60-141 Winter 2018

Assignment 2: 2D Array Manipulation

Due: Wednesday February 28, 2018 11:59pm EST

In this assignment you are to code each of the functions specified below. You will then need to test them with a *main()* function that invokes them by producing the same sequence of calls as the sample output run shown.

Assume the following declarative constants:

```
#define COL 20
#define ROW 20
```

Consider the following function prototype specifications:

```
void PopulateArray2DUnique(int A[][COL], unsigned int rowsize,
unsigned int colsize, int min, int max);
```

Populates the 2D Array of sizes rowsize x colsize with random integers ranging between min and max inclusive.

```
void DisplayArray2D(int A[][COL], unsigned int rowsize, unsigned int
colsize);
```

Display the contents of a 2D array of size rowsize x colsize in a table format; that is each line will display one row where the numbers are separated by a single space character.

```
int FindLargest(int A[][COL], unsigned int rowsize, unsigned int
colsize);
```

Given a 2D array A of size rowsize x colsize, return the largest integer number it contains.

```
int FindColSum(int A[][COL], unsigned int rowsize, unsigned int
colsize, unsigned int col_to_sum);
```

Calculate the sum of a given column col of a 2D array of size rowsize x colsize. Return the sum of that column.

```
int Sort2DArray(int A[][COL], unsigned int rowsize, unsigned int
colsize);
```

Sort a 2D array of size rowsize x colsize in ascending order. i.e. A[0][0] would have the smallest value. Example of a 3x3 sort:
1 2 3
4 5 6
7 8 9

```
int CopyArray2D(int A[][COL], int B[][COL], unsigned int rowsize,
unsigned int colsize);
```

Copy the contents of array A into array B of the same size such that the contents of B would be exactly the contents of A. e.g. copying A into B:
A: B:

```
1 2 3       1 2 3
4 5 6  -->  4 5 6
7 8 9       7 8 9
```

```
int CopyArray2DSpiral(int A[][COL], int B[][COL], unsigned int
rowsize, unsigned int colsize);
```

```
Copy the contents of array A into array B of the same size such that
the contents of B would be exactly the contents of A except they will
be in a clockwise spiral sorted order. e.g. copying A into B with
Spiral effects:
A:          B:
1 2 3       1 2 3
4 5 6  -->  8 9 4
7 8 9       7 6 5
Hint: you may consider sorting A first before starting. Note that your
function should work for any size array up to ROW x COL
```

Specific Requirements: [25 pts]

[3 pts x 7] Write the complete definition and documentation for each of the 7 functions given above.
[1 pt] Compilation on the CS server gcc compiler without errors and warnings.
[3 pts] Demonstrate the complete program using a main function capable of processing the input of any array size (not exceeding ROW and COL).

Failure to properly document your entire code will receive a mark of zero.

You are to submit the following:

- Source code file: **assign2.c**
- Script file demonstrating the compilation and execution : **assign2.txt**
  To generate the script file use the following command from the CS server:
  cp assign2.c assign2.bak [this step helps you backup your file in case something goes wrong]
  script assign2.txt [this step creates a new file called assign2.txt]
  cat assign2.c [this step will display the contents of your source code]
  cc assign2.c [this step will show your compilation]
  ./a.out [this step will run your code so you can test it, you may need to run it a few times]
  [test your code here with at least 3 different input test cases]
  exit [this step is important to close the script file and complete it]
  [These steps will create a file called assign2.txt. Do not edit its contents - just submit it!]

Sample OUTPUT Run
(you should repeat it at least 3 times with different input sizes such as 1x1, 3x4, 9x9, 10x5):

```
Testing an array of size: 3 x 4
```
Populate Array with unique random integers between 1 and 99…
DisplayArray2D:
41 91 12 15
81 34 33 25
45 55 94 28
FindLargest: 94
FindColSum of col 0: 167
Sort2DArray followed by DisplayArray2D:
12 15 25 28
33 34 41 45
55 81 91 94
CopyArray2D from A to B, then Display B:
12 15 25 28
33 34 41 45
55 81 91 94
CopyArray2DSpiral from A to B, then Display B:
12 15 25 28
81 91 94 33
55 45 41 34
-- end run –