
1. True or False. *Justify for full credit.*

- (a) If $P(A) = 0.4$, $P(B) = 0.5$, and A and B are disjoint, then $P(A \text{ AND } B) = 0.2$.
 - (b) If all the observations in a data set are identical, then the variance for this data set is 0.
 - (c) The mean is always equal to the median for a normal distribution.
 - (d) It's easier to reject the null hypothesis at significance level of 0.01 than at significance level of 0.05.
 - (e) In a two-tailed test, the value of the test statistic is 2. If we know the test statistic follows a Student's t-distribution with $P(T > 2) = 0.03$, then we have sufficient evidence to reject the null hypothesis at 0.05 level of significance.
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2. Identify which of these types of sampling is used: cluster, convenience, simple random, systematic, or stratified. *Justify for full credit.*

- (a) The quality control department of a semiconductor manufacturing company tests every 100th product from the assembly line.
 - (b) UMUC STAT Club wanted to estimate the study hours of STAT 200 students. Two STAT 200 sections were randomly selected and all students from these two sections were asked to fill out the questionnaire.
 - (c) A STAT 200 student is interested in the number of credit cards owned by college students. She surveyed all of her classmates to collect sample data.
 - (d) In a career readiness research, 100 students were randomly selected from the psychology program, 150 students were randomly selected from the communications program, and 120 students were randomly selected from cyber security program.
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3. The frequency distribution below shows the distribution for commute time (in minutes) for a sample of 50 STAT 200 students on a Friday afternoon. (*Show all work. Just the answer, without supporting work, will receive no credit.*)

Commute Time (in minutes)	Frequency	Relative Frequency
1 – 14.9	5	
15 – 29.9	10	
30 – 44.9		0.20
45 – 59.9	20	
60 or above		
Total	50	

- (a) Complete the frequency table with frequency and relative frequency. Express the relative frequency to two decimal places.
- (b) What percentage of the commute times was at least 30 minutes?

- (c) Does this distribution have positive skew or negative skew? Why?
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4. The five-number summary below shows the grade distribution of two STAT 200 quizzes for a sample of 500 students.

	Minimum	Q1	Median	Q3	Maximum
Quiz 1	15	35	55	85	100
Quiz 2	20	35	50	90	100

For each question, give your answer as one of the following: (i) Quiz 1; (ii) Quiz 2; (iii) Both quizzes have the same value requested; (iv) It is impossible to tell using only the given information. Then *explain* your answer in *each* case.

- (a) Which quiz has less range in grade distribution?
(b) Which quiz has the greater percentage of students with grades 85 and over?
(c) Which quiz has a greater percentage of students with grades less than 60?
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5. A box contains 3 marbles, 1 red, 1 green, and 1 blue. Consider an experiment that consists of taking 1 marble from the box, then replacing it in the box and drawing a second marble from the box. (*Show all work. Just the answer, without supporting work, will receive no credit.*)

- (a) List all outcomes in the sample space.
(b) What is the probability that neither marble is red? (Express the answer in simplest fraction form)
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6. There are 1000 students in a high school. Among the 1000 students, 250 students take AP Statistics, and 300 students take AP French. 100 students take both AP courses. Let S be the event that a randomly selected student takes AP Statistics, and F be the event that a randomly selected student takes AP French. *Show all work. Just the answer, without supporting work, will receive no credit.*

- (a) Provide a written description of the complement event of $(S \text{ OR } F)$.
(b) What is the probability of complement event of $(S \text{ OR } F)$?
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7. Consider rolling two fair dice. Let A be the event that the sum of the two dice is 8, and B be the event that the first one lands on 6.

- (a) What is the probability that the first one lands on 6 given that the sum of the two dice is 8? *Show all work. Just the answer, without supporting work, will receive no credit.*
(b) Are event A and event B independent? Explain.

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8. There are 8 books in the "Statistics is Fun" series. *(Show all work. Just the answer, without supporting work, will receive no credit).*
- (a) How many different ways can Mimi arrange the 8 books in her book shelf?
- (b) Mimi plans on bringing two of the eight books with her in a road trip. How many different ways can the two books be selected?
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9. Assume random variable x follows a probability distribution shown in the table below. Determine the mean and standard deviation of x . *Show all work. Just the answer, without supporting work, will receive no credit.*

