TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Student ID: .....

EXAMINATIONS — 2008

MID-YEAR

COMP 102
INTRODUCTION TO COMPUTER PROGRAM DESIGN

Time Allowed: 3 Hours

Instructions: Attempt ALL Questions.

Answer in the appropriate boxes if possible — if you write your answer elsewhere, make it clear where your answer can be found.

The exam will be marked out of 180 marks.

Non-programmable calculators without a full alphabetic key pad are permitted.

Non-electronic foreign language dictionaries are permitted.

There is documentation at the end of the paper, which you may tear off.
This includes example programs showing a variety of Java syntax.

There are spare pages for your working and your answers in this exam.

Questions

	Marks
1. Understanding Java	[61]
2. Files	[18]
3. Arrays of Objects	[35]
4. Recursion	[15]
5. Designing with Interfaces	[30]
6. Debugging Loops	[21]

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.

Question 1. Understanding Java [61 marks]

(a) [4 marks] What will the following fragment of Java print out?

```
double x = 7.0;
 int  y = 3;
double ans =  x * y;
x = x / 2;
y = y / 2;
System.out.println("x=" + x);
System.out.println("y=" + y);
System.out.println("ans=" + ans);
```

(b) [6 marks] Consider the following compute method:

```
public String compute(String s) {
    if (s.length() < 2)
        return "too small";
    else if (s.equals("four") && s.length() == 3)
        return "yes";
    else if (s.equalsIgnoreCase("x") || s.equalsIgnoreCase("yy"))
        return "XandY";
    else if (s.length() >= 5 && s.startsWith("Y"))
        return "NO";
    else
        return "all true";
}
```

What would the following calls to compute return?

compute("YY") ⟹

compute("x") ⟹

compute("four") ⟹

compute("Yesterday") ⟹

(Question 1 continued on next page)

(Question 1 continued)

(c) [5 marks] What will the following fragment of Java print out?

```
for ( int k = 8;  k > 2;  k=k−2 ){
    System.out.println("k = " + k);
}
System.out.println("Done");
```

(d) [6 marks] What will the following fragment of Java print out?

```
int n = 5;
int m = 3;
while (true){
  if (n > m)
    n = n−m;
  else
    m = m − n;

  if (n == 0  || m == 0)
    break;
  System.out.printf("Loop: n = %d, m = %d\n", n, m);
}
System.out.printf("Final: n = %d, m = %d\n", n, m);
```

(Question 1 continued on next page)

(Question 1 continued)

(e) [5 marks] Suppose the variable words is declared to be an array containing 8 strings:

```
String [ ] words = {"USA","CAN","JPN","DRG","PRC","GBR","NZL", "AUS"};
```

What will the following code fragment print out?

```
int index=1;
while( index < words.length ){
  System.out.print(index + ":  " + words[index]+ ",  ");
  index = index*2;
}
```

(f) [6 marks] Suppose that the variable words is declared as before:

```
String [ ] words = {"USA","CAN","JPN","DRG","PRC","GBR","NZL", "AUS"};
```

Show the contents of words after the following modify method is called on words:
modify(words).

```
public void modify(String [ ] wds){
    for( int i = 1; i< wds.length; i++){
        wds[i] = wds[wds.length−i];
    }
}
```

(Question 1 continued on next page)

(Question 1 continued)

The Ball class on the facing page defines Ball objects, which have two fields to store their size and shape, and two methods. The class also contains a test method.

(g) [5 marks] If the test method is called, what will it print out?

```
A:

B:

C:

D:

E:
```

(h) [6 marks] Write an additional method called puntAble for the Ball class which returns true if the size of the Ball is above 20.0 and the shape is an Oval. It should return false in all other cases.

```

```

(Question 1 continued on next page)

