Openbook

Final Grade 15 / 15

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1 **MULTIPLE CHOICE**

In a binomial experiment, which conditions are required?

A Trials without replacement and dependent, with more than two outcomes per trial

B The trials must be sequential and continuous in t ime

C The successes must follow a normal distribution

D Variable number of trials, multiple outcomes per trial, changing probability of success

E Fixed number of trials, two outcomes per trial, c onstant probability of success, independence be tween trials

2 **MULTIPLE CHOICE**

Which statistic measures the average distance of data points from the sample mean and is not sensitive to outliers?

- A Standard deviation
- B Variance
- C Box plot whisker length
- D Interquartile range (IQR)
- E Mean absolute deviation (MAD)

3 **MULTIPLE CHOICE**

What is the mean and variance of a binomial random variable X ~ Bin(n, p)?

- A Mean = n(1−p), Variance = n^2p(1−p)
- B Mean = n/p, Variance = np/p

C Mean = n−p, Variance = np(1+p)

D Mean = np, Variance = np(1−p)

E Mean = np^2, Variance = n(1−p)^2

4 **MULTIPLE CHOICE**

In a geometric distribution with success probability p, what does the random variable X represent?

A The number of successes in a fixed number of tri als

B The time until the r-th event occurs

C The count of successes in a Poisson process

D The number of failures before the r-th success

E The number of trials needed to obtain the first s uccess

5 **MULTIPLE CHOICE**

In the context of continuous distributions, which statement is true about P(X = x) for any specific x?

A P(X = x) equals f(x) for a PDF

B P(X = x) is defined only at integer x

C P(X = x) = 0 for a continuous random variable

D P(X = x) > 0 for most x

E P(X = x) equals the area under the PDF at x

6 MULTIPLE CHOICE

If X ~ Uniform(a, b), which of the following is true regarding its mean μ and variance Var(X)?

A μ = (a + b)/2 and Var(X) = (b − a)^2 / 12

B μ = (a + b)/2 and Var(X) = 12(b − a)

C μ = ab and Var(X) = (b − a)^2 / 24

D μ = (a − b)/2 and Var(X) = (b − a)^2 / 6

E $\mu = a + b$ and $Var(X) = (b - a)/12$

7 **MULTIPLE CHOICE**

For a discrete random variable, the probability mass function (PMF) p(x) satisfies which of the following properties?

A p(x) is defined as the probability of X exceeding x.

B p(x) must be nonzero for all x.

C The PMF integrates to 1 over the entire real line.

D p(x) is the derivative of the CDF.

E Sum of p(x) over all possible x equals 1.

8 **MULTIPLE CHOICE**

If X has a PMF p(x), what is the relation between the PMF and the cumulative distribution function F(x)?

A $F(x) = P(X \leq x)$ is the sum of $p(t)$ for all $t \leq x$.

B $F(x) = \int p(t)\,dt$ from $-\infty$ to x (for discrete X).

C $F(x)$ is the derivative of $p(x)$.

D $F(x) = P(X \geq x)$ for discrete X.

E $F(x)$ equals $p(x)$ for all x.

9 **MULTIPLE CHOICE**

Which distribution describes the number of trials needed to obtain r successes?

A Binomial distribution

B Negative binomial distribution

C Hypergeometric distribution

D Geometric distribution

E Poisson distribution

10 **MULTIPLE CHOICE**

Which distribution is appropriate for modeling waiting times between events in a process with a constant average rate λ?

- A Poisson distribution
- B Uniform distribution
- C Exponential distribution
- D Gamma distribution
- E Normal distribution

11 **MULTIPLE CHOICE**

What is the standard normal random variable Z used for, and what are its mean and standard deviation?

- A Z ~ Uniform(0,1); mean 0.5 and standard deviation 0.5
- B Z ~ Exponential(1); rate 1 and scale 1

C Z ~ N(0,2); mean 0 and standard deviation 2

D Z ~ N(0,1); mean 0 and standard deviation 1

E Z ~ N(1,0); mean 1 and standard deviation 0

12 **MULTIPLE CHOICE**

Which of the following statements best describes a discrete random variable X?

A X can take an uncountable number of values in a n interval.

B X takes a finite or countably infinite set of distinc t values.

C X is always a continuous function over time.

D X values are defined by a density function over a n interval.

E X can take any real value in an interval.

13 **MULTIPLE CHOICE**

Under which condition can the Poisson distribution be a good model for count data?

A When there is waiting time until the first event

B When sampling without replacement from a finit e population

C When events occur independently and at a cons tant average rate in a fixed interval

D When there are a fixed number of trials with a co nstant probability of success

E When the mean and variance are zero

14 **MULTIPLE CHOICE**

Which distribution is appropriate for modeling the number of successes when sampling without replacement from a finite population?

A Negative binomial distribution