

Family Name:

Other Names:

ID Number:

COMP102: Test 1

25 March, 2010

Instructions

Model Solutions

- Time allowed: **45 minutes** .
- Answer **all** the questions. There are 45 marks in total.
- Write your answers in the boxes in this test paper and hand in all sheets.
- If you think some question is unclear, ask for clarification.
- Brief Java documentation is provided with the test
- This test contributes 15% of your final grade
(But your mark will be boosted up to your exam mark if that is higher.)
- You may use paper translation dictionaries, and calculators without a full set of alphabet keys.
- You may write notes and working on this paper, but make sure your answers are clear.

Questions

Marks

1. Basic Java	[5]	<input type="text"/>
2. Understanding variables	[6]	<input type="text"/>
3. Defining a Method	[10]	<input type="text"/>
4. Understanding Scanner and System.out	[9]	<input type="text"/>
5. Programming with Scanner and DrawingCanvas	[8]	<input type="text"/>
6. Methods calling methods	[7]	<input type="text"/>
	TOTAL:	<input type="text"/>

Please answer the following question. (Your answer will not affect your mark in any way.)

How much programming had you done before starting the course?

Little or none

Some (used variables, if's, and loops)

Lots (eg, used arrays, defined methods/functions with parameters, used libraries)

ANSWERS

Question 1. Basic Java

[5 marks]

Consider the class below. Your answers to the questions on the facing page should be a line number or a list of line numbers. (You may abbreviate, as in "2, 6–9, 15" instead of "2, 6, 7, 8, 9, 15")

```
1 public class Question1 {
2
3     public void printQuotation(){
4         Scanner sc = new Scanner(System.in);
5         System.out.println("Number of assays: ");
6         int aNum = sc.nextInt();
7         System.out.println("Test category: ");
8         String tCateg = sc.next ();
9         double cost = computeCost(aNum, tCateg);
10        System.out.printf("Perform %d %s tests: $%d\n", aNum, tCateg, cost);
11    }
12
13    public double computeCost(int num, String categ){
14        double ans;
15        if (categ.equals("bioassay")){
16            ans = 80.50 + (num * 13.40);
17        }
18        else {
19            ans = 65.80 + (num * 8.90);
20        }
21        return ans;
22    }
23 }
```

(Question 1 continued on next page)

(Question 1 continued)

ANSWERS

The following questions refer to the code on the facing page:

(a) [1 mark] Which line or lines contain the definition of the computeCost method?

13–22

(b) [1 mark] Which line or lines contain the header of the printQuotation method?

3

(c) [1 mark] Which line or lines contain an assignment statement?

4, 6, 8, 9, 16, 19

(d) [1 mark] Which line or lines contain a declaration of a variable?

4, 6, 8, 9, 14. 13 is also acceptable

(e) [1 mark] Which line or lines contain a declaration of a parameter?

13

ANSWERS

Question 2. Understanding variables

[6 marks]

What will the following game method print out?

Hint: draw a box for each variable and keep track of the value that is put into it.

```
public void game(){
    int score = 30;
    int numEggs = 11;
    System.out.println("score=" + score);
    System.out.println("Jumped bridge");
    score = score - numEggs;
    numEggs = numEggs - 2;
    System.out.println("score=" + score);
    System.out.println("numEggs=" + numEggs);
    System.out.println("Tripped");
    int oldEggs = numEggs - 1;
    numEggs = numEggs * 2 / 3;
    score = score + (oldEggs / 3);
    System.out.println("score=" + score);
    System.out.println("numEggs=" + numEggs);
    System.out.println("oldEggs=" + oldEggs);
}
```

```
score=30
Jumped bridge
score=19
numEggs=9
Tripped
score=21 ( 8 / 3 gives 2)
numEggs=6
oldEggs=8
```

ANSWERS

Question 3. Defining a Method

[10 marks]

A university student association provides funding to student clubs based on the number of members. The grant is \$50 plus an additional \$12 per member for each member beyond the first 10. For example, a club with 3 members would get \$50; a club with 30 members would get $\$50 + \$12 \times 20 = \$290$.

Complete the following `printClubGrant` method which has two parameters — the club name and the number of members — and should print out the amount of the grant for club. If there are fewer than 10 members, the method should also print out a reminder to provide signed attendance records.

For example, calling `printClubGrant("Darts Club", 30)` should print out

```
Grant for Darts Club is $290
```

Calling `printClubGrant("Tiddliwinks Club", 3)` should print out

```
Grant for Tiddliwinks Club is $50
Remember to provide signed attendance records.
```

```
public void printClubGrant(String clubName, int members){
    if (members < 10){
        System.out.println("Grant for "+clubName+" is $50");
        System.out.println("Remember to provide signed attendance records.");
    }
    else {
        int grant = 50 + (members-10) * 12;
        System.out.println("Grant for "+clubName+" is $" + grant);
    }
}
OR
int grant = 50;
if (members > 10) {
    grant = grant + (members - 10) * 12;
}
System.out.println("Grant for "+clubName+" is $" + grant);
if (members < 10) {
    System.out.println("Remember to provide signed attendance records.");
}
}
```

ANSWERS

Question 4. Understanding Scanner and System.out

[9 marks]

Consider the following listPrices method which will prompt the user for some input and print something out.

```
public void listPrices (){
    Scanner scan = new Scanner(System.in);
    System.out.println("Items and prices: ");
    String item = "";
    String price= "$0";
    while ( ! item.equals("end") ) {
        item = scan.next();
        System.out.print("One "+item);
        price = scan.next();
        System.out.println(" costs $" + price);
    }
    System.out.println("Finally: " + item + price);
}
```

(a) [3 marks] What will the method print out if the user typed the following (underlined) input in response to the prompt:

Hint: draw a box for each variable and keep track of the value that is put into it.

```
Items and prices:
pot $10, knife $3, end 4
| One pot costs $$10, [Note extra $ and comma]
| One knife costs $$3,
| One end costs $4
| Finally: end4
```

(Question 4 continued on next page)

(Question 4 continued)

ANSWERS

(b) [3 marks] What will the method print out if the user typed the following input in response to the prompt:

```
Items and prices:
book end $20, table end $98, end 0
|
| One book costs $end
| One $20, costs $table
| One end costs $$98,
| Finally: end$98,
```

(c) [3 marks] Explain what the program would do if the user entered just *table* in response to the prompt.

