Continuous Random Variables – Quiz

Probability & Statistics

Question 1

For a continuous random variable X, what is P(X = 5)?

A. It depends on the distribution
B. 0
C. 1
D. 0.5

Question 1

For a continuous random variable X, what is $P(X = 5)$?

A. It depends on the distribution

B. 0

C. 1

D. 0.5

Answer: B

For continuous random variables, the probability of any exact value is 0. Instead, we calculate probabilities over intervals.

Question 2

The PDF (Probability Density Function) must satisfy:

A. f(x) ¡= 1 for all x
B. f(x) ¿= 0 and the total area under the curve equals 1
C. f(x) = P(X = x)
D. f(x) is always symmetric

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C. f(x) = P(X = x)

D. f(x) is always symmetric

Answer: B

A valid PDF must be non-negative everywhere and integrate to 1. The height f(x) can exceed 1 as long as the area equals 1.

Question 3

For a continuous random variable, probability is represented by:

A. The height of the PDF at a point
B. The area under the PDF curve
C. The value of the random variable
D. The mode of the distribution

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Answer: B
Probability for continuous variables is the area under the PDF curve between two points: P(a ¡ X ¡ b) = area from a to b.

Question 4

For X ˜ Uniform(0, 10), what is E[X]?

A. 0
B. 5
C. 10
D. 2.5

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B. 5
C. 10
D. 2.5

Answer: B
For Uniform(a, b), $E[X] = (a + b)/2 = (0 + 10)/2 = 5$.

Question 5

The variance of Uniform(0, 12) is:

A. 12
B. 6
C. 144
D. 12

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B. 6
C. 144
D. 12

Answer: D
For Uniform(a, b), Var(X) = (b-a)^2/12 = (12-0)^2/12 = 144/12 = 12.

Question 6

The normal distribution is characterized by:

A. A flat, rectangular shape
B. A bell-shaped curve, symmetric around the mean
C. A right-skewed shape
D. Only positive values

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Answer: B
The normal distribution has a symmetric bell shape centered at the mean mu, with spread determined by sigma.

Question 7

In the notation N(mu, sigma^2), sigma^2 represents:

A. The mean
B. The standard deviation
C. The variance
D. The median

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Answer: C
In N(mu, sigma^2), mu is the mean and sigma^2 is the variance. The standard deviation is sigma.

Question 8

The standard normal distribution has:

A. Mean $= 1$, Variance $= 0$
B. Mean $= 0$, Variance $= 1$
C. Mean $= 0$, Variance $= 0$
D. Mean $= 1$, Variance $= 1$

Question 8

The standard normal distribution has:

A. Mean = 1, Variance = 0
B. Mean = 0, Variance = 1
C. Mean = 0, Variance = 0
D. Mean = 1, Variance = 1

Answer: B
The standard normal distribution Z ˜ N(0, 1) has mean 0 and variance 1. Any normal can be standardized to this form.

Question 9

The z-score formula is:

A. $Z = (X + mu) / sigma$
B. $Z = (X - mu) / sigma$
C. $Z = sigma / (X - mu)$
D. $Z = (mu - X) \times sigma$

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B. $Z = (X - mu) / sigma$
C. $Z = sigma / (X - mu)$
D. $Z = (mu - X) \times sigma$

Answer: B
The z-score $Z = (X - mu) / sigma$ measures how many standard deviations X is from the mean.

Question 10

According to the empirical rule (68-95-99.7), approximately what percentage of data falls within 2 standard deviations of the mean?

A. 68%
B. 95%
C. 99.7%
D. 50%

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Answer: B
The empirical rule states: 68% within 1 SD, 95% within 2 SD, and 99.7% within 3 SD of the mean.

Question 11

For X ~ Exponential(lambda), what is E[X]?

A. lambda
B. 1/lambda
C. lambda^2
D. e^lambda

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For X ˜ Exponential(lambda), what is E[X]?