(Question 1 continued)

```
public class Ball{
    private double size;
    private String shape;

    public Ball(double z){
        this.size = z;
        this.shape = "Oval";
    }

    public void pumpUp(double factor){
        this.size = this.size * factor;
        if (factor > 3.0)
            this.shape = "Sphere";
    }

    public String toString(){
        return (this.size + "cm and " +this.shape);
    }


    public static void test(){
        Ball b1 = new Ball(10.0);
        Ball b4 = new Ball(3.5);

        System.out.println("A: " + b1.toString());
        System.out.println("B: " + b4.toString());

        b1.pumpUp(2.0);
        b4.pumpUp(2.0);
        System.out.println("C: " + b1.toString());

        b4.pumpUp(4.0);
        System.out.println("D: " + b1.toString());
        System.out.println("E: " + b4.toString());
    }

}
```

(Question 1 continued on next page)

(Question 1 continued)

(i) [6 marks] Suppose the file `samhunt.txt` contains the following text:

```
Tell the story
tell it true
charm it crazy
[1st edition]
```

What will the following printFile method print out?

```
public void printFile (){
    try{
        Scanner scan = new Scanner (new File ("samhunt.txt"));
        int z = 0;
        while ( scan.hasNext() ){
            String str = scan.nextLine();
            if ( str.contains("it") ) {
                System.out.println(z + ": " + str);
                z++;
            }
            else System.out.println("(" + str + ")");
        }
        scan.close();
    }
    catch(Exception e){System.out.println("File reading failed");}
}
```

(Question 1 continued on next page)

(Question 1 continued)

(j) [6 marks] Complete the following max method. max has one parameter – an array of ints – and should return the value of the largest number in the array. You may assume that the length of the array is greater than 0.

```
public int max(int [ ] data){




}
```

(k) [6 marks] Complete the following definition of a Country class. Country objects should have one field called code which holds a String. The class should have a constructor that takes one argument and sets the code field to its argument. The class should have one method called getCode (with no parameters) which returns the value of the code field.

```
public




}
```

Question 2. Files [18 marks]

Suppose the file `flightdata.txt` contains data about the daily departures of five international flights, where each line contains the flight number, the departure time, and the destination:

```
QF5  0630  Sydney
UA3  0810  Boston
BA4  0810  London
ZA9  1230  Harare
QF1  1245  London
SA6  1600  Durban
```

(a) [4 marks] What will testFiles("`flightdata.txt`") print to System.out?

```
public void testFiles(String fname) {
    try{
        Scanner fileScan = new Scanner(new File(fname));
        while (fileScan.hasNext()){
            if (fileScan.hasNextInt()){
                int time = fileScan.nextInt();
                String line = fileScan.nextLine();
                System.out.println(line);
            }
            else{
                String junk = fileScan.next();
            }
        }
        fileScan.close();
    }
    catch(IOException e){System.out.println("File reading failed: "+e);}
}
```

(Question 2 continued on next page)

(Question 2 continued)

(b) [6 marks] Complete the following printEarlyDepartures method so it reads data from a file in the format described in part (a) and prints out the information about the planes departing before 8:30 in the morning. On the example file above, it should print

```
QF5   630   SYDNEY
UA3   810   BOSTON
BA4   810   LONDON
```

```
public void printEarlyDepartures(String fname){
    try{
        Scanner fileScan = new Scanner (new File (fname));
        fileScan.close();
    }
    catch(IOException e){System.out.println("File reading failed: "+e);}
}
```

(Question 2 continued on next page)

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.

(Question 2 continued)

(c) [8 marks] Complete the following firstAndLast method which has two parameters — the name of a data file (with the format described in part (a)) and the name of a destination city. It should read the data from the file and then print the time of the earliest flight to that destination and the the time of the latest flight to that destination.

For example, calling firstAndLast("flightdata.txt", "London") should print:

```
First 810
Last 1245
```

You may assume that there is at least one flight to the destination in the file and that the lines in the file are ordered according to departure time.

```
public void firstAndLast(String fname, String destn){
    try{
        Scanner fileScan = new Scanner (new File (fname));









        fileScan.close();
    }
    catch(IOException e){System.out.println("File reading failed: "+e);}

}
```

Question 3. Arrays of Objects [35 marks]

This question concerns a program for keeping track of the current repair jobs for a computer shop. Jobs are added when a customer brings in a computer to be repaired and deleted when the computer is returned to the customer. The program keeps track of the current status of jobs (waiting, being worked on, or finished). The status of a job can be updated and the program can list the current jobs of any status. The program includes a Job class and a JobTracker class.

