Shiv Nadar University <u>CSD101: Introduction to Computing and Programming</u> Quiz #2

Max marks: 35 Time:12.00-12.40pm + 5mins (for upload) 30-Oct-2021

1. Submit a C code file that can be compiled on the C50 platform.

- 2. DO NOT submit pdf, docx, image files. They will not be graded.
- 3. All uploads must be completed by 12.45pm. Late submissions may not be graded.
- 1. You are given an $m \times n$ matrix of integer numbers note that the matrix can contain positive, negative and zero entries. Write a C program (using the template given on the next page) that finds the sub-matrix that has the maximum value for the sum of its entries. If more than one sub-matrix has the same value then output the one with the fewest entries. If the number of entries are also the same then output any one of them.

Note that a sub-matrix is one that has contiguous rows and columns from the original matrix. It can be represented by $(r_1, c_1), (r_2, c_2)$ where $r_1 \leq r_2$ and $c_1 \leq c_2$. (r_1, c_1) is the top-left corner entry and (r_2, c_2) is the bottom-right corner entry of the sub-matrix.

For example, consider the matrix:

 $\begin{bmatrix} 3 & 1 & -5 & 2 \\ 10 & 0 & 3 & 1 \\ -6 & 4 & 11 & -7 \end{bmatrix}$

The sub-matrix with the maximum value for the sum of entries is:

 $\begin{bmatrix} 10 & 0 & 3 \\ -6 & 4 & 11 \end{bmatrix}$

The maximum value is 22.

Another example: suppose the matrix is:

-1	4]
-2	-3
$^{-5}$	-6

The maximum value sub-matrix is 4 and the maximum value is also 4.

Your C code must use the template given below.

Fill in the code for the functions readMatrix and printMatrix. Then fill in the code below the comment line //Code for ... in the main function. Some declarations and code are already present in main. You should use them. Make any additional declarations that you need at the location indicated by the comment.

The template starts below.

```
#include <stdio.h>
#include <stdlib.h>
#define N 10
void readMatrix(int arr[][N], int rows, int cols) {
   //Reads matrix row wise.
}
void printMatrix(int arr[][N], int r1, int r2, int c1, int c2) {
   /* Prints the sub-matrix from r1,c1 to r2,c2. r1<=r2; c1<=c2 */
}
int main() {
   int arr[N][N];
   int rows, cols;//number of rows and cols in matrix
   int mr1, mc1, mr2, mc2;//boundaries of maximal value sub-matrix
   int mval;//Value of maximal submatrix
   int noOfentries;//number of entries in maximal submatrix
   //Put any added declarations that you may need below
   printf("Give number of rows and cols. Should be >0, <=10 = ");</pre>
   scanf("%d%d",&rows, &cols);//reads number of rows, cols
   //Code for reading matrix
   //Code for finding the maximal value sub-matrix
   printf("\nMaximal Sub-matrix\n\n");
   //Code for printing sub-matrix and max value
   exit(0);
```

}

[35]