Part A: Instructions

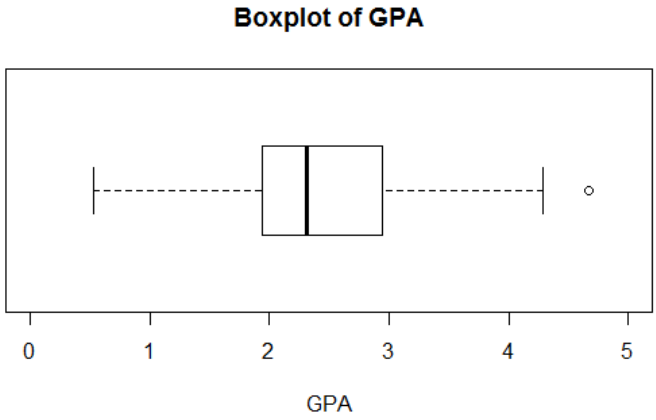
- When you read [select all that apply] there are two or more correct answers.
- When you read [select only one] there is only one correct answer.
- Each question has two points (unless specified).
- There are no partial credits in Part A.

Question A1. [Select all that apply.] Which parameter(s) measure the central tendency of a population distribution?

a. Median
b. Inter-quartile range
c. Mean
d. Standard deviation
e. Variance

Question A6. [Select only one.] The figure below shows the boxplot of high school GPAs. What is the inter-quartile range?

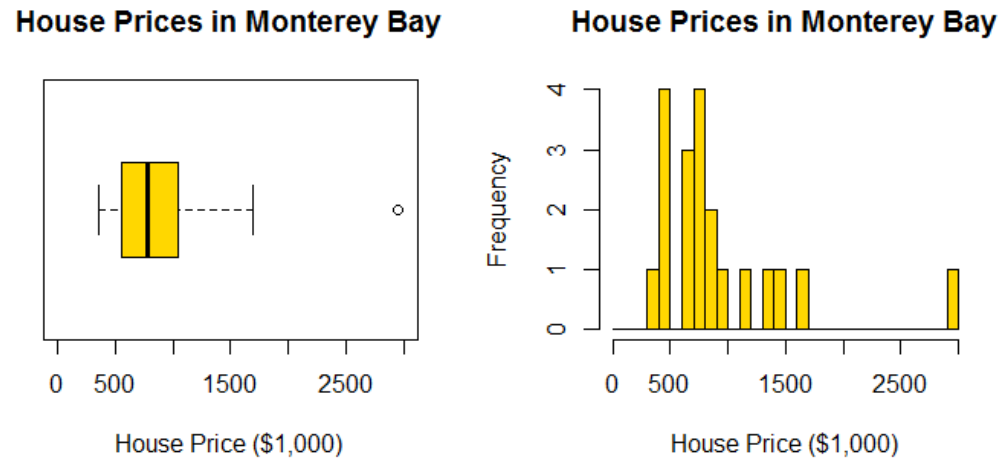
a. Approximately 1.0
b. Approximately 2.0
c. Approximately 3.0
d. Approximately 3.5
e. Approximately 4.0
f. Approximately between 2.0 and 3.0
g. Approximately between 0.5 and 4.25



Question A10. Consider a sample of size 3. When the variable is numeric (e.g. SAT mathematics score), there are infinitely many possible samples which yield a sample mean and a sample median being equal. Give an example of such a sample. (It is not a multiple choice question.)

Write your three numbers here: _____

Question A11 to **Question A14** are based on the figure below. It is a sample of *n* house prices in Monterey County.



Question A11. What is the sample size *n*? (It is not a multiple choice question.)

Write your answer here: _____

Question A15. [Select only one.] In hypothesis testing, suppose the null hypothesis is true. The rejection of the null hypothesis is called:

a. Type I error
b. Type II error
c. Type III error
d. Significance level
e. Statistical power
f. P-value

Question A20. [Select all that apply.] Which of the following are always between zero and one?

a. Test statistic for testing the population mean
b. Estimated slope in linear model
c. Sample correlation
d. Sample proportion
e. Significance level
f. Statistical power
g. P-value
h. Critical value
i. Standard error

Part B: Instructions

- In Part B, you must show sufficient amount of work to earn full credits.
- You may earn partial credits even when your final answer is incorrect.
- Each part has two points (unless specified).
- When your handwriting is not legible, you may receive no points.

Question B1. Suppose the IQ score in a population follows a normal distribution with mean 100 and standard deviation 15.

a. In the figure below, *c* denotes the center of the population distribution, 68% of the population are between *b* and *d*, and 95% of the population are between *a* and *e*. What are the values of *a*, *b*, *c*, *d* and *e*?

