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 describes the likelihood of various outcomes in a random experiment. While individual values may appear random, the overall pattern of probabilities can be predicted based on statistical analysis and mathematical models.

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

True random numbers are generated from genuinely unpredictable sources, such as atmospheric noise. Pseudo-random numbers are generated using deterministic algorithms and initial values (seeds), but they appear random enough for many applications due to their properties of unpredictability, uniformity, and statistical randomness.

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. The mean determines the center of the distribution, while the standard deviation controls the spread or variability of the distribution.

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

A real-life example of a normal distribution is the distribution of heights or weights of a large population. In such cases, many individuals tend to cluster around the average, with fewer individuals at the extremes.

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, a probability distribution may exhibit randomness, but as the number of trials grows, the distribution tends to stabilize, and the observed outcomes approach the expected probabilities. This phenomenon is described by the law of large numbers.

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

Lists, tuples, and other sequence objects can be shuffled using the random.shuffle function.

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

The math package's general categories of functions include mathematical operations (e.g., exponentiation, logarithms), constants (e.g., π, e), trigonometric functions (e.g., sine, cosine), hyperbolic functions, and more.

Q8. What is the relationship between exponentiation and logarithms?

Exponentiation and logarithms are inverse operations. If a^b = c, then log\_a(c) = b. Exponentiation raises a number to a power, while logarithms find the exponent needed to produce a given number.

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

Python supports three logarithmic functions: math.log(x), which computes the natural logarithm (base e); math.log10(x), which computes the base-10 logarithm; and math.log(x, base), which allows you to specify a custom base for the logarithm.