8.3 AP Statistics Name:

1. You construct three 88% confidence intervals as follows:

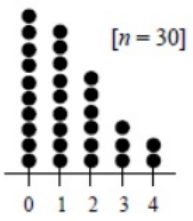
A) A *t*-interval with 6 degrees of freedom.
B) A *t*-interval with 2 degrees of freedom.
C) A *z*-interval

Assuming the mean and standard deviation are the same for all three intervals, write the three intervals (A, B, and C) in order, from narrowest to widest, and find the critical value for each interval.

2. You are sampling from a population with a known standard deviation of 20 and want to construct a 95% confidence interval with a margin or error of no more than 4. What is the smallest sample that will produce such an interval?

3. Below are graphical representations of three different samples from three different populations. In each case, discuss whether the Normality condition for constructing a *t*-confidence interval has been satisfied.

(a)

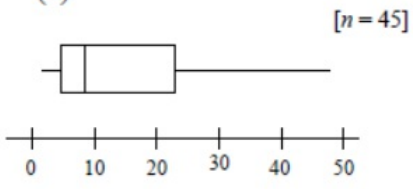


(b)

2	0 1 2
2	6 6 7
3	0 3
3	5
4	1
4	
5	1
5	7

[n = 12]

(c)



4. About 130,000 high school students took the AP Statistics exam in 2010. The free-response section of the exam consisted of five open-ended problems and an investigative task. Each free-response question is scored on a 0 to 4 scale (with 4 being the best). For one of the problems, a random sample of 30 student papers yielded the scores that are graphed in the dot plot of part (a) in the previous problem. The mean score for this sample is $\bar{x} = 1.267$ and the standard deviation is $s = 1.230$.

(a) Find and interpret the standard error of the mean.

(b) Construct and interpret a 99% confidence interval to estimate the mean score on this question. Use the four-step process.

1. C is narrower than A, A is narrower than B. So the order from narrowest to widest is C, A, B.
The critical values for each interval are: A is 1.8117, B is 2.6202, and C is 1.5548.

2. We want a sample size n such that $(1.96)\left(\frac{20}{\sqrt{n}}\right) \le 4$ Solving as an equality produces n = 96.04, so n should be 97.

3. (a) The distribution is moderately skewed right, but since n = 30, it should be safe using t-procedures because of the central limit theorem.
(b) The distribution has a moderate-to-strong right skew and maximum value is close to meeting the 1.5 x IQR rule for outliers. Moreover, the sample size is small. It is not advisable to use t-procedures with this sample.
(c) The distribution is strongly skewed right, but there are no outliers, and n = 45. We should be safe using tprocedures because of the central limit theorem.

4. (a) $\frac{s}{\sqrt{n}} = \frac{1.23}{\sqrt{30}} \approx 0.225$ If many samples of this size were taken, the difference between a sample mean score and the population mean score would be, on average, about 0.225.
(b) **State:** We wish to estimate, with 99% confidence, the true mean score on this AP Statistics question.
Plan: We will use a one-sample t-interval for a population mean.
Random: The study refers to a random sample.
Normal: We concluded in the previous question that we should be safe using t-procedures.
Independent: It seems reasonable to assume that individual student scores are independently selected, and it is safe to assume a sample of 130,000 students is less than 10% of the total population of high school students.
Do: Critical t for 99% confidence and 29 df is 2.756, so the 99% confidence interval is

$$1.267 \pm 2.756\left(\frac{1.23}{\sqrt{30}}\right) \rightarrow 1.267 \pm 0.619 \rightarrow (0.648, 1.886)$$

or Using statistical softerware the function TInterval input the statistics x = 1.267, sx = 1.23, n = 30, with .99 confidence results in the interval (.64801, 1.886).

(for above press Stats, over to Tests, down to 8:TInterval input stats)

Conclude: One is 99% confident that the interval 0.648 to 1.886 contains the true mean score on this question.