

Programming for Interaction

Re-examination

23 August 2016

Instructions

READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE STARTING THE EXAMINATION!

- You have 4 hours to complete the examination.
- Neither electronic devices nor written material are allowed in the examination room.
- This examination consists of 16 questions. Each question is worth 5 marks. You must obtain at least 40 marks to pass.
- Each question takes the form of a multiple-choice question in which one or more of the candidate statements is true. You must give the letter labels for ***all and only*** the true statements in each question in order to get the marks for that question.
- Do not write any answers on this question paper—answers written on the question paper will be ignored by the examiner. Write all your answers on the writing paper provided.
- Do not write your answers in pencil and do not use a pen with red or green ink. Use a pen with blue or black ink.
- Hand in no more than one answer to each question.
- Do not turn over until you are told to do so by the invigilator.

Question 1

Which of the following statements are true? (At least one of the statements is true.)

- A. A module, X , is said to be dependent on another module, Y , if a change in X may necessitate a change in Y .
- B. A module, X , is said to be dependent on another module, Y , if a change in Y may necessitate a change in X .
- C. A module, X , is said to be a client of another module, Y , if X provides services to Y .
- D. A module, X , is said to be a client of another module, Y , if X uses services provided by Y .

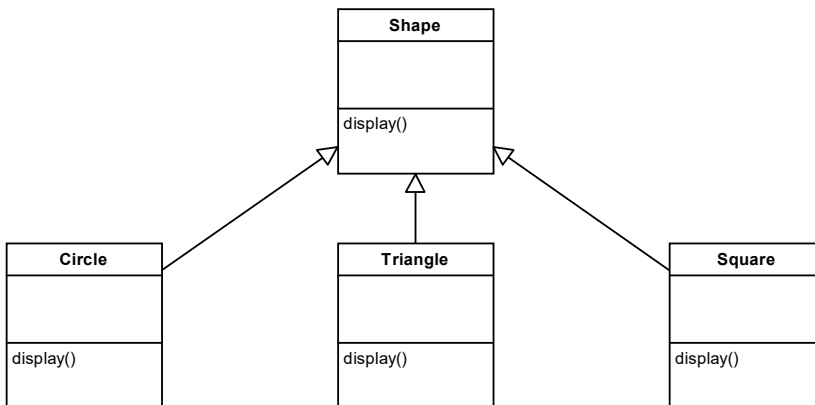
Question 2

Which of the following statements are true? (At least one of the statements is true.)

- A. A module's public interface is a superset of its private interface.
- B. A module's public interface is a subset of its private interface.
- C. The interface of a module encapsulates the module and hides implementational details that users don't need to know about.
- D. A module encapsulates its interface and exposes only those parts of its functionality that users need to be aware of.

Question 3

Study the following diagram and answer the question below it.



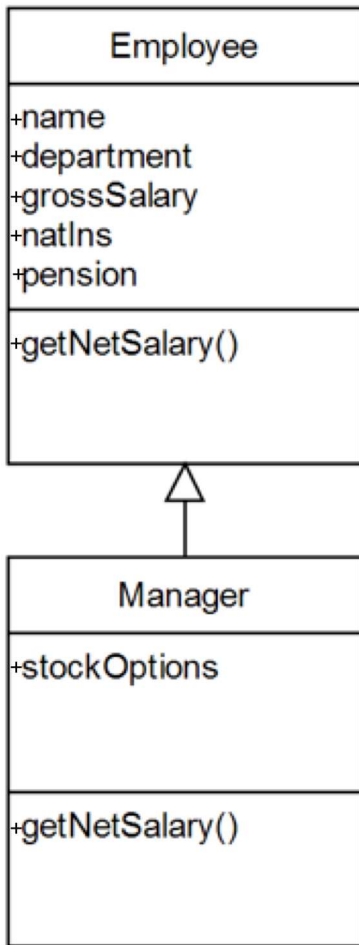
Which of the following statements are true about this diagram? (At least one of the statements is true.)

- A. Triangle is a subclass of Shape and Triangle's display method overrides the display method in Shape.
- B. Square is a superclass of Shape and Square's display attribute overloads the display attribute in Shape.
- C. Circle is a subclass of Shape and Circle's display method overloads the display method in Shape.
- D. A variable whose type is Shape can be used to refer to a Circle.

TURN OVER

Question 4

Study the following diagram and answer the question below it.



