Numpy Assignment 2

Q1. Scenario: A researcher studies the elevation of a landscape modeled as a (10, 10) matrix.  
Task: Generate a random (10, 10) matrix of elevations. Calculate the gradient of the matrix along both axes using finite differences.  
  
Expected Output Example: Two matrices representing gradients along rows and columns.

Q2. Scenario: A sports team tracks player performance across 12 matches.  
Task: Create a (12, 5) array with random integers (0 to 100, representing scores). Mask the values where the player's score is less than the team's average score for that match. Replace these values with -1.

Expected Output Example: Array with some values replaced by -1.

Q3. Scenario: A business tracks monthly revenue and expenses for 3 departments across 6 months.  
Task: Create two (3, 6) random matrices for revenue and expenses. Perform element-wise multiplication and sum along the row axis to calculate the total profit for each department.

Expected Output Example: A 1D array with the total profit per department.

Q4. Scenario: A biologist simulates the random movement of a particle in 2D space for 500 steps.  
Task: Generate a (500, 2) array representing the x and y displacements (random values between -1 and 1). Calculate the cumulative displacement at each step. Plot the particle's trajectory.

Expected Output: The final displacement and a trajectory plot.

Q5. Scenario: A 5x5 matrix represents pixel intensity values in an image.  
Task: Rotate the matrix 90 degrees clockwise without using loops or Python slicing.  
  
Expected Output Example: A rotated matrix.

Q6. Scenario: A chessboard with (8, 8) cells records a value for each cell.  
Task: Aggregate the matrix into a (4, 4) matrix where each element is the sum of values in a 2x2 block of the original matrix.  
  
Expected Output Example: A reduced matrix of sums.

Q7. Scenario: A company tracks salaries of 15 employees in 3 departments.  
Task: Create a (3, 15) matrix of random salaries. Identify and print the department(s) where all employees have salaries above ₹50,000. Replace salaries less than ₹30,000 with the department's average salary.

Expected Output Example: Updated salary matrix and department indices.

Q8. Scenario: A physicist observes the motion of an object over time.  
Task: Create a 1D array representing time steps t = [0, 1, 2, ..., 9]. Generate corresponding distances using a random quadratic polynomial a\*t^2 + b\*t + c with random coefficients. Use np.polyfit to fit a polynomial to the data and calculate the predicted distances.

Expected Output Example: Polynomial coefficients and predicted distances.