

Object-Oriented Analysis, Design and Programming

Re-examination

Medialogy Semester 4

Monday 16 August 2010

09:00 – 11:00

Instructions

- ***You have 2 hours to complete this examination.***
- ***Neither written material nor electronic equipment may be brought into the examination room.***
- ***There are 19 questions. The maximum score on this examination is 100 marks. Each question is worth 5 marks apart from Question 19, which is worth 10 marks.***
- ***You must get at least 50 marks in order to pass.***

Question 1

Explain why increasing the number of skilled programmers working on a software development project may not decrease the amount of time that the project takes to complete. What else must be done to ensure that the increase in the number of workers results in faster completion?

Question 2

Briefly explain what the terms *modularity* and *encapsulation* mean. What benefits do these principles bring when applied to software design?

Question 3

Explain, with examples, what is meant by the term *object* in software engineering? Suppose *A* and *B* are objects and that the following line of code occurs in the definition of the class *A*:

```
B.msg();
```

This line of code instructs one object to send a message to another one. State what the message is and which objects send and receive it.

continued

Question 4

Write down the output of the following Java program.

```
public class Question4 {
    public static void main(String[] args) {
        System.out.println(-3/5);
        System.out.println(-5 % 3);
        System.out.println(5 % -3);
        System.out.println(3 * 5 / 3);
        System.out.println(3 / 5 * 3);
    }
}
```

Question 5

Write down the output produced when the following Java class is run.

```
public class Point {

    private int x = 3;
    private int y = 2;

    public String toString() {
        return "("+x+", "+y+")";
    }

    public static void main(String[] args) {
        System.out.println(new Point());
    }
}
```

continued

Question 6

Study the following program.

```
public class Test3DPoint {
    public static void main(String[] args) {
        NewPoint p = new ThreeDPoint(1, 2, 3);
        System.out.println(p);
        p = new NewPoint(1,2);
        System.out.println(p);
    }
}
```

When this program is run, it generates the following output:

```
(1,2,3)
(1,2)
```

Answer the following questions.

- Is NewPoint a class, an abstract class or an interface?
- What is the relationship between ThreeDPoint and NewPoint?
- At least one method in NewPoint is overridden in ThreeDPoint. What is the signature of this method? (Include the visibility of the method.)

Question 7

Write down the output of the following program.

```
public class Question7 {
    public static int id = 0;
    public Question7() {id++;}
    public String toString() {return ""+id;}
    public static void main(String[] args){
        for(int i=5; i>0;i--)
            System.out.println(new Question7());
    }
}
```

Question 8

Explain the difference between an interface and an abstract class in Java. What advantages does an abstract class have over an interface? What advantages does an interface have over an abstract class?

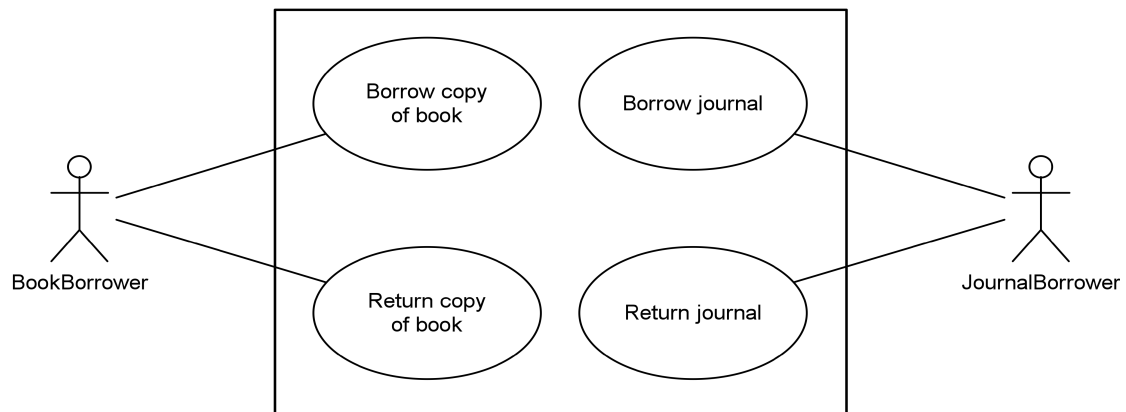
continued

Question 9

Explain the difference between a structural and a behavioural model of a software system. There are 13 official diagram types in UML 2.0. Give an example of a UML diagram type that you might use in a structural model and a UML diagram type that might be used in a behavioural model.

