

STAT 155: Final

March 22nd, 2024

Instructions

- You have 3 hours to complete this test.
- This test is worth 35%. Each correct answer is worth 1%. Incorrect answers are worth 0%.
- You are allowed to use a calculator, and your homework cheat-sheet for this test.
- Write your answers in the answer table. When you finish the test, give it to the instructor.

Code of Honor Pledge

Pledge: I have neither given nor received any unauthorized aid in completing this exam and I have conducted myself within the guidelines of the University Honor Code.

Name:

Net-ID:

Signature:

Answers

Question	Answer	Question	Answer	Question	Answer	Question	Answer
1		11		21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

PQ1: We are interested in determining the relationship between the GPA and study time per week of college students in the US. Among the top 100 universities in the USA, we select 10 universities at random and survey 50 students from each selected university. We measure (1) their weekly study time and (2) their GPA. Which of the following is a potential confounding variable in this scenario?

- A) The major of the students.
- B) The number of courses a student take.
- C) Both of the above options.
- D) None of the above options.

PQ2: Consider the following 4 datasets:

SET A : 1, 2, 3, 4, 5, 6, 7, 7, 8, 8

SET B : 2, 2, 3, 3, 4, 4, 4, 5, 5, 6

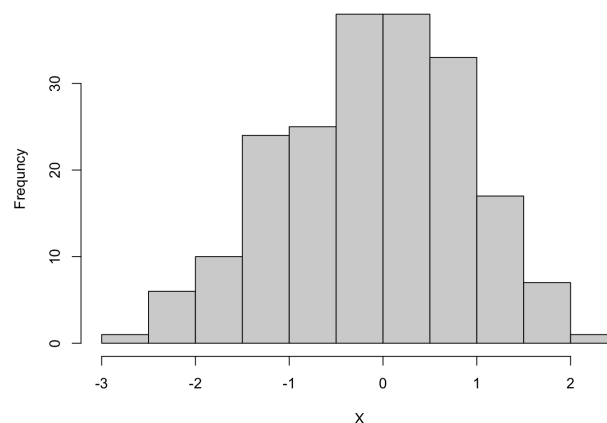
SET C : 1, 2, 3, 3, 3, 3, 6, 8, 9, 10

SET D : 1, 2, 2, 2, 4, 4, 5, 5, 6, 30

Which of these datasets has the **largest** sample mean?

- A) Set A
- B) Set B
- C) Set C
- D) Set D
- E) They are all equal.

PQ3: After gathering 200 observations, you obtain the following histogram. Which of the following is the most likely distribution this data came from?



- A) Normal distribution.
- B) Exponential distribution.
- C) Uniform distribution.
- D) Geometric distribution.

PQ4: The height of the Hobbits(a fictional race of people in the novels of J. R. R. Tolkien) is normally distributed, with an average of 42 inches and a standard deviation of 2 inches. Which of the following ranges comprises the height of **99.7%** of the Hobbit population?

- A) (40 inches, 44 inches).
- B) (38 inches, 46 inches).
- C) (36 inches, 48 inches).
- D) None of the above.

PQ5: Assume you throw 2 dices and record each of the results. Consider the following three events:

$A =$ "The first die is 1;"

$B =$ "The second die is 3;"

$C =$ "The two dice are equal."

Which of the following pairs have at least one outcome in common?

- A) A and B .
- B) B and C .
- C) A and C .
- D) All pairs share at least one outcome in common.
- E) None of the pairs have an outcome in common.

PQ6: Which law/theorem/rule does below sentence describing?

"If you take sufficiently large random samples from a population with replacement, then the distribution of the sample means will be approximately normally distributed."

- A) The law of large numbers.
- B) The additive rule.
- C) The central limit theorem.
- D) The independence rule.
- E) None of the above.

PQ7: The amount of coffee that a coffee shop employee serves in a 16 *fl oz* cup is distributed normal with mean $\mu = 16.2$ *fl oz* and $\sigma = 0.05$ *fl oz*. Let $P(X \leq 16)$ be the probability that the employee serves you less than 16 *fl oz*. Between which of the following pairs of numbers is $P(X \leq 16)$?

- A) Between 0 and 0.0015
- B) Between 0.0015 and 0.025
- C) Between 0.025 and 0.16.
- D) Between 0.16 and 0.5.
- E) Above 0.5.

x	0	2	5
P(X=x)	0.3	0.5	0.2

PQ8: Consider the distribution of a random variable given in the attachment. What is the expected value of this random variable? **Write resulting number of μ_X in the space corresponding to Q8 at the front page.**

PQ9: You work at a cafeteria, and today you are serving the BBQ beef. You serve **8 oz** of beef to each student on average, but you usually vary by a standard deviation of **0.2 oz**. If you serve **100 students**, what would be the standard deviation σ_X of the total amount of beef you dispensed?

