

Written Re-exam
Programming Mobile Applications
Medialogy, 2nd semester

Friday 26 August 2022, 9.00 – 13.00

Navn: _____

Studienr: _____

Programming Mobile Applications

Re-examination

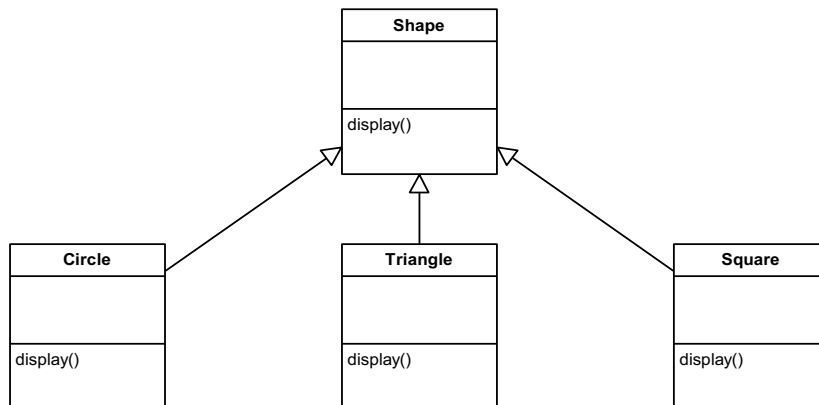
26 August 2022, 9.00 – 13.00

Instructions

- You have 4 hours to complete this examination.
- Neither electronic devices nor written material are allowed in the examination room.
- This examination consists of 10 questions. Each question is worth 10 marks. You must obtain at least 50 marks to pass.
- 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

Study the following diagram:



For each of the following 10 statements referring to this diagram, write down whether the statement is true or false.

- Circle is a superclass of Shape.
- Triangle is a subclass of Circle.
- The display operation defined in Square overrides the definition of the display operation in Shape.
- The display operation defined in Triangle overloads the definition of the display operation in Shape.
- The Circle class depends on the Shape class.
- The Shape class depends on the Square class.
- Triangle is a client of Shape.
- Shape is a client of Square.
- Square is a subclass of Shape.
- Shape acts as a server class to Circle.

[1 mark for each correct part]

Question 2

Study the following Java code and answer the questions that follow it.

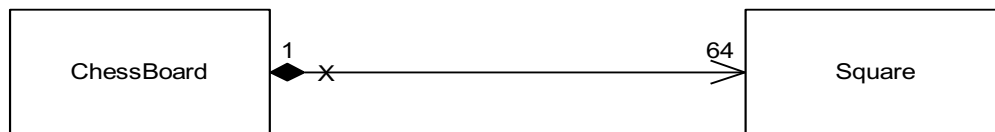
```
1 package com.titanmusic.pmareexamaugust2022;
2
3 public class Question2 {
4     public static void main(String[] args) {
5         int[] indices = {7, 5, 6, 5, 2, 3, 0, 4, 8, 1};
6         String[] strings = {"O", "S", " ", "R", "C", "A", "V", "J", "K"};
7         for(int i = 0; i < indices.length; i++)
8             System.out.print(strings[indices[i]]);
9     }
10 }
```

- Write down the output of this program.
- Why is the main method declared as “static”?
- What effect would it have on the behaviour of the program if the statement in line 1 were moved below the definition of the Question2 class?
- What is the purpose of the “args” argument of the main method?
- Which variable referred to in the program is static?

[2 marks for each correct part]

Question 3

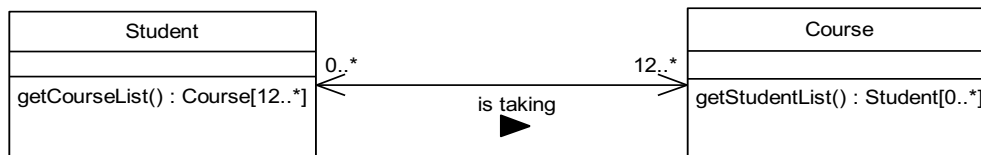
- Study the following diagram:



- Is this an example of composition or aggregation?
- How many Square objects are associated with each ChessBoard object?
- Can a Square object belong to more than one ChessBoard object?
- Is it possible for a Square object to be associated with no ChessBoard objects?
- Do Square objects know about the ChessBoard object (or objects) with which they are associated?

