Experiment-1

Matrix Operations

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Purpose: You are asked to write three functions to perform basic matrix operations; matrix addition, matrix multiplication and matrix transpose. You need to verify your functions by comparing the results with the examples in the laboratory procedure given in the last section.

Programming should be according to the format given below:

1. **(10 points)** You are asked to choose which matrix operation to perform in main function.

2. **(10 points)** The size of the arrays is asked from the user.

3. **(10 points)** <u>Request an error message when the sizes of the arrays do not match.</u> For example, for matrices multiplication <u>column size of the first operand matrix</u> must <u>match the row size of the second operand matrix.</u> Matrix sizes must be entered according to the rule so that the selected matrix operator can work.

4. **(20 points)** Separately functions should be written for all matrix operations.

   * Write a matrix addition function that has the following prototype.

```
// Function prototype for matrix addition
void matrix_ADD (
        double A[n][m], // the first operand matrix
        double B[n][m], // the second operand matrix
        double C[n][m]);// the output of the addition operation
```

   * Write a matrix multiplication function that has the following prototype.

```
// Function prototype for matrix multiplication
void matrix_MULT(int p,  int n, int m, int q,
        double A[n][m], // the first operand matrix
        double B[n][m], // the second operand matrix
        double C[n][m]);// the output of the multiplication operation
```

   * Write a matrix transpose function that has the following prototype.

```
// Function prototype for matrix transpose
void matrix_transps(
        double A[n][m], // the first operand matrix
        double T[n][m]);// the output of the transpose operation
```

5. Show the working functions by showing the outputs matching the manually solved questions in the last section laboratory procedure. (**Total 50 points**; 25 points for multiplication, 15 points for addition and 10 points for transpose)

Example output:

Enter the row (n) index value of the matrix   : **2**
Enter the column (m) index value of the matrix: **3**

Please choose the matrix operation you want to do:
1.   Matrices addition
2.   Matrices multiplication
3.   Matrices transpose

1
Matrix addition operation selected

Create the content of the first operand matrix:
1   2   3
4   5   6

Create the content of the second operand matrix:
6   5   4
3   2   1

Matrices Addition:
7   7   7
7   7   7

2
Matrix multiplication operation selected

Create the content of the first operand matrix:
1   2   3
4   5   6

Number of rows of the second operand matrix
3
Number of columns of the second operand matrix:
2

Create the content of the second operand matrix:
9   8
6   5
3   2

Matrices Multiplication:
30   24
84   69

Lab Procedure

- Write the main program to call the functions to solve the problems below, and verify your results

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} + \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} = \begin{bmatrix} 2 & 4 & 6 \\ 8 & 10 & 12 \\ 14 & 16 & 18 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} . \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} = \begin{bmatrix} 30 & 36 & 42 \\ 66 & 81 & 96 \\ 102 & 126 & 150 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}^T = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$$

Hint: You can use the hint given below for multiplication operation:

```
for (i=0; i<n;i++){
        for (j=0; j<p; j++) {
                for (k=0; k<m;k++){
                        ....
                        ....
```