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**ASSIGN : 21**

Q1. What is a probability distribution, exactly? If the values are meant to be random, how can you predict them at all?

A probability distribution is a mathematical function or model that describes the likelihood or probability of different outcomes or events occurring in a random experiment, process, or system. It provides a way to quantify and analyze uncertainty and randomness.

In a probability distribution, each possible outcome or event is associated with a probability value, which represents the likelihood of that outcome occurring. The sum of all probabilities within the distribution is equal to 1, indicating that some outcome is guaranteed to occur.

Q2. Is there a distinction between true random numbers and pseudo-random numbers, if there is one? Why are the latter considered “good enough”?

Yes, there is a distinction between true random numbers and pseudo-random numbers.

True random numbers are generated from a source of randomness that is inherently unpredictable and unbiased. They are often based on physical processes or phenomena that are considered random, such as atmospheric noise, radioactive decay, or unpredictable human actions. True random numbers cannot be reproduced or predicted, as they are genuinely random.

Q3. What are the two main factors that influence the behaviour of a "normal" probability distribution?

The two main factors that influence the behavior of a "normal" probability distribution are the mean (average) and the standard deviation.

Mean (μ): The mean of a normal distribution represents the central tendency or the average value of the distribution. It determines the location of the peak or center of the bell-shaped curve. The mean is a measure of the expected value or the typical value around which the data tend to cluster. It influences the symmetry of the distribution.

Standard Deviation (σ): The standard deviation of a normal distribution measures the dispersion or spread of the data points around the mean. It indicates the average amount by which the data deviate from the mean. A larger standard deviation implies a broader distribution with more dispersion, while a smaller standard deviation indicates a narrower distribution with less variability. The standard deviation influences the shape and width of the bell-shaped curve.

Q4. Provide a real-life example of a normal distribution.

One real-life example of a normal distribution is the distribution of heights of adult humans. In a given population, if we were to measure the heights of a large number of adults and plot a histogram of the data, it would often exhibit a bell-shaped curve resembling a normal distribution.

Q5. In the short term, how can you expect a probability distribution to behave? What do you think will happen as the number of trials grows?

In the short term, the behavior of a probability distribution can be unpredictable due to the inherent randomness and variability involved. In a small number of trials or observations, the actual outcomes may deviate significantly from the expected probabilities described by the distribution. This is because random events can introduce fluctuations and chance occurrences that may not align perfectly with the theoretical probabilities.

Q6. What kind of object can be shuffled by using random.shuffle?

The random.shuffle() function in Python can be used to shuffle the elements of a mutable sequence object. A mutable sequence is an object that can be modified, such as a list.

Q7. Describe the math package's general categories of functions.

Basic arithmetic and rounding functions:

math.ceil(x): Returns the smallest integer greater than or equal to x.

math.floor(x): Returns the largest integer less than or equal to x.

Exponential and logarithmic functions:

math.exp(x): Returns e raised to the power of x.

math.log(x): Returns the natural logarithm of x.

Trigonometric functions:

math.sin(x), math.cos(x), math.tan(x): Returns the sine, cosine, and tangent of x, respectively.

math.asin(x), math.acos(x), math.atan(x): Returns the inverse sine, cosine, and tangent of x, respectively.

Constants:

math.pi: Represents the mathematical constant π (pi).

math.e: Represents the mathematical constant e (Euler's number).

Q8. What is the relationship between exponentiation and logarithms?

The relationship between exponentiation and logarithms is based on the inverse nature of these mathematical operations. Exponentiation and logarithms are essentially opposite operations that "undo" each other.

Q9. What are the three logarithmic functions that Python supports?

math.log(x[, base]): This function calculates the natural logarithm (base e) of the given number x. It returns the logarithm value as a float. The base parameter is optional, and if provided, it represents the logarithmic base other than e.

math.log10(x): This function calculates the base-10 logarithm of the given number x. It returns the logarithm value as a float.

math.log2(x): This function calculates the base-2 logarithm of the given number x. It returns the logarithm value as a float.