THE UNIVERSITY OF AUCKLAND

SUMMER SEMESTER, 2008
Campus: City

COMPUTER SCIENCE

Principles of Programming

(Time allowed: TWO hours)

NOTE: Attempt **ALL** questions
Write your answers in the space provided
There is space at the back for answers that overflow the allotted space
No calculators are permitted

Surname:	
Forenames:	
Student ID number:	
Login name:	

Q1 (/20)	**Q4** (/6)	**Q7** (/6)	**Q10** (/8)
Q2 (/8)	**Q5** (/6)	**Q8** (/8)	**Q11** (/10)
Q3 (/8)	**Q6** (/10)	**Q9** (/10)	**TOTAL** **(/100)**

Question/Answer Sheet ID: .....

Question 1 (20 marks)

a) What is the output of the following code?

```
System.out.println(2 + 9 + "3" + 5 + (2 + 4));
```

(2 marks)

b) What is the output of the following code?

```
System.out.println(Math.max(3,5) + Math.min(4,9));
```

(2 marks)

c) Write a Java `boolean` expression which tests whether the `String` identified by the variable, `name`, is less than 10 characters long and contains the letter '`r`'.

(2 marks)

Question/Answer Sheet ID: .....

d) Complete the output of the following code.

```
Rectangle a = new Rectangle(0, 1, 2, 3);
Rectangle b = new Rectangle(10, 20, 30, 40);
Rectangle c;

c = b;
b = new Rectangle(10, 20, 30, 40);

System.out.println("1. " + a.equals(b));
System.out.println("2. " + (a == b));

System.out.println("3. " + a.equals(c));
System.out.println("4. " + (a == c));

System.out.println("5. " + b.equals(c));
System.out.println("6. " + (b == c));
```

```
1.

2.

3.

4.

5.

6.
```

(2 marks)

e) What is printed by the following?

```
int a = 5;
int b = 10;

if ((a < b) && !(b < 10)) {
     System.out.println("A");
} else {
     System.out.println("B");
}
```

(2 marks)

Question/Answer Sheet ID: .....

f) The `positive()` method is *called* in the following way:

```
boolean[] bs = {true, true, false, false};
double nums = positive(bs, "10");
```

Complete the method header for the `positive()` method (i.e. complete the first line of the method definition).

```
private [          ] positive ( [                              ] ) {

   int x = Integer.parseInt(a);
   double d = 0.0;
   for (int i = 0; i < x; i++) {
        if (nums[i]) {
             d = d + 5;
        }
   }
   return d;
}
```

(2 marks)

g) What is the output of the following code?

```
String a = "100";

System.out.println(a + 1);
System.out.println(Integer.parseInt(a) + 1);
```

(2 marks)

Question/Answer Sheet ID: .....

h) What is printed by the following code segment?

```
String[] s = { "zero", "one", "two" };

s[2] = s[1];
s[1] = s[0];

for(int i = 0; i < s.length; i++) {
     System.out.print(s[i] + " ");
}
```

(2 marks)

i) Write a Java statement which declares and constructs an array of 30 `Rectangle` objects. The array should be called `boxes`.

(2 marks)

j) Assume that the array of `Rectangles`, called `boxes`, from the previous question has been created and initialised, and contains no elements which are `null`. Write a Java statement which prints out the `x` value of the first element in the array.

(2 marks)

Question/Answer Sheet ID: .....

Question 2 (8 marks)

Consider the following code segment:

```
String word1 = "banana";
String word2 = "compsci";
String word3 = "aaaxaaa";

String result1 = removeAllAs(word1);
String result2 = removeAllAs(word2);
String result3 = removeAllAs(word3);

System.out.println(result1);
System.out.println(result2);
System.out.println(result3);
```

The output of this code is:

```
bnn
compsci
x
```

The `removeAllAs()` method is passed a String as a parameter, and returns a new String which is the same as the original except all of the lower case '`a`' characters have been removed.

