Lab 13 Two-dimensional Arrays

Introduction to Computer Science I

# Objectives:

After performing this lab, the students should be able to

* write C++ programs that involve two-dimensional arrays

# Names of Lab Group Members:

## Activity

Provide your C++ source code and screenshots of your program outputs.

For this activity, refer to the text example on matrix multiplication (Figure 5.14.2: Matrix multiplication of 4x2 and 2x3 matrices).

Write a program that perform the following operations on two 4 x 4 matrices (m1 and m2):

* Read the values to be stored in the two 4 x 4 matrices from the user, assuming that the values are entered from the first row to the last, in each of which numbers in the columns are entered sequentially. (You may assume that the user will enter exactly 16 values per matrix)
* Display the sum of the two matrices m1 and m2 (m1 + m2) (add the corresponding elements in m1 and m2)

\begin{align}
\bold{A}+\bold{B} & = \begin{bmatrix}
 a_{11} & a_{12} & \cdots & a_{1n} \\
 a_{21} & a_{22} & \cdots & a_{2n} \\
 \vdots & \vdots & \ddots & \vdots \\
 a_{m1} & a_{m2} & \cdots & a_{mn} \\
\end{bmatrix} + 

\begin{bmatrix}
 b_{11} & b_{12} & \cdots & b_{1n} \\
 b_{21} & b_{22} & \cdots & b_{2n} \\
 \vdots & \vdots & \ddots & \vdots \\
 b_{m1} & b_{m2} & \cdots & b_{mn} \\
\end{bmatrix} \\
& = \begin{bmatrix}
 a_{11} + b_{11} & a_{12} + b_{12} & \cdots & a_{1n} + b_{1n} \\
 a_{21} + b_{21} & a_{22} + b_{22} & \cdots & a_{2n} + b_{2n} \\
 \vdots & \vdots & \ddots & \vdots \\
 a_{m1} + b_{m1} & a_{m2} + b_{m2} & \cdots & a_{mn} + b_{mn} \\
\end{bmatrix} \\

\end{align}\,\!

* Ask the user for a scalar (a number) and multiple each element of the two matrices by the scalar. Display the results.

 \lambda \mathbf{A} = \lambda \begin{pmatrix}
A_{11} & A_{12} & \cdots & A_{1m} \\
A_{21} & A_{22} & \cdots & A_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
A_{n1} & A_{n2} & \cdots & A_{nm} \\
\end{pmatrix} = \begin{pmatrix}
\lambda A_{11} & \lambda  A_{12} & \cdots & \lambda A_{1m} \\
\lambda A_{21} & \lambda A_{22} & \cdots & \lambda A_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
\lambda A_{n1} & \lambda A_{n2} & \cdots & \lambda A_{nm} \\
\end{pmatrix}.

* Determine whether each of the matrices is an identity matrix. A matrix is an identity matrix if its main diagonal contains only 1s and 0s elsewhere.


I_1 = \begin{bmatrix}
1 \end{bmatrix}
,\ 
I_2 = \begin{bmatrix}
1 & 0 \\
0 & 1 \end{bmatrix}
,\ 
I_3 = \begin{bmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1 \end{bmatrix}
,\ \cdots ,\ 
I_n = \begin{bmatrix}
1 & 0 & \cdots & 0 \\
0 & 1 & \cdots & 0 \\
\vdots & \vdots & \ddots & \vdots \\
0 & 0 & \cdots & 1 \end{bmatrix}
