1) Which one of the following statements is true?
   a) $\bar{X}$ and $s$ are parameters; $\mu$ and $\sigma$ are statistics
   b) $\sigma$ and $s$ are parameters; $\bar{X}$ and $\mu$ are statistics
   c) $\bar{X}$ and $\mu$ are parameters; $\sigma$ and $s$ are statistics
   d) $\mu$ and $\sigma$ are parameters; $\bar{X}$ and $s$ are statistics

2) Which one of the following statements is false?
   a) $\mu$ is a constant representing the population mean
   b) $\mu$ is used to estimate the unknown constant $\bar{X}$
   c) $\bar{X}$ can be thought of as a random variable generated from a distribution, called the sampling distribution
   d) in practice, $\bar{X}$ is calculated from sample data

3) The Central Limit Theorem states that
   a) $X$ has normal distribution with mean $\mu$ and standard deviation $\sigma$
   b) $X$ has normal distribution with mean $\mu$ and standard deviation $\sigma/n$
   c) $\bar{X}$ has normal distribution with mean $\mu$ and standard deviation $\sigma$
   d) $\bar{X}$ has normal distribution with mean $\mu$ and variance $\sigma^2/n$

4) Which of the following statement is true?
   a) The 95% confidence interval means that approximately 95% of our samples will produce an interval that captures the true population parameter
   b) The 95% confidence interval means that there is 95% probability of the true parameter being in the interval
   c) The 95% confidence interval means that there is 95% probability that our sample statistics is in the interval
   d) The 95% confidence interval means that approximately 95% of our sample will produce an interval that captures the sample statistic
Problem: We have a random sample of 25 fifth grade students from the state of PA who after completing a special physical education program can do 15 pushups on the average, with the standard deviation of 9. Does this value of 15 differ significantly from the population value of 12?

5) Is this an experiment or an observational study? (circle one)

Experiment but since it wasn’t clear that there was manipulation I accepted observational study too.

6) What is the population of interest?

Fifth grade students from the state of PA

7) The number of pushups is
   a) discrete random variable
   b) continuous random variable
   c) nominal random variable
   d) qualitative random variable

8) If you are given the data for on the number of pushups for the 25 students, the most appropriate graphical display for this data would be:
   a) Bar graph
   b) Scatterplot
   c) Histogram
   d) Pie chart

9) If the sample standard deviation is 9, the sample variance is:
   a) 3
   b) 81
   c) 3/5
   d) 81/25

10) State the null and alternative hypothesis for this problem:
    \[ H_0: \mu = 12 \]
    \[ H_A: \mu \neq 12 \]
11) The appropriate analysis for this hypothesis is:
   a) One-sample z-test
   b) **One-sample t-test**
   c) Two-sample z-test
   d) Two-sample t-test

12) Based on your answer in (g) the value of proper statistic is:
   a) \( z= \frac{15-0}{9} = 1.667 \), p-value = 0.05
   b) \( z= \frac{15-12}{9} = 0.333 \), p-value=0.30
   c) \( t=\frac{15-0}{9} = 1.667 \), df=25, p-value=0.1
   d) \( t=\frac{15-12}{9/5} = 1.667 \), df=24, p-value = 0.1

   (hint: \( z=\frac{\text{estimate} - \text{parameter}}{\text{SD(estimate)}} \), \( t=\frac{\text{estimate}- \text{parameter}}{\text{SE(estimate)}} \))

13) Set the alpha significance level to be 0.01. Which is the correct decision
   a) Fail to reject \( H_0 \), because the correct p-value 0.3 is greater than 0.01
   b) **Fail to reject \( H_0 \), because the correct value 0.1 is greater than 0.01**
   c) Reject \( H_0 \), because the correct p-value 0.05 is greater than 0.01
   d) Reject \( H_0 \), because the correct p-value of 0.1 grater than 0.01

14) The correct statement of results for this analysis is:
   a) The number of pushups done by a group of fifth grade students in PA who have participated in a special physical education program, **is significantly greater** than the population average
   b) The number of pushups done by a group of fifth grade students in PA who have participated in a special physical education program, **does significantly differ** from the population average
   c) **The number of pushups done by a group of fifth grade students in PA who have participated in a special physical education program, does not significantly differ from the population average**
   d) The number of pushups done by a group of fifth grade students in PA who have participated in a special physical education program, **is significantly less** than the population average