The following list of 12 statements is broken into 6 groups of 2 (i.e. 6 pairs). The correct definition of the `removeAllAs()` method can be formed using exactly ONE statement from each pair. The pairs themselves are given in a random order, so you will need to select the correct statement from each pair as well as determine the correct order for the statements.

```
return result;
return word;

String result = "";
String result;

if (word.charAt(i) == 'a')
if (word.charAt(i) != 'a')

for (int i = 0; i < word.length(); i++)
for (int i = 0; i < word.length; i++)

result = result + word.charAt(i);
result = word.charAt(i);

private String removeAllAs(String word)
private String removeAllAs(word)
```

Question/Answer Sheet ID: .....

In the space provided below, give the correct definition of the `removeAllAs()` method. You must **only use the statements that were listed on the previous page**, but arranged in the correct order.

You will need to put **all of the opening and closing braces** into the code, and you must **indent** the code correctly.

(8 marks)

Question/Answer Sheet ID: .....

Question 3 (8 marks)

a) What is the output of the following program?

```
public void start() {

     int[] numbers = {17, 2, 9, 8, 11, 6, 1, 10, 5};

     doSomething(numbers);

     for (int i = 0; i < numbers.length; i++) {
          System.out.print(numbers[i] + " ");
     }
}


private void doSomething(int[] nums) {

     int temp;

     for (int i = 0; i < nums.length/2; i++) {
          temp = nums[i];
          nums[i] = nums[nums.length-1-i];
          nums[nums.length-1-i] = temp;
     }

}
```

(5 marks)

b) Explain, as a summary in your own words, what the `doSomething()` method does. Your explanation should consist of a SINGLE SENTENCE in English of no more than approximately 10 words.

(3 marks)

Question/Answer Sheet ID: .....

Question 4 (6 marks)

Complete the output when the following code is executed.

```
Point pt1, pt2, pt3;

pt1 = new Point(25, 35);
pt2 = new Point(25, 35);

System.out.println( "1.  " + (pt1 == pt2) );


pt1.move(5, 10);

System.out.println( "2.  " + pt1.x + "," + pt1.y );


pt2.translate(5, 20);

System.out.println( "3.  " + pt2.x + "," + pt2.y );


pt2 = new Point(25, 35);
pt3 = pt2;

pt2.x = pt3.y;
pt2.y = pt2.x;

System.out.println( "4.  " + pt2.x + "," + pt2.y );
```

1.

2.

3.

4.

(6 marks)

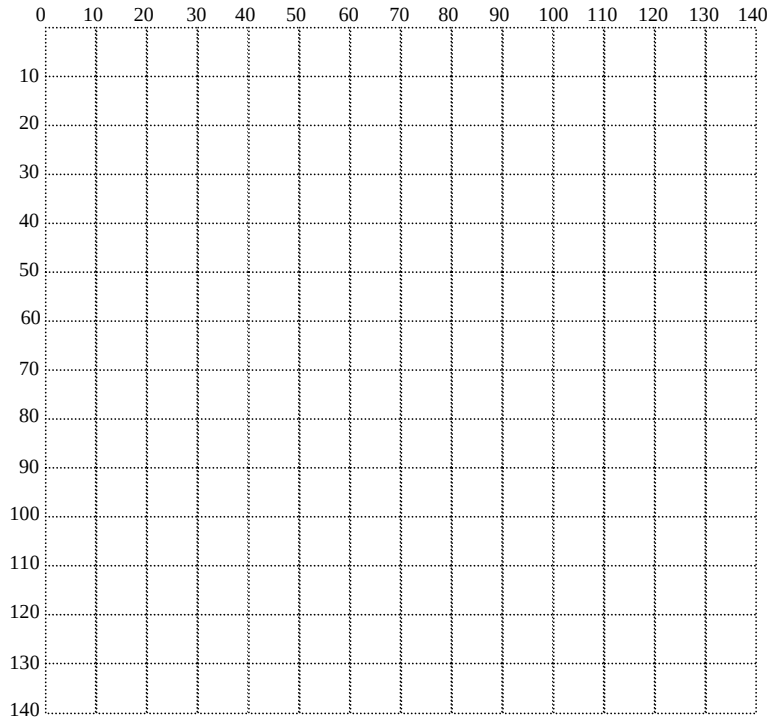
Question/Answer Sheet ID: .....

