

Programming for Interaction

Re-examination

24 August 2018

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 1 answer to each question.
- Do not turn over until you are told to do so by an invigilator.

Question 1

In each of parts a-e below, choose the **one** alternative that best completes the statement or answers the question.

- a) _____ is a construct that defines objects of the same type.
- A. A class
 - B. A method
 - C. A data field
 - D. An object
- b) Which of the following is an advantage of encapsulation?
- A. It allows for the implementation of a class to be changed without changing its contract and therefore without making it necessary to change any code outside the class.
 - B. Only public methods are needed.
 - C. Making the class final causes no consequential changes to other code.
 - D. It allows for a class's contract to be changed without changing the implementation and without making it necessary to change any code outside the class.
- c) Which one of the following statements is true?
- A. If a method overloads another method, these two methods must have the same signature.
 - B. A method in a subclass cannot overload a method in the superclass.
 - C. A method can be overridden in the same class.
 - D. If a method overrides another method, these two methods must have the same signature.
- d) Which character does the UML use before a member name to indicate that the member is protected?
- A. +
 - B. -
 - C. #
 - D. ?
- e) In OOP, a reference variable can reference a subtype object. What is this feature called?
- A. encapsulation
 - B. inheritance
 - C. polymorphism
 - D. abstraction

[2 marks for each of the five parts, a-e]

Question 2

In each of the five parts of this question, choose the **one** alternative that best completes the statement or answers the question.

- a) _____ is invoked to create an object.
- A. A method with a return type
 - B. A constructor
 - C. A method with the void return type
 - D. The main method
- b) Study the following code and answer the question that follows.

```
1 class TempClass {
2     int i;
3     public void TempClass(int j) {
4         int i = j;
5     }
6 }
7
8 public class C {
9     public static void main(String[] args) {
10        TempClass temp = new TempClass(2);
11    }
12 }
```

Which **one** of the following statements is true of this code?

- A. The program compiles and runs without an error.
 - B. The program has a compilation error because TempClass does not have a constructor with an int argument.
 - C. The program has a compilation error because TempClass does not have a default constructor.
 - D. The program compiles, but it does not run because class TempClass is not public.
- c) In Java, the default values for data fields of boolean type, numeric type and object type are _____, respectively.
- A. false, 1, null
 - B. true, 1, null
 - C. false, 0, null
 - D. true, 0, null
- d) Which keyword does Java use to reference the current object?
- A. this
 - B. that
 - C. null
 - D. thisObject
- e) You can declare two variables with the same name in _____.
- A. a block
 - B. a method, one as a formal parameter and the other as a local variable
 - C. two nested blocks in a method (two nested blocks means one being inside the other)
 - D. different methods in a class

[2 marks for each of the five parts, a-e]

Question 3

In each of the five parts of this question, choose the **one** alternative that best completes the statement or answers the question.

- a) Which **one** of the following is incorrect?
- A. A constructor may invoke a static method.
 - B. A constructor invokes its superclass no-arg constructor by default if a constructor does not invoke an overloaded constructor or its superclass's constructor.
 - C. A constructor may be static.
 - D. A constructor may invoke an overloaded constructor.
- b) In the following code snippet, what is the printout of the **second** println statement in the main method (line 9)?

```
1 public class Foo {
2     int i;
3     static int s;
4
5     public static void main(String[] args) {
6         Foo f1 = new Foo();
7         System.out.println("f1.i is " + f1.i + " f1.s is " + f1.s);
8         Foo f2 = new Foo();
9         System.out.println("f2.i is " + f2.i + " f2.s is " + f2.s);
10        Foo f3 = new Foo();
11        System.out.println("f3.i is " + f3.i + " f3.s is " + f3.s);
12    }
13
14    public Foo() {
15        i++;
16        s++;
17    }
18 }
```