Which of the following statements are true about this diagram? (At least one of the statements is true.)

- A. Employee is a subclass of Manager, Employee's getNetSalary method overloads Manager's getNetSalary method and Employee inherits the stockOptions attribute from Manager.
- B. Manager is a subclass of Employee, Manager's getNetSalary method overrides the getNetSalary method defined in Employee and the Manager class inherits the department attribute.
- C. Employee is a superclass of Manager, Manager inherits the stockOptions attribute from Employee and Employee's getNetSalary method overrides Manager's getNetSalary method.
- D. Manager is a subclass of Employee, Manager's getNetSalary attribute overloads Employee's getNetSalary attribute and Manager inherits the grossSalary method from Employee.

TURN OVER

Question 5

Study the following Java code and answer the question below it.

```
public class Question5 {
    public static void main(String[] args) {
        int[] s = {1,2,3};
        int l = s.length;
        for(int i = 0; i < 5; i++) {
            System.out.print(s[i%l]/s[(i+1)%l]+" ");
        }
    }
}
```

Which of the following statements are true about the code above? (At least one of the statements is true.)

- A. When this program is run, it outputs the following to the console:
0 0 3 0 0
- B. When this program is run, it outputs the following to the console:
0
0
3
0
0
- C. When this program is run, it outputs the following to the console:
0.5 0.6666667 3.0 0.5 0.6666667
- D. When this program is run, it outputs the following to the console:
0.5
0.6666667
3.0
0.5
0.6666667

TURN OVER

Question 6

Study the following Java program and answer the question that follows it.

```
1 public class Question6 {
2
3     private void p(String s) {
4         System.out.println(s);
5     }
6
7     public static void main(String[] args) {
8         int[] nums = {5, 1, 3, 0, 100};
9         for(int n : nums) {
10            switch(n) {
11                case 0: p("zero"); break;
12                case 1: p("one"); break;
13                case 2: p("two"); break;
14                case 3: p("three"); break;
15                case 4: p("four");
16                case 5: p("five");
17                default: p("something else");
18            }
19        }
20    }
21 }
```

Which of the following statements are true? (At least one of the statements is true.)

- A. If the string "break;" is removed from the end of line 14, then the output of this program is the following:
five
something else
one
three
four
five
something else
zero
something else
- B. The output of this program is the following:
five
something else
one
three
zero
something else
- C. The program will not compile. In order to make it compile, the word "final" must be inserted in line 3 between the words "private" and "void". If this is done, then the output of the program is as in statement B.
- D. The program will not compile. In order to make it compile, the word "static" must be inserted in line 3 between the words "private" and "void". If this is done, then the output of the program is as in statement B.

TURN OVER

Question 7

Study the following Java code and answer the question that follows it.

```
1 package com.chromamorph.pfireexam2016;
2
3 public class Question7 {
4
5     static class Point {
6         int x, y;
7         Point() {}
8         Point (int x, int y) {
9             this.x = x;
10            this.y = y;
11        }
12        public String toString() {return "("+x+", "+y+"");}
13    }
14
15    public static void main(String[] args) {
16        Point p = new Point();
17        System.out.println(p);
18        Point q = p;
19        q.x = 1; q.y = 2;
20        System.out.println(p);
21        p.x += 2; p.y += 3; p = null;
22        System.out.println(q);
23    }
24 }
```

Which of the following statements are true? (At least one of the statements is true.)

- A. Line 7 can be deleted because Java provides a no-args constructor when none is explicitly defined.
- B. The toString method in line 12 overrides the toString method in the Object class.
- C. The output of the program is as follows:
(0,0) (1,2) (3,5)
- D. The output of the program is as follows:
(0,0)
(0,0)
(1,2)

TURN OVER

Question 8

Study the following Java code and answer the question that follows it.

```
1 package com.chromamorph.pfireexam2016;
2
3 public class Question8 {
4     static class Point {
5         private int x, y;
6         Point(int x, int y) { setX(x); setY(y); }
7         int getX() {return x;}
8         int getY() {return y;}
9         void setX(int x) {this.x = x;}
10        void setY(int y) {this.y = y;}
11        public String toString(){return getX()+" "+getY()+" "};
12    }
13    static class ThreeDPoint extends Point {
14        private int z;
15        ThreeDPoint(int x, int y, int z) {super(x,y);setZ(z);}
16        int getZ() {return z;}
17        void setZ(int z) {this.z = z;}
18        public String toString(){return super.toString()+getZ()+" "};
19    }
20    public static void main(String[] args) {
21        Point p = new Point(1,2);
22        ThreeDPoint q = new ThreeDPoint(3,4,5);
23        System.out.println(""+ p + q);
24        q.setX(p.getY());
25        p.setY(q.getZ());
26        q.setZ(p.getX());
27        System.out.println(""+ p + q);
28    }
29 }
```

Which of the following statements are true? (At least one of the statements is true.)

