

Question 1: Points: 6

CLO #4,6

(A) **Points: 5**

CLO #4

- (1) Which of the following is a **discrete random variable**?
- (a) The height of students in a class.
 - (b) The number of cars passing through a toll booth in an hour.
 - (c) The time it takes to run a marathon.
 - (d) The temperature in a city.
- (2) Which of the following best describes a continuous random variable?
- (a) Number of heads in 10 coin tosses.
 - (b) Number of students present in a lecture.
 - (c) The amount of rainfall in a day.
 - (d) Number of defective items in a batch.
- (3) A probability distribution must satisfy which of the following?
- (a) All probabilities are greater than 1.
 - (b) The sum of probabilities is less than 1.

- (c) Each probability is between 0 and 1, and the sum equals 1.
 - (d) Probabilities can be negative.
- (4) Which of the following is NOT a characteristic of a discrete probability distribution?
- (a) Countable number of outcomes.
 - (b) Probabilities sum to 1.
 - (c) Can take any value within an interval.
 - (d) Each outcome has a specific probability.
- (5) The probability distribution of a Bernoulli random variable has how many possible outcomes?
- (a) Infinite
 - (b) Two
 - (c) Three
 - (d) Depends on the experiment.

(B) **Points: 1**

CLO #6

Which measure of variability is defined as the square root of the variance?

- (a) Range
- (b) Median
- (c) Standard deviation
- (d) Mode

Question 2: Points: 4

CLO #7

- (1) In a **binomial distribution**, which of the following is **NOT** a property?
- (a) Fixed number of trials
 - (b) Each trial is independent
 - (c) Each trial has the same probability of success
 - (d) The trials can have more than two possible outcomes
- (2) For a normal distribution, which of the following is true?
- (a) It is skewed to the right
 - (b) It has a single peak and is symmetric about the mean
 - (c) It has multiple peaks

- (d) Its mean is not equal to its median
- (3) What is the **expected value of a Bernoulli distribution** with probability of success p ?
- (a) $p(1 - p)$
 - (b) $(1 - p)$
 - (c) p
 - (d) 0.5
- (4) In a probability distribution, the variance cannot be:
- (a) Zero
 - (b) Positive
 - (c) Negative
 - (d) Equal to the mean

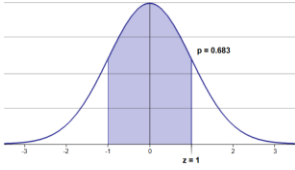
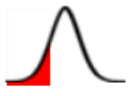
Question 3: Points: 5**CLO #8**

A factory produces light bulbs with a 2% defect rate. If a random sample of 50 bulbs is selected:

(a) Calculate the expected number of defective bulbs. Expected value $\mu = n \times p = 0.02 \times 50 = 1$	(b) What is the probability that exactly 2 bulbs are defective? $P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x}$ $P(X = 2) = \binom{50}{2} 0.02^2 (0.98)^{48}$ $P(X = 2) = 0.178$
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Question 4: Points: 5**CLO #9**

An electronics company claims that the voltage output of their new battery model is **normally** distributed with a **mean** of 12 volts and a **standard deviation** of 0.2 volts.

(a) What is the probability that a randomly selected battery has a voltage between 11.8 and 12.2 volts? Calculate the z-scores: $z_1 = \frac{x - \mu}{\sigma} = \frac{11.8 - 12}{0.2} = -1$ $z_2 = \frac{x - \mu}{\sigma} = \frac{12.2 - 12}{0.2} = 1$ $p(11.8 \leq x \leq 12.2) = p(-1 \leq z \leq 1)$  $p(11.8 \leq x \leq 12.2) = 0.68269$	(b) A quality control manager wants to identify batteries with voltages below the 5th percentile. What voltage value corresponds to this threshold? Find the z-score for the 5th percentile $p(x < z) = 0.05$  which is approximately -1.645 $x = \mu + z\sigma = 12 + (-1.645)(0.2)$ $= 11.671$
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Best Wishes

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