Write resulting number of σ_X in the space corresponding to PQ9 at the front page.

PQ10: You work at a cafeteria, and today you are serving the BBQ beef. You serve **8 oz** of beef to each student on average, but you usually vary by a standard deviation of **0.2 oz**. If you serve **100 students**, what would be the average amount of beef you dispensed?

Write resulting number of μ_X in the space corresponding to PQ10 at the front page.

PQ11: Assume in a chocolate shop you picked a total of 10 different kinds of chocolate, and you only grab a bar of each kind. How many different ways are there to put the first 3 bars in the cashier conveyor belt, assuming that the order in which you put the objects counts (say, putting items A-B-C is different than putting C-B-A).

- A) $\frac{10!}{7!3!}$
- B) $\frac{10!}{7!}$
- C) $3!$
- D) 10^3
- E) None of the above.

PQ12: What of the following expressions represents the number of ways to select 5 objects out of 50 different objects, where the order of selection of the 5 objects DO NOT matter?

- A) $\frac{5}{50}$
- B) $\frac{50!}{5!45!}$
- C) $\frac{50!}{5!}$
- D) $\frac{50!}{45!}$
- E) None of the above

PQ13: Which of the following corresponds to the **Margin of Error (MOE)** of a 80% confidence interval?

- A) $\bar{x} \pm 1.28 \times \frac{SE}{n}$
- B) $2 \left(1.96 \times \frac{SE}{n} \right)$
- C) $\bar{x} \pm 2.97 \times \frac{SE}{n}$
- D) $2 \left(1.28 \times \frac{SE}{n} \right)$
- E) None of the above

PQ14: Assume that a random variable can be characterized with the density:.

$$f(x) = \begin{cases} 0 & x < 0 \\ x + c & 0 < x \leq c \\ 0 & x > c \end{cases}$$

What is the value of the constant c that would make this into a valid density function?

- A) $\frac{1}{2}$
- B) $\sqrt{\frac{1}{2}}$
- C) $\sqrt{\frac{2}{3}}$
- D) 1

PQ15: Assume that a random variable can be characterized with the density:.

$$f(x) = \begin{cases} 0 & x < 0 \\ x & 0 < x \leq c \\ 2c - x & c < x \leq 2c \\ 0 & x > 2c \end{cases}$$

What is the value would $f(c)$ need to take on so that this would be a valid density function?

- A) $\frac{1}{4}$
- B) $\frac{1}{2}$
- C) 1
- D) 2

PQ16: Based on the previous question, what is the probability that X is less than c ?

- A) $\frac{1}{4}$
- B) $\frac{1}{2}$
- C) 1
- D) 2

PQ17: Jericho wanted to determine the average number of skewers a party buys at a restaurant. He randomly sampled 100 customers' itemized receipts and found that there was an average of 35 skewers and a standard deviation of 7 skewers. He generated a 90% confidence interval. Find the following quantities:

- $\bar{x} =$ _____
- $s =$ _____
- SE = _____
- $\alpha =$ _____
- $CI =$ _____

PQ18: Based on the previous question, if 17 was the true average amount of skewers, which of the following will be true?

- A) 17 skewers is contained in the 99.7% confidence interval.
- B) 17 is NOT contained in the 99.7% confidence interval.

PQ19: The amount of cars that pass through a certain intersection can be modeled as a Poisson process with an average of 25 cars per hour. If we only consider the hours from 7:00 AM to 10:00 AM, what is the probability that at least one car passes through in this time period?

- A) Approximately 0
- B) 0.05
- C) 0.75
- D) 0.98
- E) Approximately 1

PQ20: You gather two different samples from a population with standard deviation $\sigma = 3$. The first sample has $n = 100$ observations and sample standard deviation $s_{100} = 1$. The second has $n = 400$ observations, and a sample standard deviation $s_{400} = 2$. Which of the following will have the largest margin of error?

- A) MOE for a 90%-confidence interval for the 1st sample.
- B) MOE for a 99%-confidence interval for the 1st sample.
- C) MOE for a 92%-confidence interval for the 2nd sample.
- D) MOE for a 95%-confidence interval for the 2nd sample.
- E) Cannot be determined with the given information.

PQ21: When analyzing a sample of 100 measurements of diastolic blood pressure measurements, we obtain a sample mean of $\bar{x}_{100} = 69$ and a sample s.d. of $s_{100} = 12$. What is the 99th percentile for the distribution of the sample mean?

- A) 69
- B) 70.968
- C) 71.784
- D) 72.564
- E) None of the above

PQ22: Consider the following statement:

With more observations, the average of the sample will tend to get closer to the average of the whole population.

- A) Law of large numbers
- B) Law of rare events
- C) Central limit theorem
- D) Fundamental theorem of statistics
- E) None of the above