- A. When this program is run, it outputs the following to the console:
1 2 3 4 5
1 5 2 4 1
- B. When this program is run, it outputs the following to the console:
"" (1,2) (3,4,5) "" (1,5) (2,4,1)
- C. The internal classes, Point and ThreeDPoint, are marked "static" because they must not be allowed to change.
- D. ThreeDPoint is a subclass of Point.

TURN OVER

Question 9

Study the following Java code and answer the question that follows it.

```
package com.chromamorph.pfireexam2016;
import java.util.Random;
public class Question9 {
    static int[] nums = {1,2,3,4,5};
    static Random ran = new Random();
    static long r() {
        return ran.nextInt(200);
    }
    static class Rain implements Runnable {
        public void run() {
            try {
                for(int i = 0; i < nums.length; i++) {
                    Thread.sleep(r());
                    System.out.print(nums[i]);
                }
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
    static class Shine implements Runnable {
        public void run() {
            try {
                for(int i = nums.length-1; i >= 0; i--) {
                    Thread.sleep(r());
                    System.out.print(nums[i]);
                }
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
    public static void main(String[] args) {
        Thread rain = new Thread(new Rain());
        Thread shine = new Thread(new Shine());
        rain.start();
        shine.start();
    }
}
```

Which of the following are possible outputs of this program? (At least one of the following is a possible output of this program.)

- A. 5412332145
- B. 1254334251
- C. 2541323145
- D. 1523434215

TURN OVER

Question 10

Which of the following statements are true? (At least one of the statements is true.)

- A. UDP is a reliable, bi-directional, connection-based protocol.
- B. TCP is a reliable, bi-directional, connection-based protocol.
- C. UDP would be an appropriate protocol to use for communicating with an FTP server.
- D. TCP would be an appropriate protocol to use for communicating with an HTTP server.

Question 11

Suppose we have two programs, a client and a server. Here is the client program:

```
3 import java.io.IOException;
4 import java.net.DatagramPacket;
5 import java.net.DatagramSocket;
6 import java.net.InetAddress;
7
8 public class Question11Client {
9     public static void main(String[] args) throws IOException {
10         DatagramSocket socket = new DatagramSocket();
11         byte[] buf = new byte[256];
12         InetAddress address = InetAddress.getByName("localhost");
13         DatagramPacket packet = new DatagramPacket(buf, buf.length, address, 4445);
14         socket.send(packet);
15         socket.receive(packet);
16         System.out.println(new String(packet.getData(), 0, packet.getLength()));
17         socket.close();
18     }
19 }
```

And here is the server program:

```
3 import java.io.IOException;
4 import java.net.DatagramPacket;
5 import java.net.DatagramSocket;
6
7 public class Question11Server {
8     static class ServerRunnable implements Runnable {
9         DatagramSocket socket = new DatagramSocket(4445);
10        ServerRunnable() throws IOException { super(); }
11        public void run() {
12            while(true) {
13                byte[] buffer = new byte[256];
14                DatagramPacket packet = new DatagramPacket(buffer,buffer.length);
15                try {
16                    socket.receive(packet);
17                    String s = "Hello "+packet.getAddress()+":"+packet.getPort()+"!";
18                    buffer = s.getBytes();
19                    packet = new DatagramPacket(buffer,buffer.length,packet.getAddress(),packet.getPort());
20                    socket.send(packet);
21                } catch (IOException e) {
22                    e.printStackTrace();
23                }
24            }
25        }
26    }
27    public static void main(String[] args) {
28        try {
29            while(true) {
30                Thread t = new Thread(new ServerRunnable());
31                t.start();
32                t.join();
33            }
34        } catch (InterruptedException e) {
35            return;
36        } catch (IOException e) {
37            e.printStackTrace();
38        }
39    }
40 }
```

(Question 11 continued on next page)

Question 11 continued

Study these two programs and state which of the following statements are true. (At least one of the statements is true.)