x	-2	0	1	3	5
$P(x)$	0.1	0.2	0.3	0.1	0.3

10. Mimi plans on growing tomatoes in her garden. She has 15 cherry tomato seeds. Based on her experience, the probability of a seed turning into a seedling is 0.40.
- (a) Let X be the number of seedlings that Mimi gets. As we know, the distribution of X is a binomial probability distribution. What is the number of trials (n), probability of successes (p) and probability of failures (q), respectively?
- (b) Find the probability that she gets at least 2 cherry tomato seedlings. (round the answer to 3 decimal places) *Show all work. Just the answer, without supporting work, will receive no credit.*
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11. Assume the weights of men are normally distributed with a mean of 172 lbs and a standard deviation of 30 lbs. *Show all work. Just the answer, without supporting work, will receive no credit.*
- (a) Find the 90th percentile for the distribution of men's weights.
- (b) What is the probability that a randomly selected man weighs more than 185 lbs?
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12. Assume the IQ scores of adults are normally distributed with a mean of 100 and a standard deviation of 15. *Show all work. Just the answer, without supporting work, will receive no credit.*
- (a) If a random sample of 25 adults is selected, what is the standard deviation of the sample mean?
- (b) What is the probability that 25 randomly selected adults will have a mean IQ score that is between 95 and 105?
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13. A survey showed that 80% of the 1600 adult respondents believe in global warming. Construct a 95% confidence interval estimate of the proportion of adults believing in global warming. *Show all work. Just the answer, without supporting work, will receive no credit.*

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14. In a study designed to test the effectiveness of acupuncture for treating migraine, 100 patients were randomly selected and treated with acupuncture. After one-month treatment, the number of migraine attacks for the group had a mean of 2 and standard deviation of 1.5. Construct a 95% confidence interval estimate of the mean number of migraine attacks for people treated with acupuncture. *Show all work. Just the answer, without supporting work, will receive no credit.*
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15. Mimi is interested in testing the claim that more than 75% of the adults believe in global warming. She conducted a survey on a random sample of 100 adults. The survey showed that 80 adults in the sample believe in global warming.

Assume Mimi wants to use a 0.05 significance level to test the claim.

- (a) Identify the null hypothesis and the alternative hypothesis.
 - (b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
 - (c) Determine the P -value for this test. *Show all work; writing the correct P -value, without supporting work, will receive no credit.*
 - (d) Is there sufficient evidence to support the claim that more than 75% of the adults believe in global warming? Explain.
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16. In a study of memory recall, 5 people were given 10 minutes to memorize a list of 20 words. Each was asked to list as many of the words as he or she could remember both 1 hour and 24 hours later. The result is shown in the following table.

Subject	Number of Words Recalled	
	1 hour later	24 hours later
1	14	12
2	18	15
3	11	9
4	13	12
5	12	12

Is there evidence to suggest that the mean number of words recalled after 1 hour exceeds the mean recall after 24 hours?

Assume we want to use a 0.10 significance level to test the claim.

- (a) Identify the null hypothesis and the alternative hypothesis.
- (b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
- (c) Determine the P -value for this test. *Show all work; writing the correct P -value, without supporting work, will receive no credit.*

- (d) Is there sufficient evidence to support the claim that the mean number of words recalled after 1 hour exceeds the mean recall after 24 hours? Justify your conclusion.

17. In a pulse rate research, a simple random sample of 40 men results in a mean of 80 beats per minute, and a standard deviation of 11.3 beats per minute. Based on the sample results, the researcher concludes that the pulse rates of men have a standard deviation greater than 10 beats per minutes. Use a 0.05 significance level to test the researcher's claim..

- (a) Identify the null hypothesis and alternative hypothesis.
- (b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
- (c) Determine the P -value for this test. *Show all work; writing the correct P -value, without supporting work, will receive no credit.*
- (d) Is there sufficient evidence to support the researcher's claim? Explain.

18. The UMUC MiniMart sells four different types of teddy bears. The manager reports that the four types are equally popular. Suppose that a sample of 500 purchases yields observed counts 150, 120, 110, and 120 for types 1, 2, 3, and 4, respectively.

Type	1	2	3	4
Number	150	120	110	120

Assume we want to use a 0.05 significance level to test the claim that the four types are equally popular.

- (a) Identify the null hypothesis and the alternative hypothesis.
- (b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
- (c) Determine the critical value. *Show all work; writing the correct critical value, without supporting work, will receive no credit.*
- (d) Is there sufficient evidence to support the manager's claim that the four types are equally popular? Justify your answer.

19. A random sample of 4 professional athletes produced the following data where x is the number of endorsements the player has and y is the amount of money made (in millions of dollars).

x	0	1	2	5
y	1	2	4	8

- (a) Find an equation of the least squares regression line. *Show all work; writing the correct equation, without supporting work, will receive no credit.*
 - (b) Based on the equation from part (a), what is the predicted value of y if $x = 3$? *Show all work and justify your answer.*
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20. A study of 10 different weight loss programs involved 500 subjects. Each of the 10 programs had 50 subjects in it. The subjects were followed for 12 months. Weight change for each subject was recorded. Mimi wants to test the claim that the mean weight loss is the same for the 10 programs.

- (a) Complete the following ANOVA table with sum of squares, degrees of freedom, and mean square (*Show all work*):

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)
Factor (Between)	42.36		
Error (Within)			
Total	1100.76		N/A

- (b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
- (c) Determine the P -value for this test. *Show all work; writing the correct P -value, without supporting work, will receive no credit.*
- (d) Is there sufficient evidence to support the claim that the mean weight loss is the same for the 10 programs at the significance level of 0.05? Explain.