The Job class below represents information about individual Jobs.

```
public class Job{
    // Fields
    private String customer;
    private String fault ;
    private String status;        // "waiting" "repairing" or "finished"

    /** Construct a new Job object */
    public Job(String name, String fault){
        this.customer = name;
        this. fault = fault ;
        this.status = "waiting";
    }

    /** Returns a String describing the job */
    public String description(){
        return ("Fixing "+ this.fault + " for " + this.customer +
                ", status: " +this.status );
    }

    /** Returns true if and only if the job's customer is this name */
    public boolean hasName(String name){
        return (this.customer.equalsIgnoreCase(name));
    }

    /** Returns the current status of the job */
    public String getStatus(){
        return this.status;
    }

    /** Sets the current status of the job to "finished" */
    public void finish (){
        this.status = "finished";
    }
}
```

(Question 3 continued)

(a) [5 marks] The following test method tests the methods of the Job class. What will it print out to System.out?

```
public static void test() {

    Job job = new Job("Peter", "Broken Monitor");
    System.out.println(job.description());

    String oldStatus = job.getStatus();
    job.finish();
    System.out.println("Job: "+ oldStatus + "->" + job.getStatus());

    Job[] allJobs = new Job[5];
    allJobs[0] = job;
    allJobs[1] = new Job("Marcus", "No power supply");

    for (int i=0; i<2; i++){
        if (allJobs[i].hasName("Peter"))
            System.out.println("Job " + i + " is for Peter");
        else
            System.out.println("Job " + i + " is not for Peter");
    }
}
```

(b) [4 marks] The JobTracker class uses the Job class, and contains an array to store the information about a collection of Jobs. Declare and assign initial values for fields of the JobTracker class so that a JobTracker object could hold information on up to 100 Jobs. It should use an array and a count.

```
public class JobTracker{
```

(Question 3 continued on next page)

(Question 3 continued)

(c) [6 marks] Complete the following listWaitingJobs method in the JobTracker class which should print (to System.out) a description of each job that has a status of `"waiting"`.
Your method should use the appropriate methods of the Job class.

```
public void listWaitingJobs(){




}
```

(Question 3 continued on next page)

(Question 3 continued)

(d) [8 marks] Complete the following addJob method in the JobTracker class which should allow a user to add a new Job to the collection. If the array of jobs is full, the method should print `The collection is full` and should not ask the user for any data. Otherwise, the method should ask the user (in the terminal window) for the customer name and a description of the fault, and then add the new job to the collection.
Your method should use the appropriate constructors and/or methods of the Job class.

```
public void addJob(){




}
```

(Question 3 continued on next page)

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.

(Question 3 continued)

(e) [8 marks] Complete the following finishJob method in the JobTracker class so that it allows the user to update the status of a job to `"finished"`. The parameter of the method is the customer name. It should find the job with that name, update its status, and then print `"Updated status"`. If there is no job with the given name, it should print `"No such job"`.
You should use appropriate methods from the Job class. You may assume there is only one job for each customer.

```
public void finishJob(String name){




}
```

(f) [4 marks] There is a problem with the design of the program, especially the finishJob method, if there can be more than one current repair job for the same customer. Explain the problem and suggest how you would change the design to allow a customer to have multiple repair jobs.