Question 10

Study the following diagram and answers the questions that follow it.

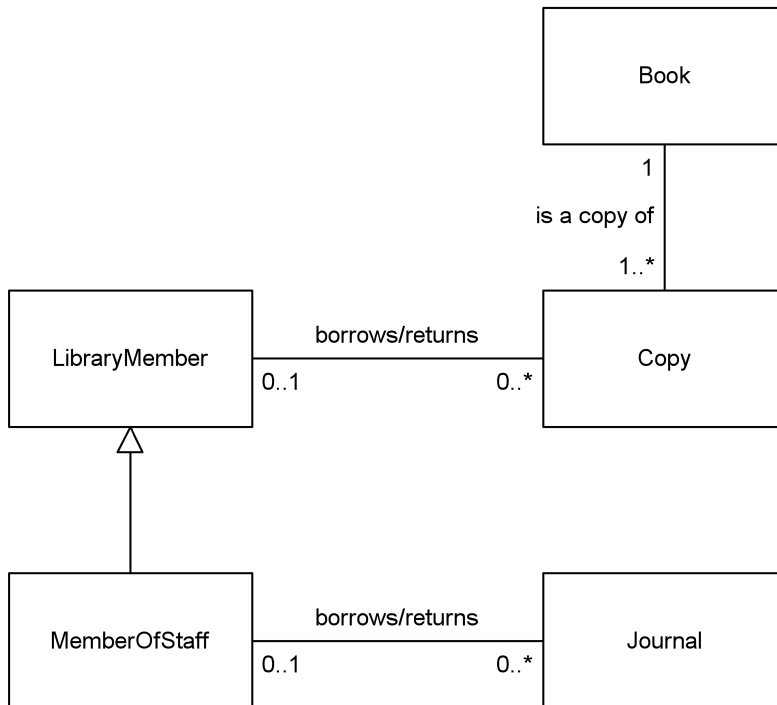


- What kind of diagram is this?
- Give an example of an actor in the diagram.
- What does the oval containing the text "Return journal" signify?
- What does the large rectangle represent?
- Is it possible for the same person to be a BookBorrower and a JournalBorrower?

continued

Question 11

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

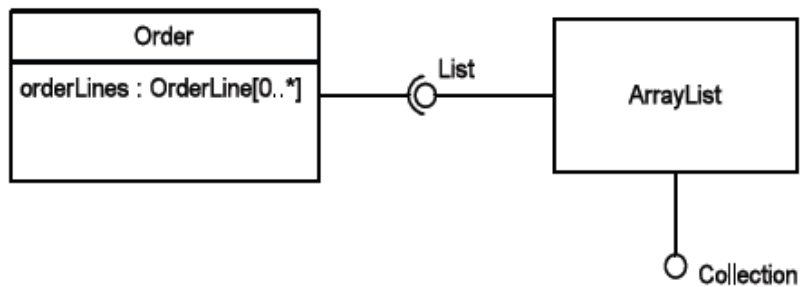


- What type of diagram is this?
- Is this a structure or a behaviour diagram?
- What does the arrow from MemberOfStaff to LibraryMember indicate?
- How many Journals can a MemberOfStaff borrow?
- How many Copies can a MemberOfStaff borrow?

continued

Question 12

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



- What is the nature of the association between List and ArrayList?
- What is the nature of the association between Order and List?
- What is the nature of the association between Collection and ArrayList?
- Can a List be instantiated?
- Can an ArrayList be instantiated?

Question 13

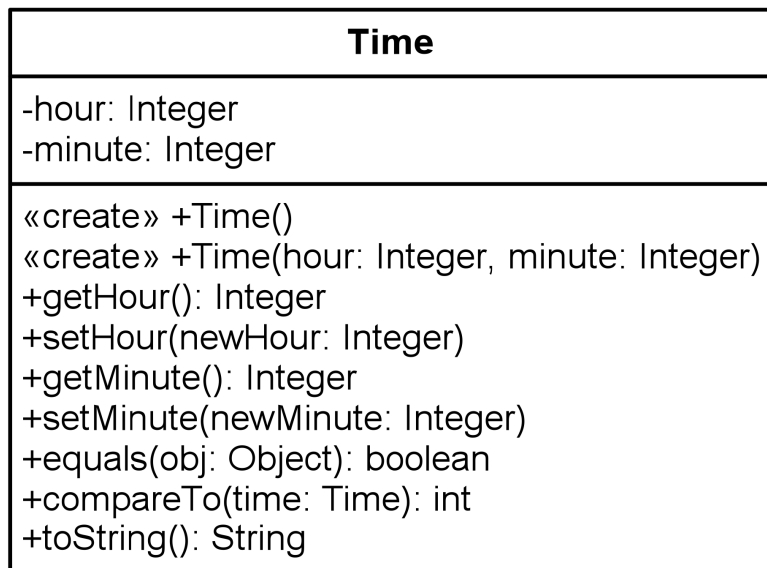
Represent the following Java class as a UML diagram.

```
public class Question13 implements Serializable {
    private static final long serialVersionUID = 1L;
    private int a;
    private int b;
    public int getA() {return a;}
    public void setA(int a) {this.a = a;}
    public int getB() {return b;}
    public void setB(int b) {this.b = b;}
}
```