- A. f2.i is 2 f2.s is 2
 - B. f2.i is 1 f2.s is 1
 - C. f2.i is 1 f2.s is 2
 - D. f2.i is 2 f2.s is 1
- c) What is the output of the following program?

```
public class Question3C {
    public static void main(String[] args) {
        String s1 = new String("Welcome to Java!");
        String s2 = new String("Welcome to Java!");
        if (s1 == s2)
            System.out.println("s1 and s2 reference the same object.");
        else
            System.out.println("s1 and s2 reference different objects.");
    }
}
```

- d) Which keyword is used to reference a method in the superclass from a subclass?
- e) What is the output of the following program?

```
1 public class Test {
2     public static void main(String[] args) {
3         new Person().printPerson();
4         new Student().printPerson();
5     }
6 }
7
8 class Student extends Person {
9     public String getInfo() {
10        return "Student";
11    }
12 }
13
14 class Person {
15     public String getInfo() {
16        return "Person";
17    }
18
19     public void printPerson() {
20        System.out.println(getInfo());
21    }
22 }
```

[2 marks for each of the five parts, a-e]

Question 4

In each of the five parts of this question, choose the **one** alternative that best completes the statement or answers the question.

a) Study the following code.

```
1 class C1 {}
2 class C2 extends C1 { }
3 class C3 extends C2 { }
4 class C4 extends C1 {}
5
6 C1 c1 = new C1();
7 C2 c2 = new C2();
8 C3 c3 = new C3();
9 C4 c4 = new C4();
```

Which **one** of the following statements evaluates to **false**?

- A. c3 instanceof C1
 - B. c2 instanceof C1
 - C. c4 instanceof C2
 - D. c1 instanceof C1
- b) Inheritance means _____.
- A. that a variable of supertype can refer to a subtype object
 - B. that a class can contain another class
 - C. that data fields should be declared private
 - D. that a class can extend another class
- c) Which of the following statements is **false**?
- A. A protected method can be accessed by a subclass in a different package.
 - B. A private method cannot be accessed by a class in a different package.
 - C. A public class can be accessed by a class from a different package.
 - D. A method with no visibility modifier can be accessed by a class in a different package.
- d) Which of the following class definitions defines a legal abstract class?
- A. abstract class A { abstract void unfinished(); }
 - B. public class abstract A { abstract void unfinished(); }
 - C. class A { abstract void unfinished() { } }
 - D. class A { abstract void unfinished(); }
- e) What is the relationship between an interface and a class that implements it?
- A. Aggregation
 - B. Inheritance
 - C. None
 - D. Composition

[2 marks for each of the five parts, a-e]

Question 5

In each of the five parts of this question, choose the **one** alternative that best completes the statement or answers the question.

- a) An instance of _____ describes system errors. If this type of error occurs, there is little you can do beyond notifying the user and trying to terminate the program gracefully.
- A. RuntimeException
 - B. Exception
 - C. Error
 - D. Throwable
- b) What exception type does the following program throw?

```
1 public class Test {
2     public static void main(String[] args) {
3         int[] list = new int[5];
4         System.out.println(list[5]);
5     }
6 }
```

- A. ArithmeticException
 - B. ArrayIndexOutOfBoundsException
 - C. StringIndexOutOfBoundsException
 - D. No exception.
- c) What exception type does the following program throw?

```
1 public class Test {
2     public static void main(String[] args) {
3         System.out.println(1 / 0);
4     }
5 }
```

- A. ArithmeticException
 - B. ArrayIndexOutOfBoundsException
 - C. ClassCastException
 - D. No exception.
- d) A method must declare to throw _____.
- A. a RuntimeException
 - B. checked exceptions
 - C. an Error
 - D. unchecked exceptions
- e) What is wrong in the following program?

