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

1. Which of the following will reduce the width of a confidence interval?
   I. Increasing the confidence level.
   II. Increasing the sample size.
   III. Decreasing the standard deviation.

   (a) I only
   (b) I and II only.
   (c) I and III only.
   (d) I, II, and III.
   (e) None of the above

2. The report of a sample survey of 1,014 adults says, "With 95% confidence, between 9% and 15% of all Americans expect to spend more money on gifts this year than last year." What does the phrase "95% confidence" mean?
   (a) 95% of all Americans will spend between 9% and 15% more than what they spent last year.
   (b) 9% to 15% of all Americans will spend 95% of what they spent last year.
   (c) there is a 95% chance that the percent who expect to spend more is between 9% and 15%.
   (d) the method used to get the interval from 9% to 15%, when used over and over, produces intervals which include the true population percentage about 95% of the time.
   (e) we can be 95% confident that the method used to get the interval always gives the right answer.

3. What sample size should be chosen to find the mean number of absences per month for school children to within ±0.2 at a 95% confidence level if it is known that the standard deviation is 1.1?
   (a) 11
   (b) 29
   (c) 82
   (d) 96
   (e) 117

\[
\frac{1.96 \times 1.1}{\sqrt{n}} = 0.2 \\
\frac{1.1}{\sqrt{n}} \leq \frac{0.2}{1.96} \\
1.1 \times 0.2 \leq \frac{(1.96)^2}{0.2} \leq n 
\]

4. A nationwide poll of 2,525 adults estimated with 95% confidence that the proportion of Americans who support health care reform is 0.78 ± 0.0162. A member of Congress thinks that 95% confidence isn't enough. He wants to be 99% confident. How would the margin of error of a 99% confidence interval based on the same sample compare with the 95% interval?
   (a) It would be smaller, because it omits only 1% of the possible samples instead of 5%.
   (b) It would be the same, because the sample is the same.
   (c) It would be larger, because higher confidence requires a larger margin of error.
   (d) Can't tell, because the margin of error varies from sample to sample.
   (e) Can't tell, because it depends on the size of the population.
5. You want to calculate a 98% confidence interval for a population mean from a sample of \( n = 18 \). What is the appropriate critical \( t^* \)?
(a) 2.110
(b) 2.326
(c) 2.539
(d) 2.552
(e) 2.567
\[ df = 17 \]

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.

6. 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.

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

\[
\bar{x} = 17.92 \\
S_x = 0.2 \\
n = 30 \\
df = 29 \\
t^* = 1.699
\]

\[
17.92 \pm 1.699 \left( \frac{0.2}{\sqrt{30}} \right)
\]

\[
(17.80, 17.98)
\]

We are 90% confident that the interval 17.80 to 17.98 contains the actual mean weight of cereal 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.

Yes, 18 oz. is outside of our interval.
7. A local newspaper in a large city wants to assess support for the construction of a highway by-pass around the central business district to reduce downtown traffic. They survey a random sample of 1152 residents and find that 543 of them support the bypass. Construct and interpret a 95\% confidence interval to estimate the proportion of residents who support construction of the bypass.

\[ \hat{p} = \frac{543}{1152} = .47 \quad \hat{q} = .53 \]

\[ n = 1152 \]

\[ z^* = 1.96 \]

\[ .47 \pm 1.96 \sqrt{\frac{(.47)(.53)}{1152}} \]

\[ \sqrt{\frac{.2491}{1152}} \]

\[ (.4412, .4988) \]

\[ \text{We are 95\% conf. that the interval } .4412 \text{ to } .4988 \text{ contains the actual proportion of residents who support construction of the bypass.} \]

8. From a normally distributed population with standard deviation of 25, an SRS of sized 100 is drawn. The mean of the sample is 235. Construct and interpret the 99\% confidence interval of the mean of the population.

\[ \bar{x} = 235 \]

\[ \sigma = 25 \]

\[ n = 100 \]

\[ z^* = 2.576 \]

\[ 235 \pm 2.576 \left( \frac{25}{\sqrt{100}} \right) \]

\[ (228.56, 241.44) \]

\[ \text{We are 99\% conf. that the interval 228.56 to 241.44 contains the mean of the population.} \]