1. True or False. *Justify for full credit.* 
   1. If the variance of a data set is zero, then all the observations in this data set are zero.
   2. If P(A) = 0.4 , P(B) = 0.5, and A and B are disjoint, then P(A AND B) = 0.9.
   3. Assume X follows a continuous distribution which is symmetric about 0. If

, then .

* 1. A 95% confidence interval is wider than a 90% confidence interval of the same parameter.
  2. In a right-tailed test, the value of the test statistic is 1.5. If we know the test statistic follows a Student’s t-distribution with P(T < 1.5) = 0.96, then we fail to reject the null hypothesis at 0.05 level of significance .

Refer to the following frequency distribution for Questions 2, 3, 4, and 5. *Show all work. Just the answer, without supporting work, will receive no credit.*

### The frequency distribution below shows the distribution for checkout time (in minutes) in UMUC MiniMart between 3:00 and 4:00 PM on a Friday afternoon.

|  |  |  |
| --- | --- | --- |
| Checkout Time (in minutes) | Frequency | Relative Frequency |
| 1.0 - 1.9 | 3 |  |
| 2.0 - 2.9 | 12 |  |
| 3.0 - 3.9 |  | 0.20 |
| 4.0 - 4.9 | 3 |  |
| 5.0 -5.9 |  |  |
| Total | 25 |  |

1. Complete the frequency table with frequency and relative frequency. Express the relative frequency to two decimal places.

|  |  |  |
| --- | --- | --- |
| **3.** | What percentage of the checkout times was at least 3 minutes? |  |
| **4.** | In what class interval must the median lie? Explain your answer. |  |
| **5.** | Does this distribution have positive skew or negative skew? Why? |  |

Refer to the following information for Questions 6 and 7. *Show all work. Just the answer, without supporting work, will receive no credit.*

### Consider selecting one card at a time from a 52-card deck. (Note: There are 4 aces in a deck of cards)

1. If the card selection is without replacement, what is the probability that the first card is an ace and the second card is also an ace? (Express the answer in simplest fraction form)

1. If the card selection is with replacement, what is the probability that the first card is an ace and the second card is also an ace? (Express the answer in simplest fraction form)

Refer to the following situation for Questions 8, 9, and 10.

### 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 | 45 | 55 | 85 | 100 |
| Quiz 2 | 20 | 35 | 50 | 90 | 100 |

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

1. Which quiz has less interquartile range in grade distribution?
2. Which quiz has the greater percentage of students with grades 90 and over?
3. Which quiz has a greater percentage of students with grades less than 60?

Refer to the following information for Questions 11, 12, and 13. *Show all work. Just the answer, without supporting work, will receive no credit.*

### There are 1000 students in a high school. Among the 1000 students, 800 students have a laptop, and 300 students have a tablet. 150 students have both devices.

1. What is the probability that a randomly selected student has neither device?
2. What is the probability that a randomly selected student has a laptop, given that he/she has a tablet?
3. Let event A be the selected student having a laptop, and event B be the selected student having a tablet. Are A and B independent events? Why or why not?
4. A combination lock uses three distinctive numbers between 0 and 49 inclusive. How many different ways can a sequence of three numbers be selected? (*Show work*)
5. Let random variable *x* represent the number of heads when a fair coin is tossed three times. *Show all work. Just the answer, without supporting work, will receive no credit.*
6. Construct a table describing the probability distribution.
7. Determine the mean and standard deviation of *x*. (Round the answer to two decimal places)
8. Mimi just started her tennis class three weeks ago. On average, she is able to return 20% of her opponent’s serves. Assume her opponent serves 10 times.
9. Let X be the number of returns 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?
10. Find the probability that that she returns at least 1 of the 10 serves from her opponent.

(*Show work*)

Refer to the following information for Questions 17, 18, and 19. *Show all work. Just the answer, without supporting work, will receive no credit.*

### The lengths of mature jalapeño fruits are normally distributed with a mean of 3 inches and a standard deviation of 1 inch.

1. What is the probability that a randomly selected mature jalapeño fruit is between 1.5 and 4 inches long?
2. Find the 90th percentile of the jalapeño fruit length distribution.
3. If a random sample of 100 mature jalapeño fruits is selected, what is the standard deviation of the sample mean?
4. A random sample of 100 light bulbs has a mean lifetime of 3000 hours. Assume that the population standard deviation of the lifetime is 500 hours. Construct a 95% confidence interval estimate of the mean lifetime. *Show all work. Just the answer, without supporting work, will receive no credit.*
5. Consider the hypothesis test given by

*H* 0 : *p* 0.5

*H*1 : *p* 0.5

In a random sample of 100 subjects, the sample proportion is found to be *p*ˆ 0.45 .

* 1. Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
  2. Determine the *P*-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
  3. Is there sufficient evidence to justify the rejection of *H*0 at the **0.01 level?

Explain.

1. Consumption of large amounts of alcohol is known to increase reaction time. To investigate the effects of small amounts of alcohol, reaction time was recorded for five individuals before and after the consumption of 2 ounces of alcohol. Do the data below suggest that consumption of 2 ounces of alcohol increases mean reaction time?

|  |  |  |
| --- | --- | --- |
|  | Reaction Time (seconds) | |
| Subject | Before | After |
| 1 | 6 | 7 |
| 2 | 8 | 8 |
| 3 | 4 | 6 |
| 4 | 7 | 8 |
| 5 | 9 | 8 |

Assume we want to use a 0.01 significance level to test the claim.

* 1. Identify the null hypothesis and the alternative hypothesis.
  2. Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
  3. Determine the *P*-value. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
  4. Is there sufficient evidence to support the claim that consumption of 2 ounces of alcohol increases mean reaction time? Justify your conclusion.

1. The UMUC MiniMart sells four different types of Halloween candy bags. The manager reports that the four types are equally popular. Suppose that a sample of 500 purchases yields observed counts 150, 110, 130, and 110 for types 1, 2, 3, and 4, respectively.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | 1 | 2 | 3 | 4 |
| Number of Bags | 150 | 110 | 130 | 110 |

Assume we want to use a 0.10 significance level to test the claim that the four types are equally popular.

* 1. Identify the null hypothesis and the alternative hypothesis.
  2. Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
  3. Determine the *P*-value for the test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
  4. Is there sufficient evidence to support the manager’s claim that the four types are equally popular? Justify your answer.

1. 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 | 3 | 5 |
| ***y*** | 1 | 2 | 3 | 8 |

1. Find an equation of the least squares regression line. *Show all work; writing the correct equation, without supporting work, will receive no credit.*
2. Based on the equation from part (a), what is the predicted value of *y* if *x* = 4? *Show all work and justify your answer.*
3. A STAT 200 instructor is interested in whether there is any variation in the final exam grades between her two classes Data collected from the two classes are as follows:

Her null hypothesis and alternative hypothesis are:

1. Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
2. Determine the *P*-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
3. Is there sufficient evidence to justify the rejection of *H*0 at the significance level of 0.05? Explain.