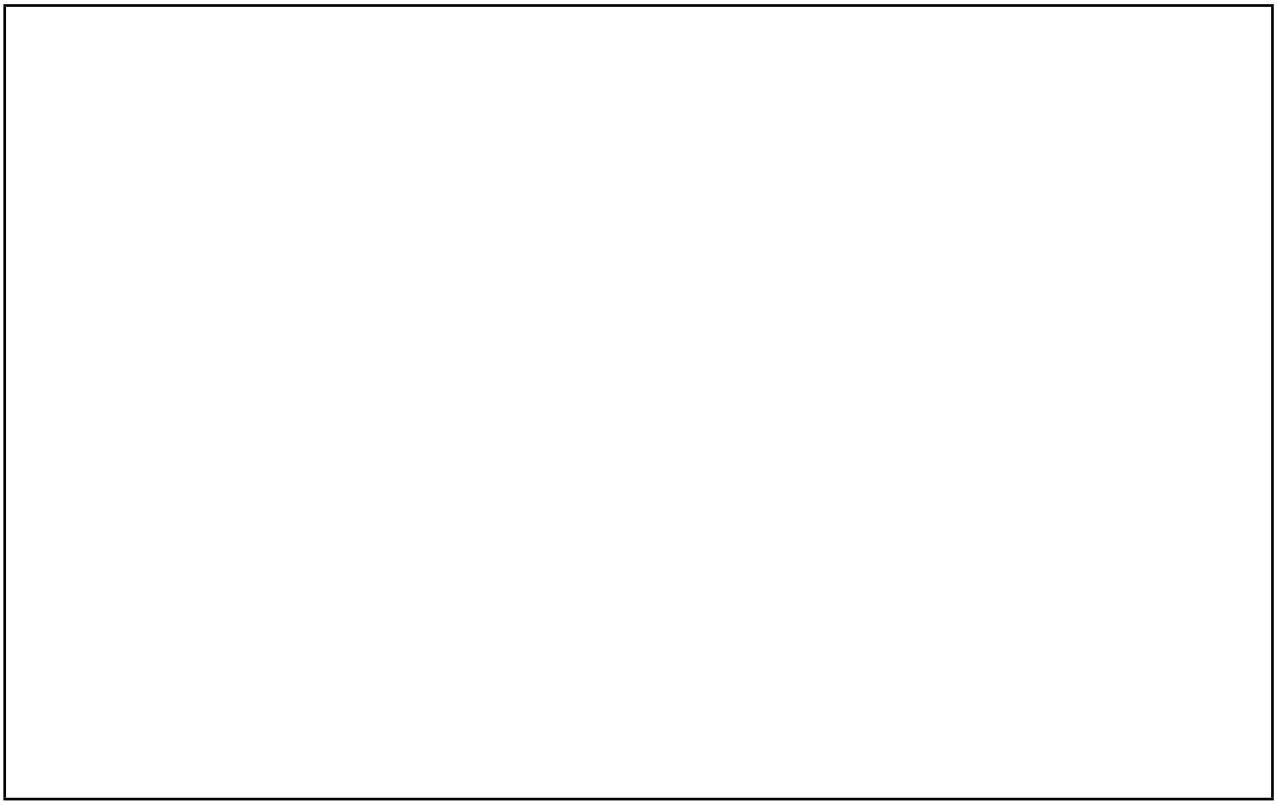
Question 4. Recursion [15 marks]

(a) [7 marks] The following recursive method, recDraw, draws rectangles on the canvas. In the box below, sketch what it would draw if it were called by the statement:

```
this.recDraw(30, 10, 4);
```

Label the rectangles with their position and size.

```
public void recDraw(int m, int p, int num){
    if (num > 0){
      this.canvas.drawRect(m, m, p, p);
      this.recDraw(m+p, p*2, num-1);
    }
}
```



(Question 4 continued on next page)

(Question 4 continued)

(b) [8 marks] The following recursive method, printRec, is passed a Scanner that is already connected to a file. The method should read the lines in the file, and print out all the lines in order, followed by all the lines in reverse order. Complete the definition of printRec.

You *must* use recursion: do *not* use loops or arrays.

For example, if the file contains the text shown on the left, the method should print out the lines shown on the right.

```
This first line is
before the 2nd
and the third.
```

```
This first line is
before the 2nd
and the third.
and the third.
before the 2nd
This first line is
```

```
public void printRec(Scanner scan){




}
```

Question 5. Designing with Interfaces [30 marks]

Suppose the interface class Item is defined as below, and that Cornflakes is a class that implements Item.

```
public interface Item {
    public double price();
    public void writeEntry( int count);
}

public class Cornflakes implements Item {
    :
}
```

