**Assignment - 21**

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

Ans: A probability distribution is a mathematical function that describes the likelihood of various outcomes or events in a random experiment or process. It specifies the probabilities of all possible outcomes, indicating how likely each outcome is to occur. While the values in a probability distribution are random, their likelihoods can still be predicted based on the distribution's parameters and properties.

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

Ans: True random numbers are generated from physical processes that are inherently unpredictable, such as radioactive decay or atmospheric noise, while pseudo-random numbers are generated using deterministic algorithms that produce sequences of numbers that appear random. Pseudo-random numbers are considered "good enough" for most practical purposes because they exhibit statistical properties similar to those of true random numbers and are computationally efficient to generate.

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

Ans: The two main factors that influence the behavior of a normal probability distribution are the mean (average) and standard deviation. The mean determines the center of the distribution, while the standard deviation measures the spread or dispersion of the data points around the mean.

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

Ans: A real-life example of a normal distribution is the distribution of heights in a population. In many human populations, heights tend to follow a normal distribution, with most individuals clustered around the average height and progressively fewer individuals at taller and shorter heights.

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?

Ans: In the short term, a probability distribution may exhibit fluctuations and variability around its expected value. However, as the number of trials grows larger, the distribution tends to stabilize and approach its theoretical properties, such as the mean and variance, in accordance with the law of large numbers.

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

Ans: The random.shuffle function can shuffle any mutable sequence object in Python, such as lists, tuples, or arrays.

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

Ans: The math package's general categories of functions include mathematical constants (e.g., pi, e), basic arithmetic operations (e.g., addition, subtraction), trigonometric functions (e.g., sine, cosine), logarithmic and exponential functions, and statistical functions (e.g., mean, standard deviation).

Q8. What is the relationship between exponentiation and logarithms?

Ans: Exponentiation and logarithms are inverse operations of each other. Exponentiation involves raising a base to a power, while logarithms involve finding the power to which a given base must be raised to obtain a specified value.

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

Ans: The three logarithmic functions that Python supports are the natural logarithm (base e) represented by math.log, the base-10 logarithm represented by math.log10, and the base-2 logarithm represented by math.log2.