Q1: What are the Probability Mass Function (PMF) and Probability Density Function (PDF)? Explain with an example.

Probability Mass Function (PMF) and Probability Density Function (PDF):

PMF: The Probability Mass Function is used in the context of discrete random variables. It assigns a probability to each possible outcome. For example, when rolling a fair six-sided die, the PMF assigns a probability of 1/6 to each of the six possible outcomes. PDF: The Probability Density Function is used for continuous random variables. It represents the probability distribution of a continuous variable over a range of values. For example, the PDF of a standard normal distribution is the bell-shaped curve that represents the likelihood of various values occurring.

Q2: What is Cumulative Density Function (CDF)? Explain with an example. Why CDF is used?

Cumulative Density Function (CDF):

The Cumulative Density Function (CDF) gives the probability that a random variable takes on a value less than or equal to a specific value. It's used to understand the cumulative probabilities of a random variable. For example, in a standard normal distribution, the CDF can tell you the probability that a z-score is less than a given value.

Q3: What are some examples of situations where the normal distribution might be used as a model? Explain how the parameters of the normal distribution relate to the shape of the distribution.

Uses of the Normal Distribution:

The normal distribution is commonly used to model various real-world phenomena, such as the distribution of heights, weights, IQ scores, errors in measurements, and many natural and social phenomena. The parameters of the normal distribution are the mean (μ) and standard deviation (σ). The mean defines the center of the distribution, while the standard deviation determines the spread or width of the distribution. Larger σ values result in wider and flatter distributions, while smaller σ values result in narrower and taller distributions.

Q4: Explain the importance of Normal Distribution. Give a few real-life examples of Normal Distribution.

: Importance of Normal Distribution:

The normal distribution is important in statistics because of the Central Limit Theorem (CLT) and its simplicity. The CLT states that the sampling distribution of the sample mean approaches a normal distribution as the sample size increases, making it a fundamental tool for statistical inference. Real-life examples include the distribution of heights in a population, IQ scores, errors in measurements, and financial data like stock prices.

Q5: What is Bernaulli Distribution? Give an Example. What is the difference between Bernoulli Distribution and Binomial Distribution?

Bernoulli Distribution:

The Bernoulli distribution models a binary outcome, such as success/failure, yes/no, or 1/0. It has a single parameter p, which represents the probability of success. An example is flipping a coin, where "heads" (success) occurs with probability p, and "tails" (failure) occurs with probability 1-p. The key difference between Bernoulli and Binomial distributions is that the Bernoulli distribution models a single trial, while the Binomial distribution models the number of successes in a fixed number of independent Bernoulli trials.

Q6. Consider a dataset with a mean of 50 and a standard deviation of 10. If we assume that the dataset is normally distributed, what is the probability that a randomly selected observation will be greater than 60? Use the appropriate formula and show your calculations.

To calculate the probability, you would use the z-score formula: $Z = (X - \mu) / \sigma$, where X is the value you're interested in (60 in this case), μ is the mean (50), and σ is the standard deviation (10). $Z = (60 - 50) / 10 = 1$. You can then use a standard normal distribution table or calculator to find the probability associated with a z-score of 1, which is approximately 0.8413. So, there's an 84.13% probability that a randomly selected observation will be greater than 60.

Q7: Explain uniform Distribution with an example.

Uniform Distribution:

The uniform distribution is a continuous probability distribution where all values within a certain range have an equal probability of occurring. It's often depicted as a rectangular probability density function. An example is rolling a fair six-sided die, where each outcome (1, 2, 3, 4, 5, 6) has an equal probability of 1/6.

Q8: What is the z score? State the importance of the z score.

: Z-Score:

A z-score (standard score) measures how many standard deviations a data point is from the mean of a dataset. It standardizes data and allows for comparisons across different datasets. The formula is $Z = (X - \mu) / \sigma$. It's important in statistics for hypothesis testing, determining outliers, and making data comparable.

Q9: What is Central Limit Theorem? State the significance of the Central Limit Theorem.

Central Limit Theorem (CLT):

The Central Limit Theorem states that the sampling distribution of the sample mean of a large enough random sample from any population will be approximately normally distributed, regardless of the shape of the original population. Its significance lies in its application to inferential statistics, enabling the use of parametric statistical tests even when the population distribution is not normal.

Q10: State the assumptions of the Central Limit Theorem.

Assumptions of the Central Limit Theorem:

1.Random Sampling: The samples are drawn randomly from the population. 2.Independence: Each observation in the sample is independent of the others. 3.Sample Size: The sample size is sufficiently large (usually n > 30 is considered adequate, but the larger, the better). 4.Finite Variance: The population has a finite variance (it's not extremely skewed or heavy-tailed).