

# ENT 835: Scientific Computing with Python

2025-03-04

## Instructions:

1. Question 1 is **compulsory**.
  2. Choose any **two** other questions.
  3. All questions carry **20 marks** each.
  4. This is a practical exam; write and execute Python code to solve each question.
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## Question 1: Comprehensive Python Programming (20 Marks)

Given the dataset “Student Scores” (provided in the appendix), write a Python script to:

1. Read the dataset into a Pandas DataFrame. (4 marks)
  2. Compute and display the average score for each subject. (6 marks)
  3. Identify and display students who scored above 85 in Mathematics. (5 marks)
  4. Save the modified dataset with an additional column “Average\_Score” to a new CSV file. (5 marks)
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## Question 2: Data Analysis with Pandas (20 Marks)

Using the dataset “Sales Data” (provided in the appendix), write a Python script to:

1. Load the dataset into a Pandas DataFrame. (4 marks)
  2. Compute the total revenue generated. (5 marks)
  3. Find the product with the highest sales in terms of quantity. (5 marks)
  4. Create a new column “Revenue\_per\_Item” (Revenue / Quantity\_Sold). (6 marks)
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## Question 3: Data Visualization with Matplotlib and Seaborn (20 Marks)

Using the dataset “Weather Data” (provided in the appendix), write a Python script to:

1. Load the dataset into a Pandas DataFrame. (4 marks)
  2. Plot a line graph showing temperature variations over time using Matplotlib. (6 marks)
  3. Use Seaborn to create a scatter plot showing the relationship between temperature and humidity. (5 marks)
  4. Customize the plots with titles, axis labels, and legends. (5 marks)
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## Question 4: Application of Python in Mathematics (20 Marks)

Write a Python program to:

1. Implement a function that computes the determinant of a 3x3 matrix. (6 marks)
2. Use NumPy to solve the system of linear equations:

$$2x + 3y - z = 5$$

$$4x - y + 2z = 6$$

$$-x + 5y + 3z = -2$$

(6 marks)

3. Compute and plot the sine and cosine functions for values between 0 and 360 using Matplotlib. (8 marks)

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## Question 5: File Input and Output, Functions, and Exception Handling (20 Marks)

Using the text file “Student Names and Scores” (provided in the appendix), write a Python script to:

1. Read the file and store the student names and scores in a dictionary. (5 marks)
2. Write a function that takes a student’s name as input and returns their score. (5 marks)
3. Handle exceptions gracefully, such as handling cases where the student’s name is not found. (5 marks)
4. Write the modified dictionary to a new file, storing student names and their squared scores. (5 marks)

## Question 6: Functions and Exception Handling (20 Marks)

Write a Python function that takes two numbers as input and performs division.

### Tasks:

1. Define a function `safe_divide(a, b)` that returns the result of `a / b`. (5 Marks)
2. Handle exceptions properly to **avoid division by zero errors** and print a custom error message. (10 Marks)
3. Test your function with three different input values and display the results. (5 Marks)

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## Appendices: Datasets

### Student Scores Dataset (Question 1)

Student\_ID,Math\_Score,Physics\_Score,Chemistry\_Score,Biology\_Score

S001,78,85,90,88

S002,65,70,75,60

S003,90,95,85,92

S004,55,60,58,65

S005,80,85,78,82  
S006, 55, 40, 60, 35  
S007, 80, 90, 92, 33  
S008, 45, 15, 67, 42  
S009, 14, 98, 12, 46  
S0010, 23, 58, 90, 95

## **Sales Data Dataset (Question 2)**

Date,Product,Quantity\_Sold,Revenue  
2025-01-01,Laptop,5,5000  
2025-01-02,Phone,10,7000  
2025-01-03,Tablet,4,3200  
2025-01-04,Laptop,2,2000  
2025-01-05,Phone,8,5600

## **Weather Data Dataset (Question 3)**

Date,Temperature,Humidity,Rainfall  
2025-01-01,22,60,5  
2025-01-02,24,55,0  
2025-01-03,20,70,10  
2025-01-04,18,80,15  
2025-01-05,25,50,0

## **Student Names and Scores (Question 5)**

Alice, 78  
Bob, 85  
Charlie, 90  
Diana, 65  
Eve, 88  
Jim, 70  
Otieno, 98  
Kamau, 45  
Etyang, 78  
Mueni, 90  
Aisha, 95

**End of Examination**