1. Suppose that you take one sample of \( n = 16 \) and another sample of \( n = 100 \). What does the Central Limit Theorem tell you about the means of those two samples, relative to the sampling distribution of the mean from which each sample mean would have been drawn? [5 pts]

The CLT says that the sampling distribution of the mean from which the sample of \( n = 100 \) was drawn will be more likely to be normally distributed (as \( n \) approaches infinity, the sampling distribution of the mean comes closer to normal) relative to the sampling distribution for \( n = 16 \). You should also expect that, everything else being equal, the sample mean with \( n = 100 \) will be closer to \( \mu \), because the standard error would be much smaller (1/10 of \( s \) as opposed to 1/4 of \( s \) for the sample of \( n = 16 \)).

2. SAT Math scores are thought to be normally distributed with \( \mu = 500 \) and \( \sigma = 100 \). [15 pts]
   a. What is the probability of getting a Math SAT score between 520 and 580?

\[
z_{520} = \frac{520 - 500}{100} = .2 \Rightarrow .5793 \text{ (Col. B)} \text{ would be below } .2 \text{ and } .4207 \text{ would be above } .2
\]

\[
z_{580} = \frac{580 - 500}{100} = .8 \Rightarrow .7881 \text{ (Col. B)} \text{ would be below } .8 \text{ and } .2119 \text{ would be above } .8
\]

Between 520 and 580 would be \( 1 - (.5793 + .2219) = .1988 \), or about 20%.

b. What Math SAT scores comprise the top 10%?

.1003 (Col. C) is associated with a z-score of 1.28. That translates into an SAT score of 628.

c. What is the probability of 25 people taking the Math SAT and receiving a mean SAT between 500 and 540?

\[
\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{100}{\sqrt{5}} = 20
\]

\[
z = \frac{500 - 500}{20} = 0
\]

\[
z = \frac{540 - 500}{20} = 2
\]

.5000 would have means greater than 500, .0228 would have means greater than 540, so .4772 would have means between 500 and 540.
3. The GPAs for a sample of students are seen below. Using these data, estimate the parameters of the parent population from which the sample was drawn. [10 pts]

3.5
2.9
3.2
3.0
2.7
3.6
3.1
2.9
3.0

\[ \bar{X} = \frac{\sum X}{n} = \frac{27.9}{9} = 3.1 \]

\[ SS = \sum X^2 - \left( \frac{\sum X}{n} \right)^2 = 87.17 - \frac{778.41}{9} = 68 \]

\[ s^2 = \frac{SS}{n-1} = \frac{68}{8} = 8.5 \]

\[ s = \sqrt{s^2} = .29 \]

4. Educators often talk about grade inflation. Suppose that the mean GPA in 1950 was 2.4 (i.e., \( \mu = 2.4 \)). How likely is it that the sample above (problem 3) was drawn from a population with \( \mu = 2.4 \)? What might this evidence say about grade inflation? [10 pts]

\[ H_0: \mu = 2.4 \]
\[ H_1: \mu \neq 2.4 \]

\[ t_{\text{Critical}} (8) = 2.306, \text{ so if the absolute value of the obtained } t \text{ is greater than 2.306, you would reject } H_0. \]

\[ s_X = \frac{s}{\sqrt{n}} = \frac{.29}{\sqrt{3}} = .097 \]

\[ t_{\text{Obtained}} = \frac{3.1 - 2.4}{.097} = \frac{.7}{.097} = 7.2 \]

Thus, you would reject \( H_0 \) (|7.2| > 2.306) and conclude that the GPA is drawn from a sampling distribution of the mean with a mean greater than 2.4, which would indicate grade inflation relative to 1950.
5. For the following questions, only a simple answer is required…and no computation should be needed. [5 pts]
   a. \( (X - \bar{X}) = 0 \), which is a property of the mean.

   b. Suppose that a sample standard deviation (s) is 10. Next, suppose that you add 5 to every score in the sample. The standard deviation of the sample would now be: 10, because an additive constant doesn't affect the variability of a distribution.

   c. Suppose that a sample standard deviation (s) is 10. Next, suppose that you convert every score in the sample to a z-score. The standard deviation of this distribution would be: 1, which is the standard deviation of the z-score distribution.

   d. Suppose that the mean of a sample of n=25 is 5. Generally speaking, if you add another score (new n=26), the variability of the sample (s^2 or s) would increase. However, there is one score you could add to the sample without increasing its variability. That would be 5, or, generally, the sample mean.

   e. The probability of making a Type I Error is typically set to 5%.

6. Use the StatView output below to answer the following questions. [5 pts]

   One Sample t-test
   Hypothesized Mean = 50

<table>
<thead>
<tr>
<th>Approval Ratings</th>
<th>Mean</th>
<th>DF</th>
<th>t-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48.857</td>
<td>27</td>
<td>-.360</td>
<td>.7215</td>
</tr>
</tbody>
</table>

   a. What was \( H_0 \)? \( \mu = 50 \)

   b. How many scores were involved in the analysis? 28 (because df = 27)

   c. What decision should you reach regarding \( H_0 \), given this output? Retain \( H_0 \), because \( p > .05 \).