Question 5 (6 marks)

Draw the output produced by the following code in the grid given at the bottom of the page.

The grid lines are not part of the output but are there to help you place the drawing in the correct position. The size of each square in the grid is 10 pixels by 10 pixels.

```
import java.awt.*;
import javax.swing.*;

public class MyJPanel extends JPanel {

     public void paintComponent(Graphics g) {
          super.paintComponent(g);
          draw(g, 60, 70, 20);
     }

     private void draw(Graphics g, int x, int y, int size) {

          g.fillRect(x, y, size, size);

          g.drawLine(x + size, y, x + size * 2, y - size);

          g.drawOval(x + size * 2, y - size*2, size, size);

          g.drawString("Hi", x + size * 3, y - size);
     }
}
```



(6 marks)

Question/Answer Sheet ID: .....

Question 6 (10 marks)

The `JPanel` defined on the next page contains two `JLabel` components, two `JTextField` components and two `JButton` components:

- `numberL` – a `JLabel` displaying "Number"
- `numberT` – a `JTextField` which contains a whole number representing the number to be added
- `totalSoFarL` – a `JLabel` displaying "Total So Far"
- `totalSoFarT` – a `JTextField` which contains the total of all the numbers added so far
- `addB` – a `JButton` displaying the String, "ADD TO TOTAL".
- `clearB` – a `JButton` displaying the String, "CLEAR".

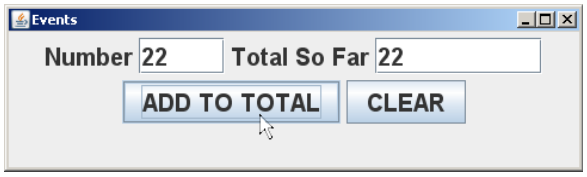
Below is a screenshot of the `JPanel` when it is first displayed. The `numberT` textField displays "0", the `totalSoFarT` textField displays "0".

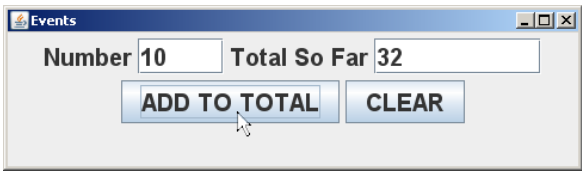
In the `numberT` textField, the user enters a whole number, representing the value which is to be added to the total displayed in the `totalSoFarT` textField. When the user presses the "ADD TO TOTAL" `JButton`, the number from the `numberT` textField is added to the value in the `totalSoFarT` textField, and the total is displayed in the `totalSoFarT` textField.

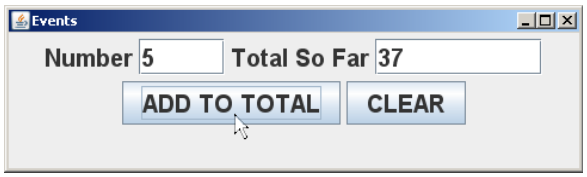
When the user presses the "CLEAR" `JButton`, the `numberT` textField displays "0", the `totalSoFarT` textField displays "0".

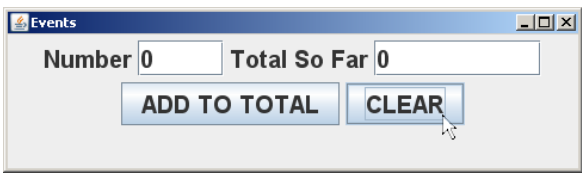
You are required to complete the `JPanel` definition on the next page so that the `JPanel` behaves as described above. You must use the variables given in the code.

The first three screenshots below show the `JPanel` as the user adds three numbers to the total. The last screenshot is displayed after the user presses the "CLEAR" button.