- A. When the server program is started first and then the client program is started, the following is an example of what might be printed out on the console of the client program:
Hello /192.168.0.1:63484!
- B. When the server program is started first and then the client program is started, the following is an example of what might be printed out on the console of the client program:
Hello /127.0.0.1:63484!
- C. When the client program is started first and then the server program is started, the following is an example of what might be printed out on the console of the client program:
Hello /127.0.0.1:63484!
- D. When the client program is started first and then the server program is started, the following is an example of what might be printed out on the console of the client program:
Hello /192.168.0.1:63484!

TURN OVER

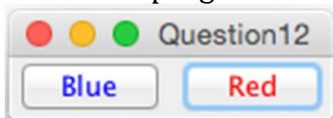
Question 12

Study the Java program below and answer the question that follows it.

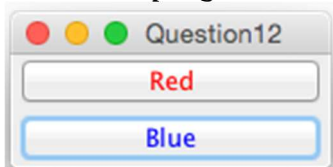
```
10 public class Question12 implements Runnable{
11
12     private void toggleButtonColor(JButton button) {
13         if (button.getText().equals("Blue")) {
14             button.setForeground(new Color(255,0,0));
15             button.setText("Red");
16         } else {
17             button.setForeground(new Color(0,0,255));
18             button.setText("Blue");
19         }
20     }
21
22     public void run() {
23         JFrame frame = new JFrame("Question12");
24         frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
25         JButton button1 = new JButton("Red");
26         button1.setBackground(new Color(255,0,0));
27         JButton button2 = new JButton("Blue");
28         button2.setBackground(new Color(0,0,255));
29         button1.addActionListener(new ActionListener() {
30             public void actionPerformed(ActionEvent e) {
31                 toggleButtonColor(button2);
32             }
33         });
34         button2.addActionListener(new ActionListener() {
35             public void actionPerformed(ActionEvent e) {
36                 toggleButtonColor(button1);
37             }
38         });
39         frame.getContentPane().add(button1, BorderLayout.LINE_START);
40         frame.getContentPane().add(button2, BorderLayout.LINE_END);
41         frame.pack();
42         frame.setVisible(true);
43     }
44     public static void main(String[] args) {
45         javax.swing.SwingUtilities.invokeLater(new Question12());
46     }
47 }
```

Which of the following statements are true? (At least one of the statements is true.)

- A. When this program is run, it produces a GUI that looks like this:



- B. When this program is run, it produces a GUI that looks like this:



- C. The `invokeLater` method called in line 45 causes the GUI to be run on the event dispatch thread.
- D. When `button1` is pressed, it causes the text and the color on `button1` to change.

TURN OVER

Question 13

Which of the following statements are true? (At least one of the statements is true.)

- A. In Android, an explicit intent requests a component that has a specified class.
- B. In Android, an explicit intent requests a component that can fulfil a specified type of action.
- C. The following is an example of creating a new explicit intent in Android:
Intent intent = new Intent(MediaStore.ACTION_IMAGE_CAPTURE);
- D. The following is an example of creating a new explicit intent in Android:
Intent intent = new Intent(this, SignInActivity.class);

Question 14

Which of the following statements are true? (At least one of the statements is true.)

- A. When an Android Activity, *A*, is launched, the first lifecycle callback method that is called is `startActivity`, followed by `onResume`; when another activity, *B*, comes into the foreground, *A*'s `onPause` method is called.
- B. When an Android Activity, *A*, ceases to be visible, the lifecycle callback method `onStop` is called, followed by `onDestroy` if *A* is then destroyed; if *A* is in a paused state and the user returns to *A*, then *A*'s `onResume` method is called.
- C. When an activity is launched, its `onCreate` method is called, followed by its `onStart` method and then its `onResume` method. When `onResume` has completed, the activity is in the resumed or running state.
- D. The operating system can finish or kill an activity if it is paused or stopped.

TURN OVER

Question 15

SNIPPET 1 is an excerpt from the definition of the main activity class of an Android app.