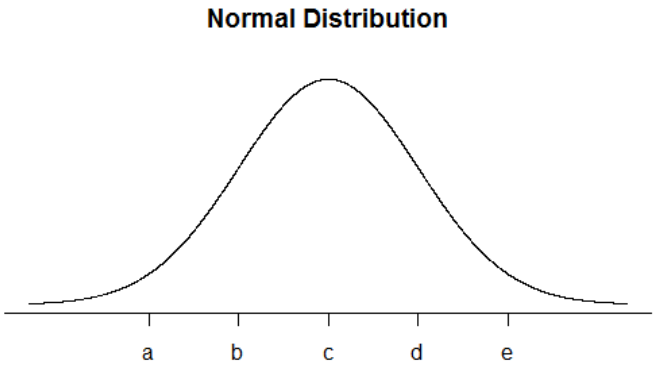
The value of *a* is _____.

The value of *b* is _____.

The value of *c* is _____.

The value of *d* is _____.

The value of *e* is _____.



b. Imagine we randomly selected one person in the population and observed an IQ score of 105. What is the z-score of this IQ score?

The z-score is _____.

Question B3. In a county, a researcher hypothesized that the population proportion of newborn boys is not equal to 0.5. The researcher took a sample of 2500 newborn babies, and 1291 were boys.

a. Assume the population proportion of newborn boys is 0.5. In the figure below, *c* denotes the center of the sampling distribution of the sample proportion, *b* and *d* are one standard deviation away from the center, and *a* and *e* are two standard deviations away from the center. What are the values of *a*, *b*, *c*, *d* and *e*? (Round to two decimals.)

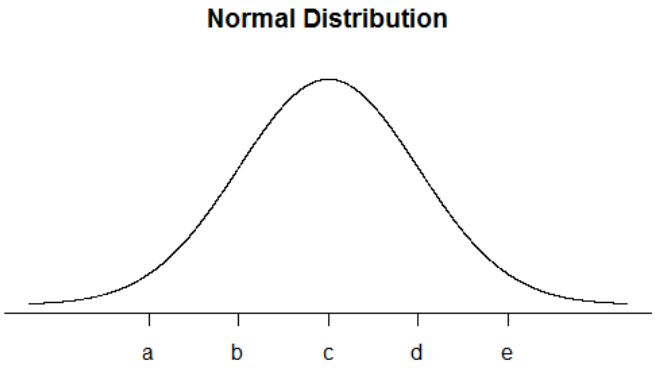
The value of *a* is _____.

The value of *b* is _____.

The value of *c* is _____.

The value of *d* is _____.

The value of *e* is _____.



b. Calculate an approximate 95% confidence interval (CI) for the proportion. (Round to three decimal places.)

The calculated 95% CI is _____.

c. Interpret the calculate 95% CI. (You must also explain what 95% confidence means.)

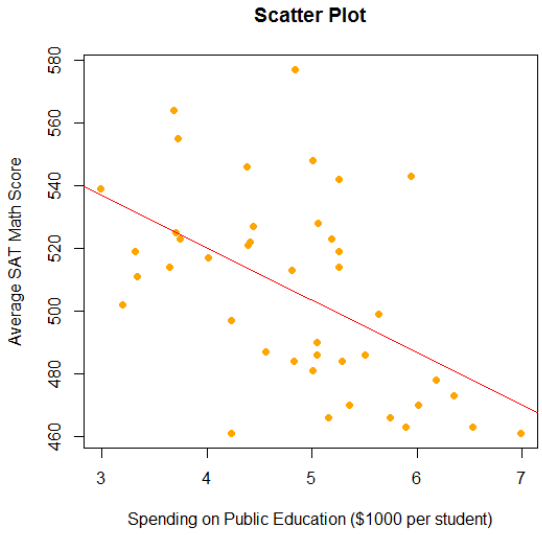
Question B5. It is hypothesized that more state funding on public education would lead to increased SAT mathematics scores on average. To test for the hypothesis, we want to analyze a sample of 41 states in the United States.

State	SATM	Dollars
AL	514	3.65
AZ	476	7.89
…	…	…
WY	519	5.25

Below describes each column.

- State: A state in the U.S. (and Washington, D.C.)
- SATM: The average SAT math score of graduating high school students in the state.
- Dollars: The spending on public education in $1000s per student in the state.

The figure below presents the scatter plot and the fitted line (using the ordinary least square estimation).



The table below presents the estimated parameters in the linear regression model.

Parameter	Estimate	Standard Error
Intercept	586.89	21.515
Slope	-16.692	4.3630

Question B6. In a university, one hundred math students took a standard calculus exam before summer began. They then spent the summer completing the Summer Calculus Program. After the summer, they took the same standard calculus exam. A professor wanted statistical evidence for the positive effect of the summer program on average. The data are summarized as below.

Student ID	Before summer	After summer	Difference
1	66	87	21
2	97	100	3
…	…	…	…
100	71	64	-7
Mean	80.66	82.74	2.080
SD*	8.677	13.32	9.962

*SD = standard deviation

a. State the null hypothesis in words.

b. State the alternative hypothesis in words.

c. Calculate the test statistic. (Round to three decimals.)

The calculated test statistic is _____.

d. Determine the p-value. (Approximation to two decimals is sufficient.)

The p-value is _____.

e. At significance level $\alpha = 0.05$, state the conclusion in the context of the problem.

THANK YOU FOR PARTICIPATING IN MATHLETICS 2017.