The program would scan the token *table* and print out *One table* then would try to scan another token. Because the user didn't type a second token, it would just wait for the user to type something.

Question 5. Programming with Scanner and DrawingCanvas

[8 marks]

Complete the `drawShapes` method on the facing page. `drawShapes` should let a user specify a set of 10 shapes (circles or squares) and draw them in a window. The program should repeatedly prompt the user for the next shape and its position (using a `Scanner`). At each prompt, the user should enter the kind of shape (square or circle) and the coordinates of the position where the shape should be drawn. The program should then draw a blue square or red circle of width 20 units at the specified position. The method should stop after it has drawn 10 shapes.

For example, if the user responded to the first prompt with *circle 100 100* and to the second prompt with *square 250 380*, the program should draw a red circle of diameter 20 at position (100,100) and a blue square of size 20 at position (250,380).

Hint: look up the documentation for `setColor`, `fillRect`, and `fillOval`.

(Question 5 continued on next page)

(Question 5 continued)

ANSWERS

```
public void drawShapes(){
    JFrame frame = new JFrame("Shapes");
    DrawingCanvas canvas = new DrawingCanvas();
    frame.setSize(600, 400);
    frame.getContentPane().add(canvas, BorderLayout.CENTER);
    frame.setVisible(true);
    Scanner scan = new Scanner(System.in);

    int count = 0;
    while ( count < 10 ){
        System.out.print("Enter shape and coordinates: ");
        String shape = scan.next();
        int x = scan.nextInt ();
        int y = scan.nextInt ();
        if (shape.equals("circle")){
            canvas.setColor(Color.red);
            canvas.fillOval (x, y, 20, 20);
        }
        else {
            canvas.setColor(Color.blue);
            canvas.fillRect (x, y, 20, 20);
        }
        count = count + 1;
    }
}
```

ANSWERS

Question 6. Methods calling Methods

[7 marks]

The following `drawRailwaySign` method is intended to be part of a program for drawing diagrams of roads. `drawRailwaySign` draws two lights on each end of a middle bar; the left light will be red, and the right light will be black. Each light is made of three concentric circles; the width of the bar is the same as the diameter of the lights.



`drawRailwaySign` has three parameters: `x` and `y` specifying the position of the center of the sign, and the `canvas` on which the sign should be drawn.

```
public void drawRailwaySign (int x, int y, DrawingCanvas canvas){
    canvas.setColor(Color.black);
    int width = 16;
    canvas.fillRect (x-width/2, y-1, width, 3); // the bar across the middle

    canvas.fillOval (x-width/2-16, y-8, 16, 16); //outside of left light
    canvas.setColor(Color.white);
    canvas.fillOval (x-width/2-14, y-6, 12, 12); //white ring of left light
    canvas.setColor(Color.red);
    canvas.fillOval (x-width/2-12, y-4, 8, 8); //center of left light

    canvas.setColor(Color.black);
    canvas.fillOval (x+width/2, y-8, 16, 16); //outside of right light
    canvas.setColor(Color.white);
    canvas.fillOval (x+width/2+2, y-6, 12, 12); //white ring of right light
    canvas.setColor(Color.black);
    canvas.fillOval (x+width/2+4, y-4, 8, 8); //center of right light
}
```

The `drawRailwaySign` method is not well designed: it has a lot of repetition and has many constants which are hard to interpret and would make it hard to change the size of the sign. It would be better design to make another method called `drawLight` which draws a single light and make `drawRailwaySign` call the method twice, as in the version of `drawRailwaySign` on the facing page. `drawLight` should also use variables rather than constants.

Complete the definitions of `drawRailwaySign` and `drawLight` on the facing page. You will need to determine the appropriate arguments for the calls to `drawLight`, the appropriate parameters in the definition of `drawLight`, as well as the statements in `drawLight`.

You should define and use variables inside `drawLight` to make the code more readable, and easier to scale.

(Question 6 continued on next page)

(Question 6 continued)

```

public void drawRailwaySign (int x, int y, DrawingCanvas canvas){
    canvas.setColor(Color.black);
    int width = 16;
    canvas.fillRect (x-width/2, y-1, width, 3);    // the bar across the middle

    this.drawRailwayLight( x-width, y, width, Color.red, canvas );

    this.drawRailwayLight( x+width, y, width, Color.black, canvas );
}

public void drawRailwayLight( int x, int y, int sz, Color col,
                             DrawingCanvas canvas){
    int diam = sz;
    canvas.setColor(Color.black);
    canvas.fillOval (x-diam/2, y-diam/2, diam, diam); //outside
    diam = sz *3/4;
    canvas.setColor(Color.white);
    canvas.fillOval (x-diam/2, y-diam/2, diam, diam); //white ring
    diam = sz /2;
    canvas.setColor(col);
    canvas.fillOval (x-diam/2, y-diam/2, diam, diam);    // center
}

}

```

SPARE PAGE FOR EXTRA ANSWERS

Cross out rough working that you do not want marked.
Specify the question number for work that you do want marked.
