Hacettepe University
Department of Electrical and Electronics Engineering
ELE122 - Computers And Programming Laboratory

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Experiment 3

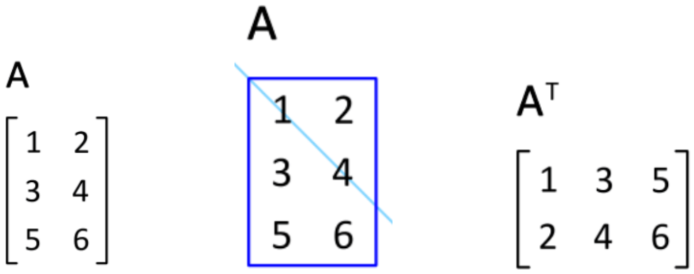
Q1) In linear algebra, the trace of a **square** matrix (N × N) is defined to be the sum of the main diagonal elements. Mathematical expression of the trace of a matrix is

$$tr(\mathbf{A}) = a_{11} + a_{22} + \cdots + a_{NN} = \sum_{i=1}^{N} a_{ii}$$

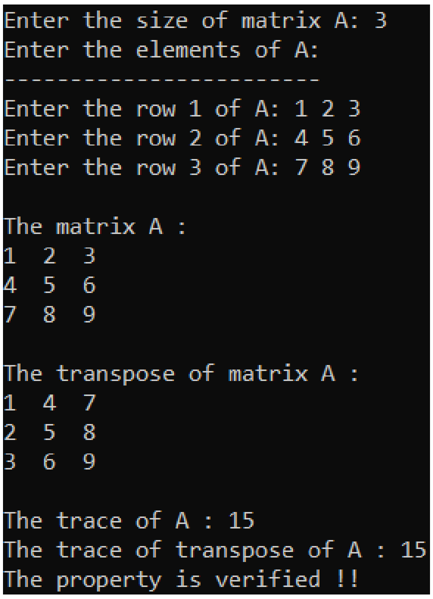
where a_{ii} denotes the entry on the ith row and ith column of **A**. One of the basic properties of the trace is as follows:

$$tr(\mathbf{A}) = tr(\mathbf{A}^T)$$

where $\mathbf{A}^T$ represents the transpose of **A**. The transpose of a matrix is an operator which flips a matrix over its diagonal; that is, it switches the row and column indices of the matrix **A** by producing another matrix. An example of the transpose of a matrix is shown below.



Write a C program that verifies this property. The program asks the user to enter the dimension of matrix **A**. To calculate the trace of **A**, the number of rows and columns of matrix A must be equal. The user needs to enter the elements of matrix **A.** An example output of the program is as follows:



```
Enter the size of matrix A: 3
Enter the elements of A:
------------------------
Enter the row 1 of A: 1 2 3
Enter the row 2 of A: 4 5 6
Enter the row 3 of A: 7 8 9

The matrix A :
1  2  3
4  5  6
7  8  9

The transpose of matrix A :
1  4  7
2  5  8
3  6  9

The trace of A : 15
The trace of transpose of A : 15
The property is verified !!
```

Q2) Write a C program to compute the perimeter and area of a rectangle as follows:

i. The user will enter the length and width of the rectangle.

ii. The user will choose the operation (area or perimeter calculation).

iii. You are restricted to use **<u>switch cases</u>** while asking the operation choice to the user.

iv. You have to write two functions for operations and then call these functions from the main program.

Use the following function prototype:

```
float computeArea(float length, float width)
float computePerimeter(float length, float width)
```