Python course work

Question 1:

Codes used:

- **swap_first_last()**: Takes the number as a string and swaps the first and last digits using slicing.
- **reverse_number()**:Reverses the number by converting it to a string and using [::-1].
- **mathematical_problem()**:
  *)Used a while loop to repeatedly ask for input.
  *)Validates input using isdigit() and checks the number range using 100 <= num <= 9999.
  *) Performs operations like swapping digits, finding the difference, reversing the difference, and summing them.
  - Please input number at last 3 digit or 4 digits.

Question2:

Libraries used: numpy

- ❖ Part a: using if and else function to check if the number is non-negative.
- ❖ Part b: used codes **(np.linalg.inv)** and **(A.transpose())** to find inverse and transpose. Further, find the answer of given equation 49(B −1) ^2 + 7B ^−1A^ T + 7A ^TB^ −1 + (A T) ^2
- ❖ Part c: Find (B-2C)^-1=A ?

Here, I took inverse on both side resulting in (B-2C)=A^-1 then I got final expression as

C=0.5*(B-A^-1)

- ❖ Part d: Show that M is invertible and find M^−1 ?

First I took determinant of M which was not = to 0 and then find M^-1

- ❖ Part e: eigenvalues of matrix M= 1,-3 and

an eigenvector corresponding to each eigenvalues were= for 1 it is [1,1] and

for -3 it is [0,1] both are in column not row. Find out using det(M-lamda*I)=0 equation

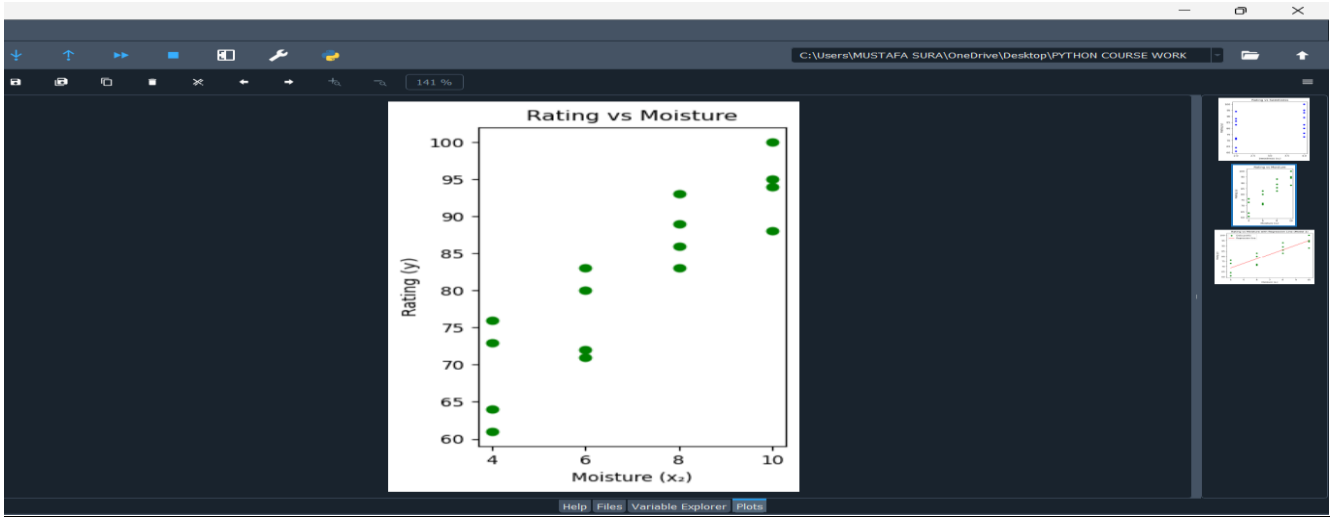
- ❖ Part f: M = P DP^−1 here, matrix P formed by placing [V1,V2] eigenvectors, then took inverse of P and finally find out the diagonal matrix D which is with eigen values on diagonals.

Question 3:

❖ **Part b:**

Plot 1: Rating vs Sweetness: The scatter plot shows that as Sweetness increases from 2 to 4, the Rating tends to increase for each level of Moisture, suggesting a positive relationship.

