Probability Theory - Discrete Random Variables: MCQ Practice

1. What is a discrete random variable?

a) A variable that takes any real value in a range

b) A variable whose values are countable

c) A variable with infinite decimal values

d) A continuous measurement over time

Answer: b

Explanation: Discrete random variables can take only a finite or countably infinite set of values.

2. Which of the following is not a valid property of a probability mass function (PMF)?

a) P(X = x) >= 0

b) Sum P(X = x) = 1

c) P(X = x) <= 1

d) Sum P(X = x) >= 1

Answer: d

Explanation: The total probability of all outcomes must be exactly 1, not more than 1.

3. A die is rolled once. Let X be the number shown. What is the expected value of X?

a) 3

b) 3.5

c) 4

d) 2.5

Answer: b

Explanation: E[X] = (1+2+3+4+5+6)/6 = 21/6 = 3.5

4. Which distribution is appropriate for modeling the number of heads in 10 coin tosses?

a) Poisson

b) Binomial

c) Uniform

d) Exponential

Answer: b

Explanation: Coin tosses are Bernoulli trials; the number of successes follows a Binomial distribution.

5. Let X be a discrete random variable with the PMF: 0->0.2, 1->0.5, 2->0.3. What is Var(X)?

a) 0.71

b) 0.49

c) 0.85

d) 1.00

Answer: b

Explanation: E[X] = 1.1, E[X^2] = 1.7, Var(X) = 1.7 - 1.21 = 0.49

6. A Bernoulli random variable takes value 1 with probability p and 0 with probability (1-p). What is its expected value?

a) 0

b) 1

c) p

d) 1 - p

Answer: c

Explanation: E[X] = 1*p + 0*(1-p) = p

7. If a random variable X has the same probability for each of the outcomes 1, 2, 3, 4, what is the value of P(X=2)?

a) 0.25

b) 0.50

c) 0.20

d) 0.75

Answer: a

Explanation: Uniform distribution: P = 1/4 = 0.25

8. Which of the following is true about the mean (expected value) of a discrete random variable X?

a) It always equals the mode

b) It is the maximum value of X

c) It is the average value weighted by probability

d) It is undefined for discrete variables

Answer: c

Explanation: E[X] = sum x * P(X = x), the probability-weighted average.

9. If a fair coin is flipped 4 times, what is the expected number of heads?

a) 1

b) 2

c) 3

d) 4

Answer: b

Explanation: E[X] = n * p = 4 * 0.5 = 2

10. For a binomial distribution with n = 5 and p = 0.4, what is the variance?

a) 1.2

b) 0.6

c) 2.5

d) 0.4

Answer: a

Explanation: Var = np(1-p) = 5 * 0.4 * 0.6 = 1.2