

Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

- A random sample of 900 individuals has been selected from a large population. It was found that 180 are regular users of vitamins. Thus, the proportion of the regular users of vitamins in the population is estimated to be 0.20. The standard error of this estimate is approximately
 - 0.1600
 - 0.0002
 - 0.4000
 - 0.0133
 - 0.0267
- A traffic consultant wants to estimate the proportion of cars on a certain street that have more than two occupants. She stands at the side of the road for two hours on a weekday afternoon and flips a coin each time a car approaches. If the coin comes up heads, she counts the number of occupants in the car. After two hours, she has counted 103 cars, 15 of which had more than two occupants. Which condition for constructing a confidence interval for a proportion has she failed to satisfy?
 - $n \geq 30$
 - $np \geq 10$
 - $n(1 - p) \geq 10$
 - The sample is less than 10% of the population.
 - The data is an SRS from the population of interest.
- A polling organization announces that the proportion of American voters who favor congressional term limits is 64%, with a 95% confidence margin of error of 3%. Which of the following statements is a correct interpretation of 95% confidence?
 - If the poll were conducted again in the same way, there is a 95% chance that the fraction of voters favoring term limits in the second poll would be between 61% and 67%.
 - There is a 95% probability that the true percent of voters favoring term limits is between 61% and 67%.
 - If the poll were conducted again the same way, there is a 95% probability that the percent of voters favoring term limits in the second poll would be within 3% of the percent favoring term limits in the first poll.
 - Among 95% of the voters, between 61% and 67% favor term limits.
 - None of the above.
- Suppose the poll in the previous question was conducted by email, and those conducting the survey are concerned about the possibility of undercoverage, since some people do not use email or have filters that block mass emails. Which of the following is the best way for them to correct for this source of bias?
 - Throw this sample out and start over again with a better sampling method.
 - Use a higher confidence level, such as 99%.
 - Use a lower confidence level, such as 80%.
 - Use a t -interval instead of a z -interval.
 - Take a larger sample.

5. To assess the accuracy of a laboratory scale, a standard weight that is known to weigh 1 gram is repeatedly weighed a total of n times and the mean \bar{x} of the weighings is computed. Suppose the scale readings are Normally distributed with unknown mean μ and standard deviation $\sigma = 0.01$ g. How large should n be so that a 95% confidence interval for μ has a margin of error of ± 0.0001 ?
- (a) 100
 - (b) 196
 - (c) 27,061
 - (d) 10,000
 - (e) 38,416
6. Which of the following has the highest probability?
- (a) Randomly selecting a value between -2 and 2 from a standard Normal distribution.
 - (b) Randomly selecting a value between -2 and 2 from a t -distribution with 4 degrees of freedom.
 - (c) Randomly selecting a value between -2 and 2 from a t -distribution with 20 degrees of freedom.
 - (d) Randomly selecting a value less than -2 or greater than 2 from a standard Normal distribution.
 - (e) Randomly selecting a value less than -2 or greater than 2 from a t -distribution with 20 degrees of freedom.
7. A 95% confidence interval for the mean reading achievement score for a population of third-grade students is $(44.2, 54.2)$. Suppose you compute a 99% confidence interval using the same data. Which of the following statements is correct?
- (a) The intervals have the same width.
 - (b) The 99% interval is narrower.
 - (c) The 99% interval is wider.
 - (d) The 99% interval could be wider or narrower—it depends on the sample.
 - (e) The answer can't be determined from the information given.
8. What is the critical value t^* that satisfies the condition that the t distribution with 8 degrees of freedom has probability 0.10 to the right of t^* ?
- (a) 0.90
 - (b) 1.282
 - (c) 1.397
 - (d) 1.415
 - (e) 1.860
9. The weights of 9 men have mean $\bar{x} = 175$ pounds and standard deviation $s = 15$ pounds. What is the standard error of the mean?
- (a) 58.3
 - (b) 15
 - (c) 5
 - (d) 1.67
 - (e) 1.29

10. In preparation for constructing confidence interval for a population mean, it's important to plot the distribution of sample data. Below are stem plots describing samples from three different populations. For which of the three samples would it be safe to construct a t -interval?

Sample X
 $n = 20$

```

0 | 2
1 |
2 |
3 |
4 | 1
5 | 3 5 6 7 7 9
6 | 0 1 2 3 5 5 6 8
7 | 1 2 3
8 | 5
    
```

Sample Y
 $n = 19$

```

0 | 2
1 | 5
2 | 1
3 |
4 | 1
5 | 6 8 8
6 | 1 5 5 6 7
7 | 0 2 5 5 7 8 8
    
```

Sample Z
 $n = 11$

```

3 | 2
4 | 1
5 | 3 5 6
6 | 0 1 2
7 | 1 2
8 | 5
    
```

- (a) Sample X only
- (b) Sample Y only
- (c) Sample Z only
- (d) Sample X and Z
- (e) None of the plots.

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

11. A survey of a random sample of 1280 student loan borrowers found that 218 had loans totaling more than \$40,000 for their undergraduate education.

Construct and interpret a 95% confidence interval to estimate the population proportion of student loan borrowers who have loans totaling more than \$40,000.

12. A cereal maker's container machine is designed to fill boxes so that the mean weight of cereal in the boxes is 18 ounces. A simple random sample of 30 boxes produced by the machine yields a mean weight of 17.92 ounces and a standard deviation of 0.2 ounces. The distribution of box weights is summarized in the Minitab output below:

| | MEAN | STDEV | SEMEAN | MIN | Q1 | MEDIAN | Q3 | MAX |
|--------|--------|-------|--------|-------|-------|--------|-------|-------|
| WEIGHT | 17.920 | 0.200 | 0.0365 | 17.55 | 17.76 | 17.90 | 18.00 | 18.25 |

- (a) Construct and interpret a 90% confidence interval to estimate the true mean weight of cereal in the boxes.

- (b) Does the interval in (a) give you reason to suspect that the machine is not filling boxes with the correct amount of cereal? Explain your reasoning.