**Final Exam Programs, COSC 501, Fall 2023 Due date-time: Monday 12/11/2023-11:59pm**

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**Final Programs: Code block design and output evaluation.**

1. Write a C++ program that creates an array with 10 random integers (between 1 and 100) and passes the array to functions to sort the array and print the array.
2. This program creates a linked list with three colors, write the code for the push and pop member functions.

struct node {

string data;

node\* next;

};

typedef node\* pNODE;

class slist { //singly linked list

private:

pNODE pList; //head of slist

public:

//constructor, destructor  
// and member function prototypes. . .

};//slist

int main() {

slist colours;

colours.appNode("green");

colours.appNode("blue");

colours.appNode("violet");

colours.printList("print list:");

printf("#insert indigo after blue...\n");

colours.insColor("blue", "indigo");

colours.printList("print list:");

//printf("#test pop, push member functions...\n");

//call colours.pop() and print...

//call colors.push("red")...

printf("\n");

return 0;

}//main

1. **Jet Propulsion** wants to write a program that takes an array containing a digitized representation  
   for a night sky picture and locates the stars on the picture.   
     
   Each element in the input array denotes the light amount at the corresponding portion of the image when the picture was taken. Light amount ranges from 0 to 20.

**Sample Input:**

0 3 4 0 0 0 6 8

5 13 6 0 0 0 2 3

2 6 2 7 3 0 10 0

0 0 4 15 4 1 6 0

0 0 7 12 6 9 10 4

5 0 6 10 6 4 8 0

A star is probably located in the area covered by array element **a[i][j]** in the case of

**(a[i][j] + sum of 4 surrounding light amounts) / 4.0 > 3.5,**  
  
where 4 surroundings are the 4 neighbors (North, South, East and West).

**Ignore possible stars at the edge of the array, which means you do not need to check the boundary elements.**The output shall be a star map that contains asterisks at where stars present and blanks otherwise. With the given **Sample Input**, your **Sample Output** (star map) might look like:

**Sample Output** (**not correct!!!**)**:**

1 2 3 4 5 6 7 8

1

2 \*

3

4 \*

5 \* \* \*

6

Write **detect** and **printmap** functions in C++. The 2-D array shall be passed to **detect**, which generates a 2-D star map using the aforementioned condition. Please use the following declarations:

const int NR=6, NC=8;

void detect(int t[][NC], int stars[][NC], int nrows, int ncols);

void printmap(int stars[][NC], int nrows, int ncols);

static int lightdata[NR][NC] = {

{ 0, 3, 4, 0, 0, 0, 6, 8 },

{ 5, 13, 6, 0, 0, 0, 2, 3 },

{ 2, 6, 2, 7, 3, 0, 10, 0 },

{ 0, 0, 4, 15, 4, 1, 6, 0 },

{ 0, 0, 7, 12, 6, 9, 10, 4 },

{ 5, 0, 6, 10, 6, 4, 8, 0 }

};

static int starmap[NR][NC];

int main() {

detect(lightdata, starmap, NR, NC);

printmap(starmap, NR, NC);

printf("\n\n");

return(0);

}//main