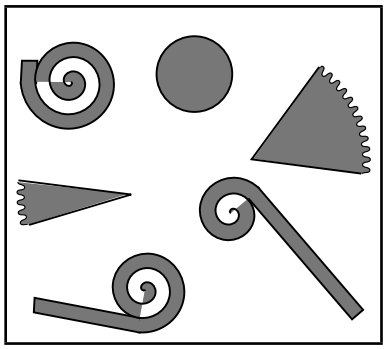
(a) [4 marks] For each of the following assignment statements, state whether it is valid or invalid. If it is invalid, explain why.

```
Item it = new Item();                  //Ans:

Item itm = new Cornflakes();           //Ans:

double pr2 = itm.price();              //Ans:

Object ob = new Cornflakes();          //Ans:

double pr3 = ob.price();               //Ans:
```

(Question 5 continued on next page)

(Question 5 continued)

The rest of this question concerns a BlowUpGame program that is an extended version of the BalloonGame from assignment 8. BalloonGame displayed a collection of Balloon objects on the window, allowed the user to expand them, and popped balloons that touched. BlowUpGame has a collection of three different kinds of expandable items — balloons, party whistles, and bellows. The figure below shows a collection with three party whistles, two bellows, and one balloon.



The main class of the program is BlowUpGame. It has a field called items that contains an array with all the current expandable items.

The program also contains three classes (Balloon, PartyWhistle, and Bellows) for the different kinds of expandable items. Each class has different fields for storing information, and the objects have different shapes, and expand differently. However, all three classes have the following four methods.

- draw, which has one DrawingCanvas parameter. It draws the item on the canvas.
- pointOn, which has two integer parameters specifying a point. It returns true if and only if the point is on the item.
- expand, which has one integer parameter. It makes the item larger in the approriate way. (Balloons just get bigger, party whistles unroll, and bellows open up.)
- touching, which has one parameter that is another expandable item. It returns true if and only if this item is touching the other item.

(b) [6 marks] Define an interface class called ExpandableItem to represent all three types of expandable items, specifying the four methods that can be called on any object of type ExpandableItem.

```
public




}
```

(c) [3 marks] Give an appropriate declaration for the items field in the BlowUpGame class to hold up to 100 Balloons, PartyWhistles, and Bellows. The field declaration should also initialise the field appropriately.

```
public class BlowUpGame{



        :   // you do not need to declare the other fields .
```

(d) [4 marks] Explain why it is a good idea to define an ExpandableItem interface for this program.

The PartyWhistle class represents party whistle items which are initially rolled up, and can unroll to a maximum length of 200. At any point in time, a PartyWhistle object will be rolled out by some fraction of its maximum length. Each PartyWhistle object also has a position and the direction that the entrance is facing (a double), both of which are set when the object is created.

(e) [8 marks] Complete the following header, field declarations, and constructor of the PartyWhistle class.

```
public class PartyWhistle
    // Fields                    . . . . . .




    //Constructor




    // You do not need to define the methods
}
```

(Question 5 continued on next page)

(Question 5 continued)

(f) [5 marks] Implementing the touching method for the Balloon class in the BalloonGame program was relatively easy. Give at least two different reasons why it would be more difficult to implement the touching methods for the three different expandable item classes.

Question 6. Debugging Loops [21 marks]

The following listIdenticalRows method is intended to find pairs of identical rows in a table of numbers stored in a 2D array. It should print out the row numbers of each pair of identical rows, and should print the total number of pairs of rows at the end. The rows are numbered from 0.

For example, for each array of numbers on the left, listIdenticalRows should print out the text on the right.

	0	1	2
0	1	5	21
1	3	6	14
2	3	2	21
3	3	6	14

$\Longrightarrow$

```
same: 1 & 3
number of pairs: 1
```

	0	1	2
0	1	7	21
1	3	6	10
2	1	7	21
3	3	6	10
4	1	7	21

$\Longrightarrow$

```
same: 0 & 2
same: 0 & 4
same: 1 & 3
same: 2 & 4
number of pairs: 4
```

