# Assignment Day 1: Python Foundation

Problem Statement:
You are tasked with simulating the placement of stars in the sky. Given a world with coordinates ranging from -110000 to 110000 on both the x and y axes, you need to generate 500 stars (represented as dots) in a random manner such that the minimum distance between any two stars is at least 5000 units. The positions of the stars should be generated using a fixed seed value to ensure that the star positions are reproducible across multiple executions. Finally, you must plot these stars on a 2D plane using Matplotlib.

If any confusion is related to this you can ask on the general channel chat. The instructors are there to guide you all

# Assignment Day 2: Data Management

# Assignment Day 3: Mathematics for ML

**1. Linear Algebra in Real Life**
**Objective:** Apply matrix operations to a real-world scenario.
**Problem:**
A small café tracks its daily sales for three products: coffee, sandwiches, and cakes. The sales for three days are recorded as:
Day 1: [100 coffees, 50 sandwiches, 30 cakes]
Day 2: [120 coffees, 70 sandwiches, 40 cakes]
Day 3: [90 coffees, 60 sandwiches, 20 cakes]

The prices for the products are:

- Coffee: $2 each
- Sandwich: $5 each
- Cake: $4 each

1. Represent the sales and prices as matrices.
2. Compute the total revenue for each day using matrix multiplication.
3. Calculate the transpose of the sales matrix and explain its significance.

**2. Optimization in Delivery Route**
**Objective:** Use gradient descent to find the shortest delivery route.
**Problem:**
A delivery company is testing a new algorithm to optimize delivery routes. The company uses a simple cost function:

$$C(x) = (x - 3)^2 + 5$$

1. Use gradient descent to minimize the cost function. Start with x=10, a learning rate of 0.1, and run for 15 iterations.
2. Plot the cost at each iteration.
3. Explain how gradient descent helps find the optimal route in real-world scenarios.

**3. Calculus in Machine Learning Loss Functions**
**Objective:** Explore the role of differentiation in training models.
**Problem:**
The accuracy of a machine learning model is measured using the function:

$$A(w) = -w^2 + 4w + 6$$

where www is a weight parameter.

1. Find the derivative of A(w)and determine the weight www that maximizes the accuracy.
2. Plot the function A(w) and its derivative to verify your solution.
3. Discuss how gradients are used in machine learning to adjust weights for better accuracy.