Tuesday, 25 April 2017
9.30 am – 11.30 am
(Duration: 2 hours)

DEGREES OF MSc in Information Technology, MSc in Software Development

PROGRAMMING

(Answer all 5 questions.)

This examination paper is worth a total of 75 marks

The use of a calculator is not permitted in this examination

This page is intentionally left blank

1. Imagine you have to write a loop that sums over all numbers between `1` and `100` (included), i.e., a loop that calculates the sum `1+2+3+…+100`.

    (a) Write the loop using a `while` construct.

        [4 marks]

    (b) Write the same loop using a `do while` construct.

        [2 marks]

    (c) Write the same loop using a `for` construct.

        [4 marks]

2. According to the Chinese Horoscope, `1909` was a Rooster Year. Since then, there has been a rooster year every `12` years, i.e., in `1921`, `1933`, `1945`, `1957`, `1969`, `1981`, `1993`, `2005`, and `2017`. Write a helper method `isRoosterYear` that takes as input an integer number `year` between `1900` and `2017` (included) and returns a boolean variable `roosterYear` which is `true` if year is a Rooster Year and `false` otherwise.

Marks will be awarded as follows (10 in total):

- 4 marks: method header;
- 4 marks: method body;
- 2 marks: general structure of the method.

Marks will not be deducted for trivial syntax errors.

3. Consider the following main method:

```
public static void main(String args[]){

        int i = 0;
        boolean test = true;

        if (test) {

              int k = 3;

        }

        System.out.println(i);
        System.out.println(k);

}
```

(a) Does the `main` method above include syntax errors? If yes, which ones?

[4 marks]

(b) Imagine the main method above is modified as follows:

```
public static void main(String args[]){

        int i = 0;
        boolean test = true;

        if (test) {

              int k = 3;

        }

        int k = 2;

        System.out.println(i);
        System.out.println(k);

}
```

Does this new version of the `main` method includes syntax errors?

[2 marks]

(c) If the modified version of the `main` method - the one at point **(b)** above - includes syntax errors, explain which ones. Otherwise, write what the program prints on the screen.

[4 marks]

4. Write a complete program to read from a file called `phone.txt`, which is in the current directory. This file contains a series of lines, each with a name and number separated by a "`:`" character. Here are three sample lines:

```
Ron Poet: 123
Fred: 456
Roy  R  Poet : 789
```

Note that names can include a variable number of spaces. There will be a variable number of lines of data, but no more than 1000.
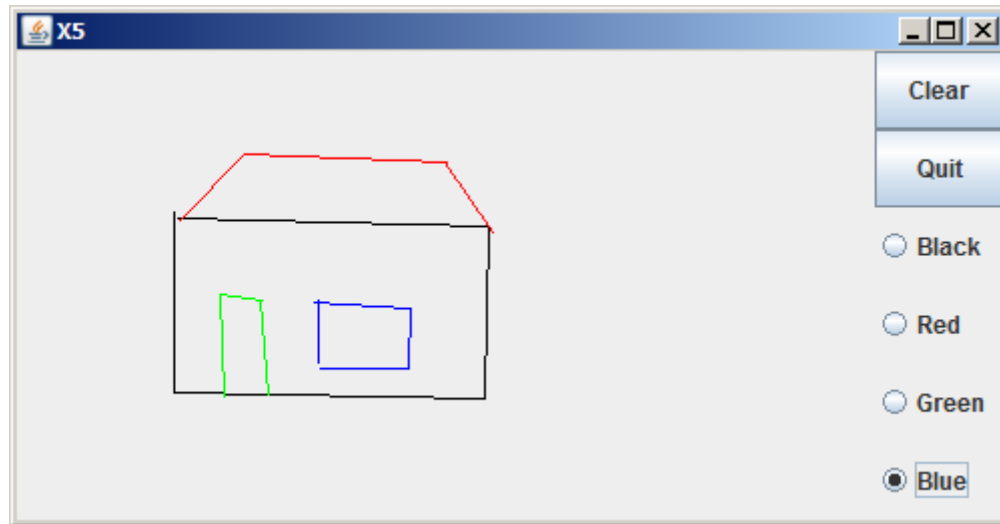
Your program should first read the information from the file `phone.txt` into an appropriate internal data representation. It should then sort the information alphabetically by name, before writing it out in tabulated form, with 40 characters for each name and 12 for each number, in a file called `phonebook.txt`. You should write your own sorting algorithm as part of this exam question.

Marks will be awarded as follows (20 in total):

- 6 marks: file handling;
- 5 marks: sorting;
- 2 marks: formatting;
- 3 marks: internal data structure;
- 4 marks: general structure of the program.

Marks will not be deducted for trivial syntax errors.

5. Write a program that lets the user create simple line drawings with the mouse. The user interface should look like this:

The drawing area is on the left hand side. The user draws a single line by positioning the mouse at the start of the line, pressing and holding the left mouse button, moving the mouse to the end of the line and then releasing the mouse button. Several lines, but not more than 100, can be drawn this way, creating a simple drawing.

The right hand side is a control panel with two buttons, one to clear the screen and the other to quit the program. The control panel also contains a group of four radio buttons to select the drawing colour. The available colours are: BLACK, RED, GREEN and BLUE.

You do not need to provide the class to do the drawing. You can use the following class and associated methods:

```
public class Q5Component
{
        public Q5Component();
        public void addLine(int x1,int y1,int x2,int y2,Color
col);
        public void clear();
        public void repaint();
}
```

Marks will be awarded as follows (25 in total):

- 5 marks: creating the control panel;
- 5 marks: responding to the Clear and Quit buttons;
- 3 marks: positioning the drawing area;
- 3 marks: responding to mouse press events;
- 4 marks: responding to mouse release events;
- 5 marks: general structure of the program.

Marks will not be deducted for trivial syntax errors.