval from this study to be no more than 10 minutes wide (**TOTAL WIDTH**). A pilot study done with a similar product yielded a mean of 135 minutes and a corresponding standard deviation of 20 minutes. Based on this information, how many subjects must be sampled in order for this team to meet their objective?
- A) 66
 - B) 47
 - C) 46
 - D) 44
 - E) 11
- 23) Under the same sampling conditions, compared to studies done with small sample sizes at large confidence levels we can conclude that studies done with large sample sizes at smaller confidence levels will tend to have:
- A) Larger CI widths
 - B) Smaller margins of error
 - C) Larger margins of error
 - D) Margins of error that are equal
 - E) This cannot be determined without the descriptive statistics
- 24) Consider a hypothesis setting of the following type: $H_0: \theta = c$ versus $H_a: \theta \neq c$. Here θ represents a general parameter (anything you want it to be) and “c” is some generalized hypothesized value. Let $\alpha = 0.05$. Further, let the test statistic be a positive value but not large enough so that H_0 is rejected. From the choices below, which of the following could **not** be the P-value?
- A) 0.015
 - B) 0.030
 - C) 0.045
 - D) 0.075
 - E) Choices A, B and C could not be the P-values for this setting
- 25) Consider that an investigator sets up the following hypothesis test at a significance level of 0.01: $H_0: p = c$; $H_a: p \neq c$ where “c” is some hypothesized value. Consider, also, that z_{calc} is negative and there is enough sample evidence supporting H_a so this investigator rejects the null. From the choices listed below, the true statement is:
- A) We FTR H_0 for the left tail test at the same significance level
 - B) We reject H_0 for the left tail test at the same significance level
 - C) We reject H_0 for the right tail test at the same significance level
 - D) We cannot make a statistical decision for the right tailed test at the same significance level
 - E) We cannot make a statistical decision for the left tailed test at the same significance level

Bonus:

26) The following choices list some changes that are made to the sample statistics. The null/alternative hypothesis pair is: $H_0: p \leq \theta$; $H_a: p > \theta$ where θ is some hypothesized value for the population proportion and z_{calc} is positive. Given the choices below, those that would **certainly** result in a **increase** in the P-value is(are)

- A) \hat{p} decreases, n remains the same
- B) \hat{p} decreases, n increases
- C) \hat{p} increases, n remains the same
- D) The P- value would decrease in the situations described in A and B
- E) The P- value would decrease in situations A, B, and C

Answers to sample exam 3

Problem	1	2	3	4	5	6	7	8	9
Answer	C	D	B	C	C	B	E	E	D
Problem	10	11	12	13	14	15	16	17	18
Answer	C	A	C	E	D	A	B	C	E
Problem	19	20	21	22	23	24	25	26	
Answer	C	A	B	D	B	E	B	A	