[5 marks, one for each correct subpart]

- Study the following diagram:



- How many Student objects can be associated with each Course object?
- How many Course objects can be associated with each Student object?
- Do Student objects know about the Course objects with which they are associated?
- Do Course objects know about the Student objects with which they are associated?
- The return type of the getCourseList() operation is given as “Course[12..*]”. Explain in words what is meant by “Course[12..*]”.

[5 marks, one for each correct subpart]

Question 4

Study the following code, which shows the content of a single file called Question4.java:

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 class Point {
4     private int x, y;
5     public void setX(int x) {this.x = x;}
6     public void setY(int y) {this.y = y;}
7     public int getX() {return x;}
8     public int getY() {return y;}
9
10    public Point(int x, int y) {
11        setX(x);
12        setY(y);
13    }
14
15    public String toString() {return "("+getX()+","+getY()+"}";}
16 }
17
18 public class Question4 {
19    public static void main(String[] args) {
20        Point p = new Point(1,2);
21        Point q = p;
22        q.setX(q.getX() * 2);
23        q.setY(q.getY() * 3);
24        q = null;
25        System.out.println(p);
26        System.out.println(q);
27    }
28 }
```

- What is written to the console window when this program is run?
- If line 15 were commented out, what would the program print to the console when it is run.
- What would happen if the following line were added between lines 26 and 27:
`q = new Point();`
Explain your answer.
- What would happen if the following line were added between lines 26 and 27:
`q.setX(5);`
Explain your answer.
- What would be the effect of adding the word, "public", at the beginning of line 3?

[2 marks for each correct part]

Question 5

Study the following code, which forms the content of a single file called Question5.java:

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 public class Question5 {
4
5     int x = 1;
6     static int y = 2;
7     final static int z = 3;
8
9     public Question5() {
10        x += 5;
11        y += 5;
12        z += 5;
13    }
14
15    public String toString() {return "" + x + " "+y+ " "+z;}
16
17    public static void main(String[] args) {
18        Question5 a = new Question5();
19        System.out.println(a);
20        new Question5();
21        System.out.println(a);
22        new Question5();
23        System.out.println(a);
24    }
25 }
```

- Explain why this code will not compile. Which single line would need to be commented out in order to correct the code so that it can be compiled? [4 marks]
- Assuming the line you have identified in part (a) has been commented out, what would be the output of the corrected program? [3 marks]
- What would be the output of the corrected program if, in addition to commenting out the line you have identified in part (a), you also remove the word “static” from line 6? [3 marks]

Question 6

The following shows the content of a single file called Question6.java. What does the program print to the console when it is run?

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 import java.util.TreeSet;
4
5
6 class MyPoint implements Comparable<MyPoint> {
7     int x, y;
8
9     @Override
10    public int compareTo(MyPoint o) {
11        int d = x - o.x;
12        if (d != 0) return d;
13        d = o.y - y;
14        if (d != 0) return d;
15        return 0;
16    }
17
18    public boolean equals(Object o) {
19        return compareTo((MyPoint)o) == 0;
20    }
21
22    public MyPoint(int x, int y) {
23        this.x = x;
24        this.y = y;
25    }
26
27    public String toString() {return "("+x+","+y+"");}
28 }
29
30 public class Question6 {
31    public static void main(String[] args) {
32        TreeSet<MyPoint> s = new TreeSet<MyPoint>();
33        for (int x = 0; x < 3; x++)
34            for(int y = 2; y >= 0; y--)
35                s.add(new MyPoint(x,y));
36        System.out.println(s);
37    }
38 }
```

[10 marks for a correct answer]

Question 7

Study the following program and answer the questions that follow it.

