

Applied Machine Learning Workshop (CSE 3193)

ASSIGNMENT-4: CRASH COURSE ON LINEAR ALGEBRA AND STATISTICS

1. Write a program to solve the given linear equation using numpy with and without using solve function.

$$2a+b+c=4$$

$$a+3b+2c=5$$

$$a=6$$

2. Write a Python program to find the inverse of a given matrix.

Matrix1=[[8, 3, -2], [-4, 7, 5], [3, 4, -12]]

3. Write Python code to find the Euclidean distance between two vectors with and without using built-in functions.

v=[1,2,3]

w=[1,1,1]

4. In a study on feelings of stress and life satisfaction. Participants completed a measure of how stressed they were feeling (on a 1 to 30 scale) and how satisfied they felt with their lives (measured on a 1 to 10 scale). The table below indicates the participants' scores.

Participants	Stress Score(X)	Life Satisfaction(Y)
1	11	7
2	25	1
3	19	4
4	7	9
5	23	2
6	6	8
7	11	8
8	22	3
9	25	3
10	10	6
11	12	7
12	21	4
13	5	3
14	17	1
15	26	5
16	14	2

Table 1: Stress level vs. Life Satisfaction

Using the given data, answer the following questions.

- Create a data frame for the above dataset.
- Plot a scatter plot of stress vs. life satisfaction to provide better data visualization.
- Write a Python code to compute the mean of stress and life satisfaction with and without using the built-in function.

- iv) Write a Python code to compute the median for life satisfaction.
 - v) Write a Python code to arrange the life satisfaction in increasing order.
 - vi) Write a Python code to compute the above data's standard deviation with and without using the built-in function.
 - vii) Write a Python code to find the correlation between stress and life satisfaction.
 - viii) Write Python code to find the mode of life satisfaction without using a built-in function.
5. Analyze the dataset as shared and answer the following questions:
- i) Write a Python program to create a data frame for the given dataset and find the number of rows and columns.
 - ii) Write a Python program to describe the dataset.
 - iii) Write a Python program to find the maximum number of projects a person handles.
 - iv) Write a Python program to find the mean of the average_monthly_hours spent.
 - v) Write a Python program to find the median of maximum_time_spend company
 - vi) Write a Python program to generate the descriptive statistics table.
 - vii) Write a Python program to create a histogram of satisfaction_level and discuss the distribution.
6. For the given data set, compute the z score with mean and standard deviation (without using functions).
Data=[12,15,1821,24,27,30,33,36,39]
7. Write a Python program to plot a normal distribution for height for a mean of 175 and a standard deviation of 6 where the number of observations is 10000.
8. Write a Python program to standardize the distribution by computing the z-score for each data point and print the percentage of data within one and two standard deviations.
9. Write a Python code to find the percentage of men shorter than 183 cm with a mean of 175 and a standard deviation of 5.
10. Write a Python code to find the probability of a man's being more than 177 cm.
11. Write a Python program to find the point of function minima using the Gradient Descent method without the built-in function, taking the initial solution $x_0 = 2$.

$$f(x) = x^2 + \sin(x)$$

12. Write a Python program to find the point of minima of the Rosenbrock function using the Gradient Descent method (without using built-in), taking the initial solution (0,0). Rosenbrock's function is defined below.

$$f(x, y) = (1 - x)^2 + (y - x^2)^2$$

13. Write a Python program using a gradient descent algorithm to find the smallest value among all three-dimensional vectors. The function is smallest when its input v is a vector of zeros.

$$f(x, y, z) = x^2 + y^2 + z^2$$