Question/Answer Sheet ID: .....

```
import java.awt.*;
```


```
import javax.swing.*;

public class AJPanel extends JPanel _____ {

     private JTextField numberT, totalSoFarT;
     private JButton addB, clearB;


     public AJPanel() {

          JLabel numberL, totalSoFarL;
          numberL = new JLabel("Number");
          totalSoFarL = new JLabel("Total So Far");
          numberT = new JTextField(4);
          totalSoFarT = new JTextField(8);

          addB = new JButton("ADD TO TOTAL");
          clearB = new JButton("CLEAR");
```


```
          numberT.setText("0");
          totalSoFarT.setText("0");

          add(numberL);
          add(numberT);
          add(totalSoFarL);
          add(totalSoFarT);
          add(addB);
          add(clearB);
     }
```

Question/Answer Sheet ID: .....

```
public void _____ ( _____ e) {









}
}
```

(10 marks)

Question/Answer Sheet ID: .....

Question 7 (6 marks)

Complete the output when the following code is executed.

```
Rectangle rect1, rect2, rect3;
Point pt1 = new Point(30, 35);

rect1 = new Rectangle(30, 40, 50, 20);
rect2 = new Rectangle(25, 10, 40, 30);

System.out.println( "1.  " + (rect2.contains(pt1)) );

rect3 = rect2;
rect2.y = rect2.x;

System.out.println( "2.  " + rect2.x + " " + rect2.y );
System.out.println( "3.  " + rect3.x + "," + rect3.y );
```

```
1.

2.

3.
```

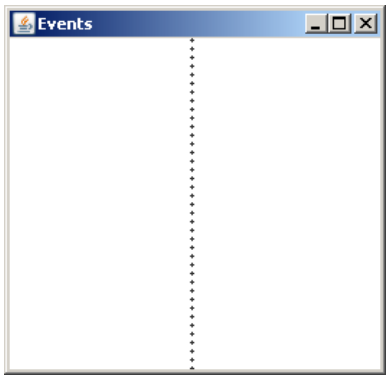
(6 marks)

Question/Answer Sheet ID: .....

Question 8 (8 marks)

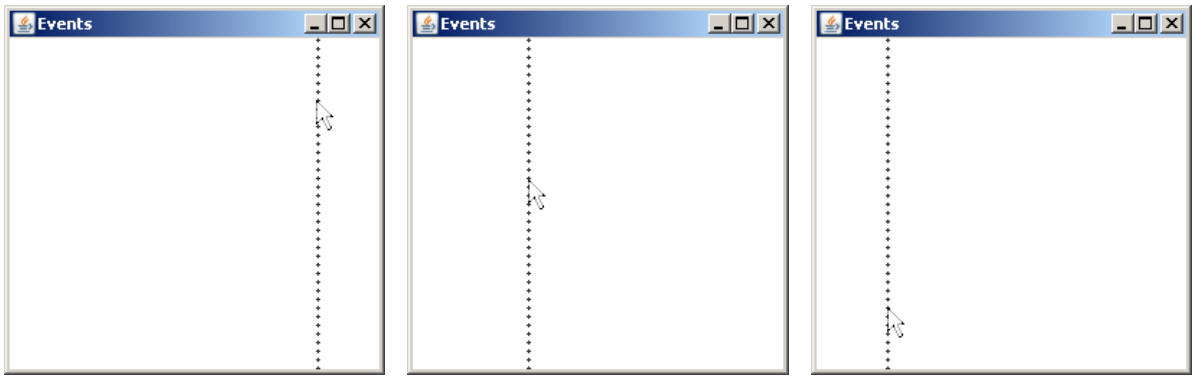
The following `JPanel` responds to `MouseEvents`. The `JPanel` displays a vertical line of dots down the `JPanel`. Each dot is drawn as an oval which is 3 pixels wide by 3 pixels high.

Below is a screenshot of the `JPanel` when it is first displayed. Initially, each dot in the vertical line of dots has an x value which is 100.