```
3 public class Question13 {
4
5     static int k = 3;
6
7     static class CountRunnable implements Runnable {
8         int i;
9         CountRunnable(int i) { this.i = i; }
10
11        public void run() {
12            for(int j = 0; j < k; j++) {
13                System.out.print(k*i+j+" ");
14            }
15        }
16    }
17
18    public static void main(String[] args) {
19        for(int i = 0; i < k; i++)
20            new Thread(new CountRunnable(i)).start();
21    }
22 }
```

- Why is k declared static in line 5? [2 marks]
- How many threads execute in the program? (Remember the main thread!) [2 marks]
- Why is there more than one possible output from the program? [3 marks]
- Which of the following are possible outputs of this program?
 - 3 4 5 0 7 6 8 1 2
 - 3 4 5 6 0 1 2 7 8
 - 0 1 2 3 4 5 6 7 8
 - 0 1 2 6 3 4 7 8 5

[3 marks]

Question 8

- a) What are the three different types of thread that can be used in Swing and what is each type used for? [6 marks]
- b) Study the following code:

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 import java.awt.BorderLayout;
4
5 import javax.swing.JFrame;
6 import javax.swing.JLabel;
7
8 public class Question8 {
9     public static void main(String[] args) {
10         JFrame frame= new JFrame("Hello world");
11         frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
12         frame.getContentPane().add(new JLabel("1"));
13         frame.getContentPane().add(new JLabel("2"));
14         frame.getContentPane().add(new JLabel("3"),BorderLayout.LINE_END);
15         frame.getContentPane().add(new JLabel("4"),BorderLayout.PAGE_END);
16         frame.getContentPane().add(new JLabel("5"),BorderLayout.PAGE_START);
17         frame.getContentPane().add(new JLabel("6"),BorderLayout.LINE_START);
18         frame.pack();
19         frame.setVisible(true);
20     }
21 }
```

Draw a sketch of the GUI that appears on the screen when this code is run. [4 marks]

Question 9

The following shows the content of a Java source code file called Q9Client.java:

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 import java.io.IOException;
4 import java.net.DatagramPacket;
5 import java.net.DatagramSocket;
6 import java.net.InetAddress;
7
8 public class Q9Client {
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         packet = new DatagramPacket(buf, buf.length);
16         socket.receive(packet);
17         String received = new String(packet.getData(), 0, packet.getLength());
18         System.out.println(received);
19         socket.close();
20     }
21 }
```

and the following shows the content of a Java source code file called Q9Server.java

```
1 package com.titanmusic.pmareexamaugust2022;
2
3 import java.io.IOException;
4 import java.net.DatagramPacket;
5 import java.net.DatagramSocket;
6 import java.net.InetAddress;
7
8 public class Q9Server {
9     public static void main(String[] args) throws IOException {
10         String[] responses = {"1", "2", "3"};
11         for(int i = 0; true; i = ++i % responses.length) {
12             DatagramSocket socket = new DatagramSocket(4445);
13             byte[] buf = new byte[256];
14             DatagramPacket packet = new DatagramPacket(buf, buf.length);
15             socket.receive(packet);
16             buf = responses[i].getBytes();
17             InetAddress address = packet.getAddress();
18             int port = packet.getPort();
19             packet = new DatagramPacket(buf, buf.length, address, port);
20             socket.send(packet);
21             socket.close();
22         }
23     }
24 }
```

- If Q9Server is started and then Q9Client is run on the same machine, what does Q9Client write to the console window? If Q9Server is kept running and Q9Client is run 4 more times, write down what Q9Client writes to the console on each of these four subsequent runs. [5 marks]
- Does this program use UDP or TCP? [1 mark]
- Name one advantage of UDP over TCP and an example of a real-world application in which UDP is used. [2 marks]
- Name one advantage of TCP over UDP and an example of a real-world application in which TCP is used. [2 marks]

Question 10

- a) Name the four different basic types of component from which an Android app is built. [2 marks]
- b) Name the two different types of Intent that are used in Android to communicate between components. Explain the difference between these two types of Intent. [4 marks]
- c) Suppose we have an activity, A, in an Android app that currently has focus and then the user opens another activity, B, that appears in front of A and has focus. If part of A is still visible because B does not completely cover the screen, which lifecycle callback will this cause to be run on A? [2 marks]
- d) Assuming we still have the situation described in part (c) and then we close activity B. What lifecycle callback does this cause to be called on A? [2 marks]

END OF EXAMINATION