The version of listIdenticalRows below has several errors.

```
public void listIdenticalRows ( int[ ][ ] data){
    int rows = data.length;
    int cols = data[0].length;
    int count = 0;

    for ( int row= 0;  row<rows; row++){
        for ( int otherRow= 0; otherRow<rows; otherRow++){
            if (otherRow !=  row){

                // test  if  rows are  the same
                boolean same = false;
                for ( int col= 0;  col<cols;  col++){
                    if (data[row][col] == data[otherRow][col])
                        same = true;
                }
                if (same){
                    System.out.println("same: " + row + " & " + otherRow);
                }
                count++;
            }
        }
    }
    System.out.println("number of pairs: " + count);
}
```

(a) [8 marks] The version of listIdenticalRows on the facing page has errors. What does it print out if it is called with an argument that is the following 2D array of numbers (same as first example on facing page):

	0	1	2
0	1	5	21
1	3	6	14
2	3	2	21
3	3	6	14

(b) [3 marks] Circle and briefly describe three errors in the version of listIdenticalRows on the facing page.

Answer on the code on the facing page

[part **(c)** is on next page.]

(Question 6 continued on next page)

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.

(Question 6 continued)

(c) [10 marks] Write a correct version of listIdenticalRows that does what it is supposed to do.

```
public void listIdenticalRows ( int[ ][ ] data){
   int rows = data.length;
   int cols = data[0].length;
   int count = 0;









   System.out.println("number of pairs: " + count);
}
```

****

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

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Brief and partial documentation of some classes and methods

```
PrintStream class:                                  // Note, System.out is a PrintStream object
 public PrintStream (File f)                        // Constructor, for printing to a file
 public void close()                                // Close the file (if it is wrapping a File object)
 public void print (String s)                       // Prints s with no newline
 public void print (int i)                          // Prints i with no newline
 public void print (double d)                       // Prints d with no newline
 public void println ()                             // Prints a newline
 public void println (String s)                     // Prints s followed by newline
 public void println (int i)                        // Prints i followed by newline
 public void println (double d)                     // Prints d followed by newline
 public void printf (String format, ...)            // Prints the format string, inserting the remaining
                                                    // arguments at the %'s in the format string:
                                                    //   %s for Strings.
                                                    //   %d for ints, (%3d: use at least 3 characters),
                                                    //   %.2f for 2dp doubles,
                                                    //   (%6.2f: at least 6 characters and 2dp),
                                                    // Use \n for newline
Scanner class:
   public Scanner (InputStream i)                   // Constructor. Note: System.in is an InputStream
   public Scanner (File f)                          // Constructor, for reading from a file
   public Scanner (String s)                        // Constructor, for reading from a string
   public boolean hasNext()                         // Returns true if there is more to read
   public boolean hasNextInt()                      // Returns true if the next token is an integer
   public boolean hasNextDouble()                   // Returns true if the next token is a number
   public String next()                             // Returns the next token (chars up to a space/line)
                                                    //   (throws exception if no more tokens)
   public String nextLine()                         // Returns string of chars up to next newline
                                                    //   (throws exception if no more tokens)
   public int nextInt()                             // Returns the integer value of the next token
                                                    //   (throws exception if next token is not an integer
                                                    //     or no more tokens)
   public double nextDouble()                       // Returns the double value of the next token
                                                    //   (throws exception if next token is not a number
                                                    //     or no more tokens)
   public void close()                              // Closes the file (if it is wrapping a File object)

File class:
   public File (String fname)                       // Constructor. Creates a File object attached to the
                                                    //   file with the name fname
   public boolean exists()                          // Returns true iff the file exists

Integer class:
   public static final int MAX_VALUE                // The largest possible int: 2^(31−1)
   public static final int MIN_VALUE                // The smallest possible int: −2^(31)
```

(Continued on next page)

String **class**:

```
public int length()                          // Returns the length (number of characters) of the string
public boolean equals(String s)              // String has same characters as s
public boolean equalsIgnoreCase(String s)    // String has same characters as s, ignoring their case
public String toUpperCase(String s)          // Returns upper case copy of string
public String toLowerCase(String s)          // Returns lower case copy of string
public boolean startsWith(String s)          // First part of string matches s
public boolean contains(String s)            // s matches some part of the string
public String substring(int j, int k)        // Returns substring from index j to index k−1
public int indexOf(String s)                 // Returns the index of where s first matches
                                             // Returns −1 if string does not contain s anywhere
```