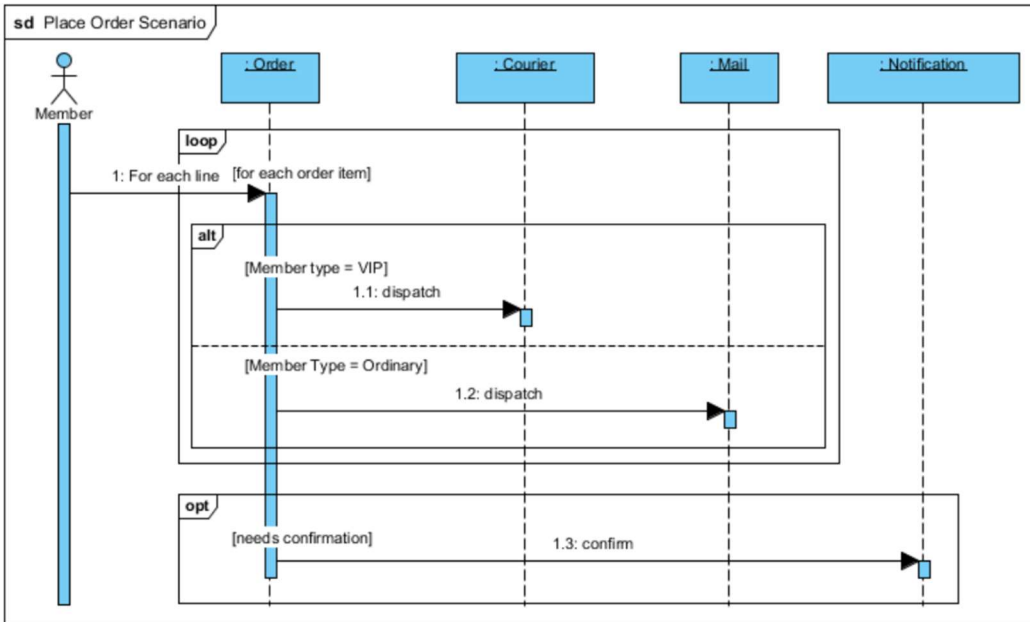
```
1 class Test {
2     public static void main (String[] args) {
3         try {
4             System.out.println("Welcome to Java");
5         }
6     }
7 }
```

- A. You cannot have a try block without a catch block or a finally block.
- B. You cannot have a try block without a catch block.
- C. A method call that does not declare exceptions cannot be placed inside a try block.
- D. Nothing is wrong.

[2 marks for each of the five parts, a-e]

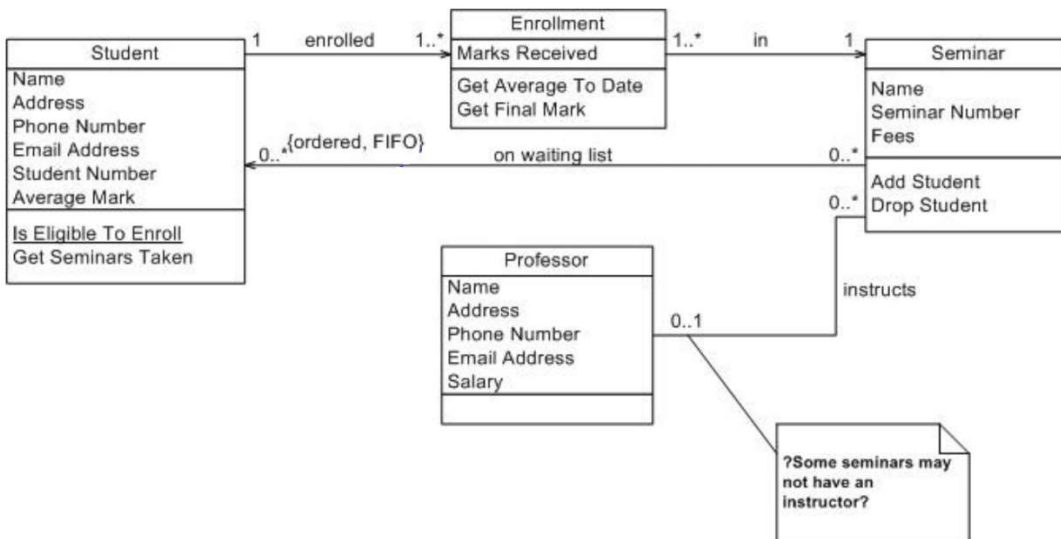
Question 6

Consider the following UML diagram and answer the questions that follow it.



