GOMYCODE

Checkpoint Challenge

Data Analysis and Matrix Operations

1) **Create a matrix with 2 rows and 3 columns and fill it with random numerical data.**

Consider the matrix below:

$$\begin{vmatrix} 8 & 7 & 5 \\ 15 & 6 & 19 \end{vmatrix}$$

2) **Identify the data type of the matrix and calculate the mean, mode and median of the data.**

The elements of the above matrix are numerical.

- Calculation of the mean
  To calculate the average, we divide the sum of the elements of the matrix by the number of elements of the matrix.
  The mean = (8+7+5+15+6+19)/6 = 60/6 = 10

- Calculation of the mode
  To find the mode of the matrix, we will first need to convert the matrix into a vector and then find the most frequent value within that vector. So, we got:
  (8,7,5,15,6,19)

  Since there is no most frequent value, we can conclude that this matrix has no mode.

- Calculation of the median
  To find the mode of the matrix, we will first sort the data of the matrix and the then find the middlemost element of the matrix:
  Sorted element: 5,6,7,8,15,19.
  The median is (7+8)/2 = 7.5

3) **Perform basic matrix operations (addition, subtraction, transpose and scalar multiplication) on the matrix.**

Let consider this second matrix:

$$\begin{vmatrix} 11 & 7 & 9 \\ 5 & 18 & 4 \end{vmatrix}$$

- Addition:

$$\begin{vmatrix} 8 & 7 & 5 \\ 15 & 6 & 19 \end{vmatrix} + \begin{vmatrix} 11 & 7 & 9 \\ 5 & 18 & 4 \end{vmatrix} = \begin{vmatrix} 8+11 & 7+7 & 5+9 \\ 15+5 & 6+18 & 19+4 \end{vmatrix} = \begin{vmatrix} 19 & 14 & 14 \\ 20 & 24 & 23 \end{vmatrix}$$

- Subtraction

$$\begin{vmatrix} 8 & 7 & 5 \\ 15 & 6 & 19 \end{vmatrix} - \begin{vmatrix} 11 & 7 & 9 \\ 5 & 18 & 4 \end{vmatrix} = \begin{vmatrix} 8-11 & 7-7 & 5-9 \\ 15-5 & 6-18 & 19-4 \end{vmatrix} = \begin{vmatrix} -3 & 0 & -4 \\ 10 & -12 & 15 \end{vmatrix}$$

- Transposition of the first matrix

$$\begin{vmatrix} 8 & 7 & 5 \\ 15 & 6 & 19 \end{vmatrix} = \begin{vmatrix} 8 & 15 \\ 7 & 6 \\ 5 & 19 \end{vmatrix}$$

- Scalar multiplication

$$\begin{vmatrix} 8 & 7 & 5 \\ 15 & 6 & 19 \end{vmatrix} \times 5 = \begin{vmatrix} 8x5 & 7x5 & 5x5 \\ 15x5 & 6x5 & 19x5 \end{vmatrix} = \begin{vmatrix} 40 & 35 & 25 \\ 75 & 30 & 95 \end{vmatrix}$$

4) Research and find a real-world application of matrices in data analysis and explain how it is used.

One of the everyday uses of matrices is image editing. For example, we take an image of dimension 1000 x 1000 pixels, we consider that this image is a matrix of dimension 1000x1000, where each pixel is represented by a number, for a black and white image we can for example represent black by 1 and white by 0, with a tint of gray in between, more black towards 1 and vice versa. Thus, the images become matrices to which we can do any kind of calculation with other matrices. There are many matrices which allow, through the multiplication of the latter, to change an aspect of the image such as the Kernel matrix which makes the image more blurred.