A. lambda
B. 1/lambda
C. lambdaˆ2
D. eˆlambda

Answer: B
For Exponential(lambda), E[X] = 1/lambda. If lambda = 2 events per hour, expected time until event is 1/2 hour.

Question 12

The exponential distribution has which special property?

A. Symmetry
B. Memoryless property
C. Constant density
D. Finite support

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The exponential distribution has which special property?

A. Symmetry
B. Memoryless property
C. Constant density
D. Finite support

Answer: B
The exponential distribution is memoryless: P(X ¿ s+t — X ¿ s) = P(X ¿ t). Past waiting time doesn't affect future probability.

Question 13

If X is log-normal, then ln(X) follows:

A. Uniform distribution
B. Exponential distribution
C. Normal distribution
D. Poisson distribution

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If X is log-normal, then ln(X) follows:

A. Uniform distribution
B. Exponential distribution
C. Normal distribution
D. Poisson distribution

Answer: C
By definition, X is log-normal if ln(X) is normally distributed. Log-normal variables are always positive.

Question 14

Why are stock prices often modeled as log-normal rather than normal?

A. Log-normal is simpler
B. Stock prices must be positive, and log-normal ensures this
C. Normal distributions don't exist for continuous data
D. Log-normal has no variance

Question 14

Why are stock prices often modeled as log-normal rather than normal?

A. Log-normal is simpler
B. Stock prices must be positive, and log-normal ensures this
C. Normal distributions don't exist for continuous data
D. Log-normal has no variance

Answer: B
Stock prices cannot be negative. Log-normal distributions only take positive values, making them appropriate for price modeling.

Question 15

The CDF F(x) for a continuous random variable gives:

A. P(X = x)
B. P(X ¿ x)
C. P(X ¡= x)
D. The PDF at x

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B. P(X ¿ x)
C. P(X ¡= x)
D. The PDF at x

Answer: C
The CDF F(x) = P(X ¡= x) gives the cumulative probability up to x. It ranges from 0 to 1.

Question 16

To find P(a ¡ X ¡ b) using the CDF:

A. F(a) + F(b)
B. F(b) - F(a)
C. F(a) x F(b)
D. F(b) / F(a)

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To find P(a ¡ X ¡ b) using the CDF:

A. F(a) + F(b)
B. F(b) - F(a)
C. F(a) x F(b)
D. F(b) / F(a)

Answer: B
P(a ¡ X ¡ b) = F(b) - F(a). We subtract the cumulative probability up to a from that up to b.

Question 17

The gamma distribution generalizes which distribution?

A. Normal
B. Exponential
C. Uniform
D. Binomial

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B. Exponential
C. Uniform
D. Binomial

Answer: B
The gamma distribution with shape alpha $= 1$ is the exponential distribution. Gamma generalizes exponential to model sums of exponential waiting times.

Question 18

The beta distribution is defined on which interval?

A. All real numbers
B. [0, 1]
C. [0, infinity)
D. [-1, 1]

Question 18

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C. [0, infinity)
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Answer: B
The beta distribution is defined on [0, 1], making it useful for modeling probabilities and proportions.

Question 19

In a Q-Q plot, if data follows a normal distribution:

A. Points form a U-shape
B. Points fall approximately on a straight line
C. Points form an S-curve
D. Points are randomly scattered

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B. Points fall approximately on a straight line
C. Points form an S-curve
D. Points are randomly scattered

Answer: B
A Q-Q plot compares data quantiles to theoretical quantiles. If data is normal, points lie approximately on the diagonal line.

Question 20

If a Q-Q plot shows an S-curve at the tails, the data likely has:

A. Normal distribution
B. Thin tails
C. Heavy tails (more extreme values than normal)
D. No variance

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A. Normal distribution
B. Thin tails
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Answer: C
An S-curve in a Q-Q plot indicates heavy tails - more extreme values occur than a normal distribution would predict.