Math **class**:

```
public static double sqrt(double x)          // Returns the square root of x
public static double min(double x, double y) // Returns the smaller of x and y
public static double max(double x, double y) // Returns the larger of x and y
public static double abs(double x)           // Returns the absolute value of x
public static int min(int x, int y)          // Returns the smaller of x and y
public static int max(int x, int y)          // Returns the larger of x and y
public static int abs(int x)                 // Returns the absolute value of x
```

DrawingCanvas **class**:

```
public void clear()                                  // Clears the drawing canvas
public void setForeground(Color c)                   // Change the colour for later commands
public void drawLine(int x, int y, int u, int v)     // Draws line from (x, y) to (u, v)
public void drawRect(int x, int y, int wd, int ht)   // Draws outline of rectangle
public void fillRect(int x, int y, int wd, int ht)   // Draws solid rectangle
public void clearRect(int x, int y, int wd, int ht)  // Draws clear rectangle
public void drawOval(int x, int y, int wd, int ht)   // Draws outline of oval
public void fillOval(int x, int y, int wd, int ht)   // Draws solid oval
```

Color **class**:

```
public Color(int red, int green, int blue)   // Make a colour; arguments must be 0..255
Color.gray, Color.blue, Color.red,           // Some of the predefined colours
Color.green, Color.black, Color.white
```

MouseListener **interface**:

```
public void mousePressed(MouseEvent e);      // Called when mouse pressed
public void mouseReleased(MouseEvent e);     // Called when mouse released
public void mouseClicked(MouseEvent e);      // Called when mouse clicked
public void mouseEntered(MouseEvent e);      // Called when mouse enters component
public void mouseExited(MouseEvent e);       // Called when mouse exits component
```

MouseEvent **class**:

```
public int getX()                            // Get the x component of the mouse position
public int getY()                            // Get the y component of the mouse position
```

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Small fragments of programs with examples of Java syntax

```
public void prompt(){
    Scanner sc = new Scanner(System.in);
    System.out.print("answer: ");
    if (sc.hasNextInt()){
        int n = sc.nextInt();
        System.out.println(n);
    }
    else{
        String s = sc.next();
        System.out.println(s);
    }
}
```

```
public void table( int n){
    for ( int i=1; i<=n; i++){
        for ( int j=1; j<=n; j++){
            System.out.printf(" %3d |", i*j);
        }
        System.out.println();
    }
}
```

```
public String longest(String fname){
    String[] words = new String[20];
    try{
        Scanner f = new Scanner(new File(fname));

        int i =0;
        while (f.hasNext() && i < words.length){
            words[i] = f.next();
            i++;
        }
    }
    catch(Exception e){System.out.println("File broken: "+ e);}

    String ans = "";
    for ( int j=0; j<words.length; j++ ){
        if ( words[j].length() > ans.length() ){
            ans = words[j];
        }
    }
    return ans;
}
```

(Continued on next page)

```
public void actionPerformed(ActionEvent e){
    String button = e.getActionCommand();
    if ( button.equals("Clear") )
        this.canvas.clear();
    else if ( button.equals("Quit"))
        frame.dispose();
}
```

```
public void mouseClicked(MouseEvent e){
    this.canvas.fillOval(e.getX(), e.getY(), 10, 10);
}
```

```
public class Flag{
    private int size = 40;
    private int x;
    private int y;

    public Flag(int u, int v){
        this.x = u;
        this.y = v;
    }

    public void draw(DrawingCanvas canvas){
        canvas.setColor(Color.black);
        int left = this.x - this.size/2;
        int top = this.y - this.size/2;
        canvas.drawRect(left, top, this.size, this.size);
        canvas.setColor(Color.green);
        canvas.drawLine(this.x, top, this.x, top+this.size);
        canvas.drawLine(left, this.y, left+this.size, this.y);
    }
}
```

```
  public void print2Darray(int [][] table){
    for (int row=0; row<table.length; row++){
      for (int col=0; col<table[row].length; col++){
        System.out.printf("%4d", table[row][col]);
      }
      System.out.println();
    }
  }
```