- a) What type of UML diagram is this?
- b) Under what condition is the `dispatch` method defined in the `Courier` class executed?
- c) To which class does the `confirm` method belong?
- d) How would you modify the label of the `:Courier` object so that this object has the name `c`?
- e) Are the message calls in this diagram synchronous or asynchronous?

Consider the following UML diagram and answer the questions that follow it.



- f) What type of UML diagram is this?
- g) How many Seminar objects are associated with each Professor object?
- h) Write down the attributes of the Enrollment class.
- i) Show how you would modify the diagram in order to add a new class, called "Assistant Professor" that is a subclass of the Professor class and defines its own new attribute named "Contract end date". (Draw only the part of the diagram that you need to change.)
- j) List the operations of the Seminar class.

[1 mark for each of the 10 parts, a-j]

Question 7

- a) Which **one** of the following statements is true?
- A. An advantage of the waterfall model is that it allows implementation and testing to be carried out in parallel.
 - B. A disadvantage of the waterfall model is that it does not accommodate parallel or incremental work.
 - C. An advantage of the waterfall model is that it allows a product to be developed in increments.
 - D. A disadvantage of the waterfall model is that it does not follow a strict enough scheme.
- b) Which **one** of the following statements is true?
- A. In agile development, high risk and high value issues are left until later iterations of the project.
 - B. Agile software development prioritises comprehensive documentation over working software.
 - C. Agile software development prioritises individuals and interactions over process and tools.
 - D. Agile software development prioritises contract negotiation over customer collaboration.
- c) Which **one** of the following statements is true?
- A. In extreme programming, developers specify which stories should be implemented within any given iteration.
 - B. In extreme programming, the client decomposes stories into development tasks.
 - C. In extreme programming, business decides the importance of a given feature whereas developers decide the cost of the feature.
 - D. In extreme programming, software is evaluated by writing stories with the client.
- d) Which **one** of the following statements is true?
- A. In Scrum, the scrum master knows what to build and the order in which features should be implemented.
 - B. In Scrum, the goal of the project kick-off meeting is to create a product backlog.
 - C. In Scrum, the product owner is responsible for the Scrum values and practices and has the main objective of removing obstacles.
 - D. The Scrum equivalent of an iteration is called a sprint. Each sprint takes no longer than 1 week.
- e) Which **one** of the following statements is true?
- A. Haskell, Prolog and F# are examples of imperative programming languages.
 - B. Declarative programming focuses on *how* a program should achieve its task.
 - C. Concurrent programming is where one programmer types while another watches, with the roles typically being switched during a day.
 - D. In functional programming, change of state and mutable data are avoided.

[2 marks for each of the five parts, a-e]

Question 8

- a) Name the four basic types of component from which an Android app is made?
- b) Which **one** of the following statements is true?
- A. Each Android app runs within its own process which has its own virtual machine.
 - B. Each Android app runs within its own Windows process.
 - C. Android apps obey the “principle of greatest privilege” which states that the app should have access to as much information as possible.
 - D. An Android app can only be started by clicking on the app’s icon in the launcher.

- c) Consider the following code:

```
public void takePhotoReturnIcon() {
    Intent intent = new Intent(MediaStore.ACTION_IMAGE_CAPTURE);
    if (intent.resolveActivity(getPackageManager()) != null) {
        startActivityForResult(intent, REQUEST_IMAGE_CAPTURE);
    }
}
```

Which **one** of the following statements is true of this code snippet?

