### Pre-Requisites

To effectively understand this session, learners are expected to have:

- A basic understanding of Python programming (basic data and control structures, functions, libraries)
- Familiarity with foundational mathematics, including combinatorics and basic probability
- Prior exposure to core probability concepts via pre-read platform content (probability definitions, random variables, expected value, etc.)

## Session Summary

This live session will run for approximately 90 minutes. It is designed to reinforce and extend learners' understanding of probability distributions, bridging conceptual clarity with practical simulation in Python.

The session will begin with a recap of key probability ideas through a recall quiz and discussion. This is followed by a deep dive into discrete and continuous probability distributions, where learners will explore the theory and applications of Uniform, Bernoulli, Binomial, and Normal distributions. The session also explains the interpretation and utility of the cumulative distribution function (CDF) and the standard normal distribution using Z-scores.

The instructor will guide learners through visual examples, coding demonstrations using Jupyter or Colaboratory notebooks, and hands-on simulations. By the end of the session, learners will have developed a more confident and fine understanding of probability distributions and their implementation in Python.

## Learning Objectives/Outcomes

By the end of this session, learners will be able to:

- Recall and clarify core probability terms such as random variables, PMFs, expected values, and types of distributions
  ***Why**: To ensure a strong conceptual base for further statistical modelling and analysis*

- Differentiate between discrete and continuous probability distributions through real-world analogies and mathematical properties
  ***Why**: This distinction is foundational in applying the correct models to different data types*

- Describe and simulate key distributions (Uniform, Bernoulli, Binomial, Normal) and interpret their behaviour
  ***Why**: Understanding the characteristics and use cases of these distributions aids in effective statistical reasoning.*

- Interpret and compute cumulative probabilities using the CDF and apply Z-scores to standard normal data.
  ***Why**: Enables practical reasoning about likelihood and thresholds in data.*

- Apply knowledge through code to simulate distributions and calculate probabilities, proportions, and Z-scores.
  ***Why**: Reinforces learning by connecting theoretical knowledge with computational tools.*

# Brief Agenda

Table 1: Brief Agenda

| Learning Objective | Comments | Duration | Mode |
|---|---|---|---|
| **Part I: Introduction & Revision** | Introduction to the live session and structured revision of key probability concepts through quizzes | 20 mins | Theoretical |
| **Part II: Key Probability Distributions** | Discrete vs Continuous RVs, key distributions (Uniform, Bernoulli, Binomial, Normal), CDFs, Z-scores | 40 mins | Theoretical + Guided Coding |
| **Part III: Simulation & Analysis** | Exercises using Python to simulate and analyse distributions | 25 mins | Guided Coding |
| **Part IV: Q&A and Closing** | Doubt Resolution and General Q&A | 5 mins | - |

# Conclusions

By the end of the session, learners will have reviewed essential probability concepts and will gain practical experience simulating and interpreting key probability distributions using Python. They will be prepared to understand and address real-world variability using probabilistic methods.

# What's Ahead

Learners will next delve into vectors and matrices. They will progress towards understanding linear transformations and eigenvalues, setting the stage for more advanced applications in data science and machine learning.

# Additional Readings

The following additional links have been provided as references for additional learning:

Scipy.stats documentation