Whenever the user presses the mouse, the vertical line of dots is displayed at the `x` value of the position where the user pressed the mouse. The dots are of size 3 pixels and there is a gap of 3 pixels between each dot.

Below are some screenshots of the `JPanel` in action.



Question/Answer Sheet ID: .....

The following numbered statements are part of the code. Place the correct number in the correct place in the `MyJPanel` definition on the next page so that the `MyJPanel` executes as described above.

```
1.   public void mouseExited(MouseEvent e) {}

2.   xPos = e.getX();

3.   int y = 0;

4.   Graphics g

5.   for (int i = 0; i < NUMBER_OF_DOTS; i++) {
          g.fillOval(xPos, y, 3, 3);
          y = y + 6;
     }

6.   repaint();

7.   private int xPos;

8.   addMouseListener(this);

9.   implements MouseListener

10.  xPos = 100;
```

Question/Answer Sheet ID: .....

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

public class MyJPanel extends JPanel                    {

public static final int NUMBER_OF_DOTS = 300;


     public MyJPanel() {









     }

     public void mousePressed(MouseEvent e) {









     }

     public void paintComponent(                    ) {

          super.paintComponent( g );









     }


     public void mouseClicked(MouseEvent e) {}
     public void mouseEntered(MouseEvent e) {}
     public void mouseReleased(MouseEvent e) {}
}
```

(8 marks)

Question/Answer Sheet ID: .....

Question 9 (10 marks)

Below is the `IceCream` class which you need to complete. A program which uses the `IceCream` class is shown on the next page. The `IceCream` class represents a flavoured ice cream. The cost of an ice cream is $1.50 per scoop plus $0.50 if the ice cream is in a cone.

```
public class IceCream {
     private String flavour;
     private int numberOfScoops;
     private boolean isInACone;

     public IceCream(String flavour, int numberOfScoops,
                                                boolean isInACone) {
          this.flavour = flavour;
          this.numberOfScoops = numberOfScoops;
          this.isInACone = isInACone;
     }

     public void setIsInACone(boolean isInACone) {
```

```
     }

     public boolean getIsInACone () {
```

```
     }

     public double getCost() {
```

```
     }

     public boolean costsMoreThan(IceCream other) {
```

```
     }
```

Question/Answer Sheet ID: .....

```
    public String toString() {
         String iceCreamInfo = flavour + " ice cream";
         iceCreamInfo = iceCreamInfo + ", scoops: " +
                                                  numberOfScoops;
         if (isInACone) {
              iceCreamInfo = iceCreamInfo + ", in a cone";
         }

         return iceCreamInfo;
    }
}
```

The code shown below uses the `IceCream` class.

```
IceCream  iceCream1, iceCream2;
iceCream1 = new IceCream( "Berry", 3, true);
iceCream2 = new IceCream( "Chocolate", 1, false);
System.out.println( "1. " + iceCream1.toString() );
System.out.println( "2. " + iceCream2.toString() );

iceCream1.setIsInACone(false);
iceCream2.setIsInACone(true);
System.out.println( "3. " + iceCream1.toString() );
System.out.println( "4. " + iceCream2.toString() );


System.out.println( "5. $" + iceCream1.getCost() );
System.out.println( "6. $" + iceCream2.getCost() );

if (iceCream1.costsMoreThan(iceCream2) ) {
     System.out.println( "7. IceCream1 costs more then
                                                  iceCream2" );
} else {
     System.out.println( "7. IceCream1 does not cost more than
                                                  iceCream2" );
}
```

Complete the `IceCream` class definition so that the code above compiles and gives the output shown below:

```
1. Berry ice cream, scoops: 3, in a cone
2. Chocolate ice cream, scoops: 1
3. Berry ice cream, scoops: 3
4. Chocolate ice cream, scoops: 1, in a cone
5. $4.5
6. $2.0
7. IceCream1 costs more then iceCream2
```

(10 marks)

Question/Answer Sheet ID: .....

Question 10 (8 marks)

For this question you need to write the `getFirstLetterString()` method. This method is passed one parameter, an array of Strings. The method returns a String containing the first letter of each String in the array, i.e., the first letter of the first String in the array is concatenated to the first letter of the second String in the array, and so on.

Consider the code segment below:

```
String[] words = { "tip", "angle", "net", "glad", "ore" };
String firstLetters = getFirstLetterString(words);
System.out.println(firstLetters);
```

If you have defined the `getFirstLetterString()` method correctly, the output from the above code segment should be:

```
tango
```

You can assume that no element in the array passed to the `getFirstLetterString()` is `null`. You can also assume that all the elements in the array contain *at least* one character.

Define the `getFirstLetterString()` method in the space provided below:

```
private _____ getFirstLetterString ( _____ ){









}
```

(8 marks)

Question/Answer Sheet ID: .....

Question 11 (10 marks)

The following `JPanel` uses a `Timer` object. The `Timer` object is created with a delay of 100 milliseconds. The `JPanel` displays a square box which, once the `Timer` has started, moves continuously down the `JPanel`.

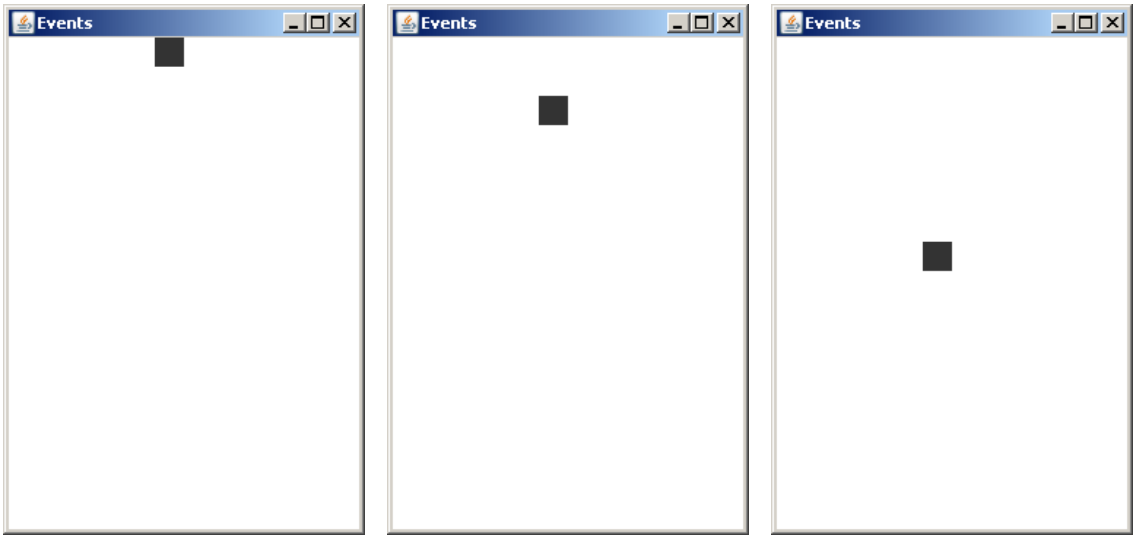
Whenever the user presses the DOWN arrow key the `Timer` should start and the box should begin to move from its current position down the JPanel. Whenever the user presses the UP arrow key the `Timer` should stop and the box should stop in its current position.

Below are some screenshots of the `JPanel` in action. Screenshot 1 shows the `JPanel` when it is first displayed. The box is not moving.

Screenshots 2 and 3 show the `JPanel` as the box moves down the `JPanel`.

NOTES:

1) In your code you MUST use the instance variables which have been defined. You should not define any other instance variables.
2) Each time the box moves, its `y` value is increased by 20 pixels.



Question/Answer Sheet ID: .....

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

public class AJPanel extends JPanel  _____

                                     _____ {

     public static final int SIZE = 20;


     private Rectangle box;
     private Timer t;

     public AJPanel() {

          box = new Rectangle(100, 0, SIZE, SIZE);
```