SNIPPET 1:

```
1 public class MainActivity extends AppCompatActivity {
2     int requestCode = 1234;
3     protected void onCreate(Bundle savedInstanceState) {
4         super.onCreate(savedInstanceState);
5         setContentView(R.layout.activity_main);
6     }
7     public void actOnButtonPress(View view) {
8         Intent intent = new Intent(MediaStore.ACTION_IMAGE_CAPTURE);
9         startActivityForResult(intent, requestCode);
10    }
11    public void onActivityResult(int requestCode, int resultCode, Intent intent) {
12        if (requestCode == this.requestCode && resultCode == RESULT_OK) {
13            ImageView imageView = (ImageView)findViewById(R.id.imageView);
14            imageView.setImageBitmap((Bitmap)intent.getExtras().get("data"));
15        }
16    }
17 }
```

SNIPPET 2 is the xml layout file associated with the above MainActivity class.

SNIPPET 2:

```
1 <RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
2     xmlns:tools="http://schemas.android.com/tools" android:layout_width="match_parent"
3     android:layout_height="match_parent" android:paddingLeft="@dimen/activity_horizontal_margin"
4     android:paddingRight="@dimen/activity_horizontal_margin"
5     android:paddingTop="@dimen/activity_vertical_margin"
6     android:paddingBottom="@dimen/activity_vertical_margin" tools:context=".MainActivity">
7     <Button
8         android:layout_width="wrap_content"
9         android:layout_height="wrap_content"
10        android:text="Button"
11        android:id="@+id/button"
12        android:layout_alignParentBottom="true"
13        android:layout_centerHorizontal="true"
14        android:layout_marginBottom="160dp"
15        android:onClick="actOnButtonPress"/>
16    <ImageView
17        android:layout_width="wrap_content"
18        android:layout_height="wrap_content"
19        android:id="@+id/imageView"
20        android:layout_above="@+id/button"
21        android:layout_centerHorizontal="true" />
22 </RelativeLayout>
```

Which of the following statements are true? (At least one of the statements is true.)

- A. Lines 7-15 of SNIPPET 2 define a button in the UI. When this button is pressed, the method, `actOnButtonPress`, defined in lines 7-10 of SNIPPET 1 is executed.
- B. When this program runs, the view argument of `actOnButtonPress` will contain the `ImageView` object defined in lines 16-21 of SNIPPET 2.
- C. In line 11 of SNIPPET 1, the object passed to `onActivityResult` in this method's "intent" argument is the same as the object created in line 8 of SNIPPET 1.
- D. The `onActivityResult` method, defined in lines 11-16 of SNIPPET 1, is called when the `MainActivity` object receives the result from an earlier call to `startActivityForResult`.

TURN OVER

Question 16

Study the following Android code and answer the question that follows it.

```
1 public class MainActivity extends AppCompatActivity implements SensorEventListener{
2
3     SensorManager sensorManager;
4     Sensor accelerometer;
5
6     @Override
7     protected void onCreate(Bundle savedInstanceState) {
8         super.onCreate(savedInstanceState);
9         setContentView(R.layout.activity_main);
10        sensorManager = (SensorManager) getSystemService(SENSOR_SERVICE);
11        accelerometer = sensorManager.getDefaultSensor(Sensor.TYPE_ACCELEROMETER);
12        sensorManager.registerListener(this, accelerometer, SensorManager.SENSOR_DELAY_FASTEST);
13    }
14
15    public void onSensorChanged(SensorEvent event) {
16        if (event.sensor.getType() == Sensor.TYPE_ACCELEROMETER) {
17            float[] a = event.values;
18            TextView textView1 = (TextView) findViewById(R.id.textView1);
19            TextView textView2 = (TextView) findViewById(R.id.textView2);
20            TextView textView3 = (TextView) findViewById(R.id.textView3);
21            textView1.setText(String.format("%.3f", a[0]));
22            textView2.setText(String.format("%.3f", a[1]));
23            textView3.setText(String.format("%.3f", a[2]));
24        }
25    }
26
27    @Override
28    public void onAccuracyChanged(Sensor sensor, int accuracy) {}
29
30    protected void onPause() {
31        super.onPause();
32        sensorManager.unregisterListener(this);
33    }
34
35 }
```

Which of the following statements are true? (At least one of the statements is true.)

- A. The onPause method is called when the user presses the "Pause" button in the UI.
- B. The MainActivity class object itself is registered as a listener for events coming from the default accelerometer.
- C. The main activity screen of the app shows three text labels. The values in these text labels change when the device is tilted.
- D. The sensor delay for the accelerometer is set to be as long as possible.

END OF EXAMINATION