Assignment 21

# Q1

A probability distribution is a function or a mathematical model that describes the likelihood of different outcomes or events in a random process. It provides information about the probabilities associated with each possible value or range of values that a random variable can take. While the values in a probability distribution are based on randomness, the distribution itself represents the probabilities of those values occurring based on underlying patterns or assumptions.

# Q2

There is a distinction between true random numbers and pseudo-random numbers. True random numbers are generated from physical processes that are inherently unpredictable, such as atmospheric noise or radioactive decay. Pseudo-random numbers, on the other hand, are generated by algorithms that produce sequences of numbers that appear to be random, but are actually determined by an initial starting point called a seed. Pseudo-random numbers are considered "good enough" for many applications because they exhibit statistical properties of randomness and can be efficiently generated.

# Q3

The two main factors that influence the behavior of a "normal" probability distribution are the mean (average) and the standard deviation. The mean determines the central tendency of the distribution, while the standard deviation measures the spread or variability of the distribution. These two parameters together define the shape and characteristics of the normal distribution.

# Q4

A real-life example of a normal distribution is the distribution of heights or weights of a large population. In such a distribution, the majority of individuals tend to cluster around the mean height or weight, with fewer individuals at the extremes. The distribution forms a symmetric bell-shaped curve, where the mean, median, and mode coincide at the peak of the curve.

# Q5

In the short term, the behavior of a probability distribution can be unpredictable. However, as the number of trials or observations increases, the distribution tends to stabilize and exhibit the expected properties. This is known as the law of large numbers, which states that with a large enough sample size, the observed frequencies will converge to the theoretical probabilities predicted by the distribution.

# Q6

The random.shuffle function in Python can shuffle a mutable sequence object, such as a list. It modifies the sequence in-place, randomly rearranging its elements.

# Q7

Basic mathematical functions: These include functions like abs, max, min, round, which perform common mathematical operations.

Trigonometric functions: These include functions like sin, cos, tan, asin, acos, atan, which calculate trigonometric values.

Exponential and logarithmic functions: These include functions like exp, log, log10, sqrt, which perform calculations involving exponentiation and logarithms.

Special functions: These include functions like factorial, gamma, erf, erfc, which compute special mathematical functions.

Constants: The math package also provides various mathematical constants, such as pi, e, and inf.

# Q8

Exponentiation and logarithms are mathematical operations that are inverses of each other. Exponentiation involves raising a base number to a given power, while logarithms involve finding the exponent to which a base number must be raised to obtain a given value. In other words, exponentiation "undoes" logarithms, and logarithms "undo" exponentiation. They are closely related and used in various mathematical and scientific computations.

# Q9

math.log(x): This function computes the natural logarithm (base e) of x.

math.log10(x): This function computes the logarithm base 10 of x.

math.log(x, base): This function computes the logarithm of x with a specified base. The base parameter is optional, and if not provided, it defaults to the natural logarithm.