Plot 2: Rating vs Moisture: As Moisture increases from 4 to 10, the Rating generally increases, indicating a strong positive relationship.



❖ **Part c:** Model 1: slope= 4.375 intercept= 68.625

The estimated regression equation for Model 1 is:

Rating = 68.62 + 4.38 * Sweetness

Model 2: slope = 4.425 intercept = 50.77

The estimated regression equation for Model 2 is:

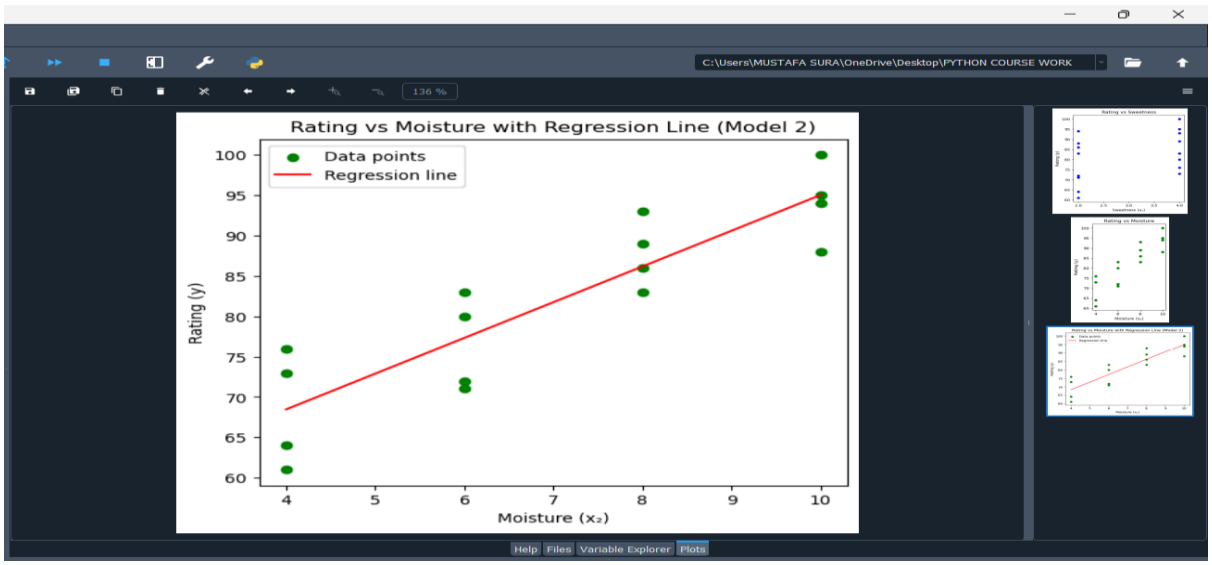
Rating = 50.78 + 4.42 * Moisture

- **Part d:** At a significance level of alpha=0.05. Since 0.130 > 0.05, we fail to reject the null hypothesis. Therefore, it's not a significant relationship between Sweetness and Rating in Model 1 at the 5% significance level because the p-value (0.130) is greater than 0.05.

- **Part e:** Value of R^2= 0.7964 for model 2
  Interpretation: This indicates that 79.6% of the variation in the Rating can be explained by the Moisture level of the pastry.

- **Part f:** By comparing R^2 and p-value of both models 1 and 2 the model 2 is more perfect to use in estimating the rating of a pastry.
  This is because Model 2 has a **higher R^2 value (0.796)**, indicating better explanatory power, and the predictor **Moisture is statistically significant (p < 0.05)**.Contrary to this, Model 1 has a low R^2 and an insignificant predictor.

- **Part g:** scatter plot just like the one in (3b) but also with an estimated regression line:



  - The plot shows a strong positive linear relationship between Moisture and Rating.
  - As Moisture increases, the Rating also tends to increase.

- **Part h:** If a new record of ratings on sweetness is 6 and moisture is 10, based on your selected model in (3f), what is the predicted pastry rating?
  Can't use Sweetness as in model 2 its **between Rating and Moisture**
  Therefore, using Moisture=10
  Gives the predicted pastry rating as 95.025