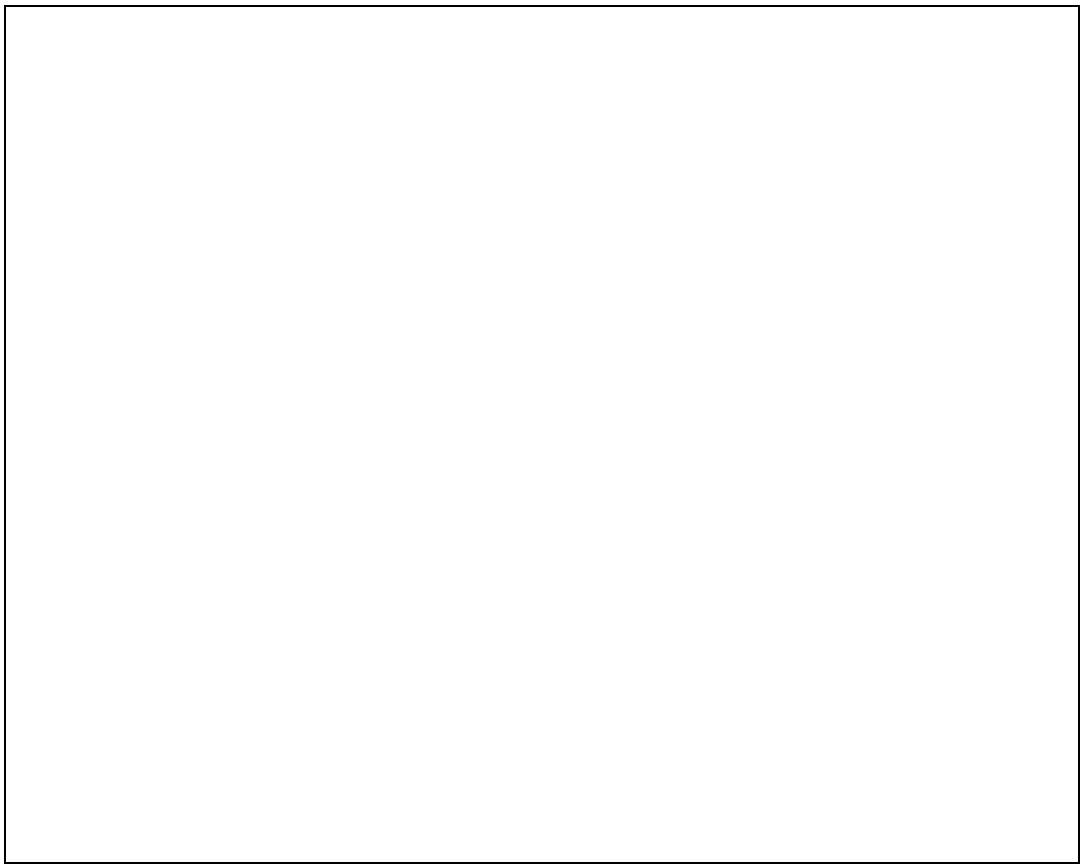
```
     }

     public void actionPerformed(ActionEvent e) {
```

```
     }

     public void paintComponent(Graphics g) {
          super.paintComponent(g);
```

```
     }
```

Question/Answer Sheet ID: .....

```
    public void keyPressed(KeyEvent e) {
```



```
    }

    public void keyReleased(KeyEvent e) {}
    public void keyTyped(KeyEvent e) {}
}
```

(10 marks)

Question/Answer Sheet ID: .....

OVERFLOW PAGE

(If you have used this page, please indicate clearly under the relevant question that you have overflowed to this page)

Question/Answer Sheet ID: .....

ROUGH WORKING (WILL NOT BE MARKED)

(You may use this page for rough working)

Question/Answer Sheet ID: .....

ROUGH WORKING (WILL NOT BE MARKED)

(You may use this page for rough working)