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AMERICAN UNIVERSITY OF ARMENIA
College of Science and Engineering
COMP120 Introduction to Object-Oriented Programming

MIDTERM 1 EXAM

Date: Tuesday, February 17 2015
Starting time: 10:30
Duration: 1 hour 20 minutes
Attention: **ANY TYPE OF COMMUNICATION IS STRICTLY PROHIBITED**
Please write down your name at the top of all used pages

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Problem 1

Square arrays can be rotated by 90^0, say, in clock-wise direction. For example:

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

→

21	16	11	6	1
22	17	12	7	2
23	18	13	8	3
24	19	14	9	4
25	20	15	10	5

The easiest way to implement the rotation by 90^0 is to transpose the initial square array and then to reverse all its rows separately. Write a Java method ***void rotate(int[][] array2D)*** that takes as its argument a square ***int[][] array2D*** and rotates its. Use already implemented methods ***void reverse(int[] array1D)*** and ***void transpose(int[][] array2D)***:

```
public static void reverse(int[] array1D) {
      for (int i = 0; i < array1D.length / 2; i++) {
            array1D[array1D.length - 1 - i] += array1D[i];
            array1D[i] = array1D[array1D.length - 1 - i] - array1D[i];
            array1D[array1D.length - 1 - i] -= array1D[i];
      }
}

public static void transpose(int[][] array2D) {
      for (int row = 0; row < array2D.length; row++)
            for (int col = row + 1; col < array2D.length; col++) {
                  array2D[row][col] += array2D[col][row];
                  array2D[col][row] = array2D[row][col] - array2D[col][row];
                  array2D[row][col] -= array2D[col][row];
      }
}
```

```
public static void rotate(int[][] array2D)
{ transpose(array2D)
  for(int i=0; i<n; i++)
{ reverse(array2D[.]) }
```

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Use the backside, if needed

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Problem 2

Colors in Java can be represented by objects of type ***Color***. Each such object contains the ***red***, ***green*** and ***blue*** components of the corresponding color as integer values from **0** to **255**. Consider below a Java code that creates and initializes a rectangular array of ***Color*** type:

```
import java.util.Scanner;
import java.awt.Color;

public class Colors {

public static void main(String args[]) {
      Scanner in = new Scanner(System.in);

// Read number of rows and columns and create a Color array of such size
      Color[][] c = new Color[in.nextInt()][in.nextInt()];

// For each element read the red, green and blue components as integers and
// create a Color object by calling Color(int, int, int) constructor
      for (int row = 0; row < c.length; row++)
            for (int col = 0; col < c[0].length; col++)
                  c[row][col] = new Color(in.nextInt(), in.nextInt(), in.nextInt());
// TO BE CONTINUED
}
}
```

Continue with a Java code that creates another array ***Color[][] g*** of the same size and fills it with gray equivalents of the colors from the array ***Color[][] c***. To get a grey equivalent of a given color ***c[i][j]***, it is enough to construct a ***Color*** object, whose red, green and blue components all are equal to the calculated average of red, green and blue components of the initial ***c[i][j]***. Use ***int getRed()***, ***int getGreen()*** and ***int getBlue()*** methods of class ***Color***.

```
Color [][] g = new Color[c.length][c[0].length]
for (i=0; i<g.length; i++)
for (int j = 0; j<g.length; j++)
{ g[i][j] = new Color(in.nextInt(), in.nextInt(), in.nextInt())
  int average = (g[i][j].getRed() + g[i][j].getGreen() +
                + g[i][j].getBlue()) / 3;
  g[i][j] = new Color(average, average, average);
}
}
```

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Problem 3

Similar to files, strings also can be related to streams in C++, this time using ***stringstream*** objects. Particularly, it is enough to create an object of type ***istringstream*** to organize formatted reading from a string. Consider, for example, a C++ code below:

```
#include <string>
#include <sstream>
#include <iostream>
using namespace std;

void main()
{
	string text = "Before_increment: 199999999", word;
	int num;
	istringstream tokens(text);

	tokens >> word >> num;
	cout << "After " << word.substr(7) << num + 1 << endl;
}
// After increment:200000000
```

Write a C++ function ***double value(string expression)*** that takes as its argument a string representing an arithmetic expression, evaluates it and returns its value. The expression includes only '+' and '–' operations and double operands, both positive and negative. The operands and operations are delimited by spaces.

For example, ***value("5.1 – -0.7 + 1.2")*** results in ***7.0***.

```
double value(string expression)
{ istringstream tokens(expression);

  char action;
  double a;
  double result;
  tokens >> result;
  while (tokens >> action)
  { if (action == '+') {
        tokens >> a;
        result += a;
  }
  else if (action == '-')
  { tokens >> a;
    result -= a;
  }
  }
  return result
}
```

Use the backside, if needed