- A. This method uses an explicit intent.
 - B. REQUEST_IMAGE_CAPTURE is a static final constant defined in R.java.
 - C. The startActivityForResult method can only be used to start an Activity that belongs to the same app as that from which the method is called.
 - D. The Intent’s resolveActivity method consults the package manager to find out if there is a component installed that can satisfy the Intent.
- d) Consider the following code:

```
@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
    if (requestCode == REQUEST_IMAGE_CAPTURE && resultCode == RESULT_OK) {
        Bundle extras = data.getExtras();
        Bitmap imageBitmap = (Bitmap) extras.get("data");
        ImageView imageView = (ImageView)findViewById(R.id.imageView1);
        imageView.setImageBitmap(imageBitmap);
    }
}
```

Which **one** of the following statements is true?

- A. The onActivityResult method is automatically called whenever an Activity receives an Intent that is sent in response to a call to startActivityForResult.
 - B. REQUEST_IMAGE_CAPTURE is a static constant defined in the Activity class.
 - C. The extras Bundle object is an array of bytes that needs to be typecast to obtain the image that is encoded in it.
 - D. If the requestCode does not match the value in REQUEST_IMAGE_CAPTURE, then an exception is thrown.
- e) Which **one** of the following statements is true?
- A. If a new Activity is started that does not completely cover the screen, then the background Activities that remain partially visible are stopped.
 - B. The Android Activity back stack is a FIFO stack that holds pointers to the Activities that are currently paused, stopped or resumed.
 - C. Under normal circumstances, an Activity can be killed by the system if it is either paused or stopped.
 - D. An Android View is a special type of ViewGroup that can contain a LayoutManager.

[2 marks for each part, a-e]

Question 9

Consider the following code and answer the questions that follow it.

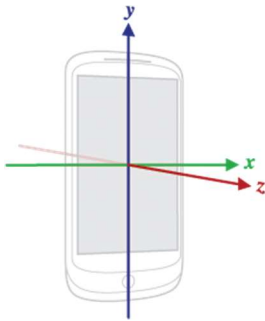
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:orientation="vertical" >
    <TextView android:id="@+id/text"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="I am a TextView" />
    <Button android:id="@+id/button"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="I am a Button" />
</LinearLayout>
```

- What kind of LayoutManager is being used here?
- How many Views are present in the user interface defined by this file and what types of View are they?
- In the lines that read
android:layout_width="wrap_content"
what is the meaning of the value "wrap_content" and what effect does it have on the size of the View of which it is a property?
- Explain the purpose of the line,
android:id="@+id/text"
In particular, explain the meaning and effect of the '@' and '+' symbols and the substring 'id/'.
- What is the effect of the value "vertical" in the android:orientation property of the LinearLayout element.

[2 marks for each part, a-e]

Question 10

- a) Give an example of each of the following types of Android sensor:
 - i. motion sensor
 - ii. environment sensor
 - iii. position sensor
 - iv. software sensor
- b) The `getMinDelay()` method on the `Sensor` class returns an `int` value. If this value is 0 what does it mean? What does the value mean if it is non-zero?
- c) To monitor a sensor's readings in Android, two callback methods have to be implemented that are declared in the `SensorEventListener` interface. What are these two methods?
- d) Sensor listeners are typically registered in the `onResume` method of an `Activity` and unregistered in the `onPause` method. Why is registration and unregistration of sensor listeners carried out in these particular methods?
- e) The accelerometer sensor returns a 3D vector representing acceleration along each device axis, where the device axes are as shown in the following diagram.



The first, second and third values in this vector represent the components of the acceleration along the x, y and z device axes. State what these values will be when a device is first lying on a table and then each of the following actions is taken:

- i. the device is pushed to the left;
- ii. the device is pushed at the edge nearest the bottom of the screen in its natural orientation;
- iii. no action is taken – the device left lying still;
- iv. the device falls off the table and is in free-fall.

[2 marks for each of the five parts, a-e]

END OF EXAMINATION