continued

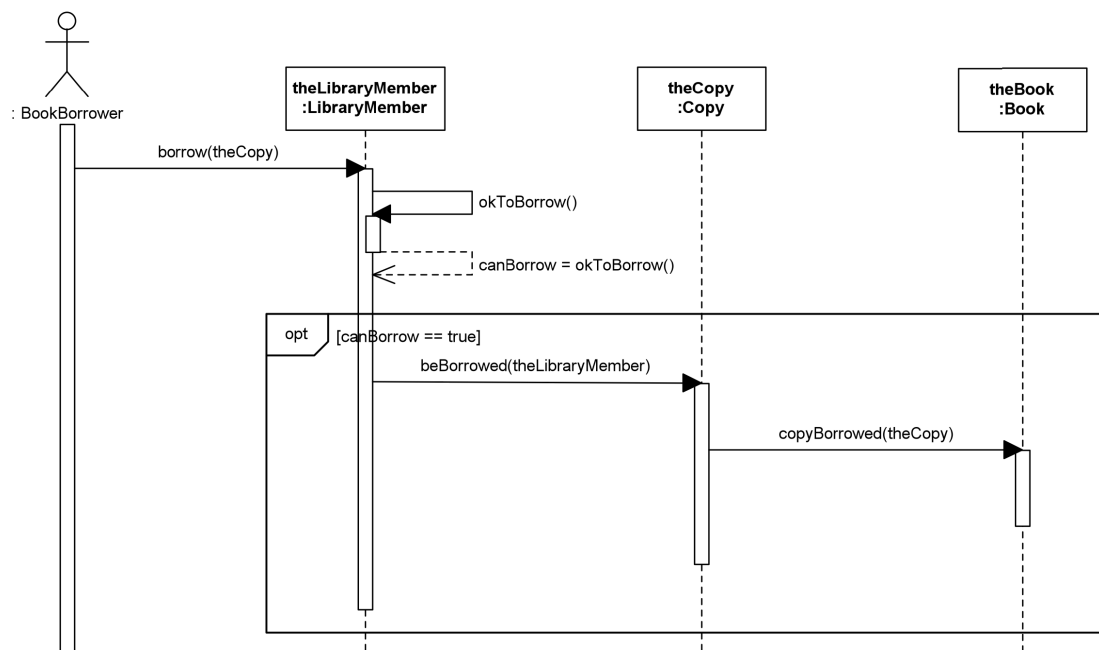
Question 14

Write a Java class that implements the following UML class diagram.



Question 15

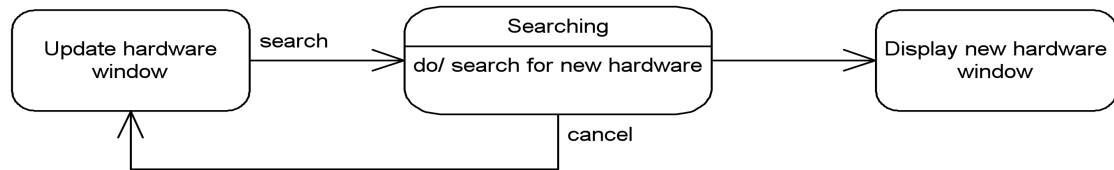
Study the following diagram and answer the questions that follow it.



- a. What kind of diagram is this?
- b. What kind of thing is Copy?
- c. What kind of thing is theBook?
- d. What does the dashed arrow labelled “canBorrow = okToBorrow()” represent?
- e. Is the “beBorrowed(theLibraryMember)” message a synchronous or an asynchronous message? Under what conditions is it sent?

Question 16

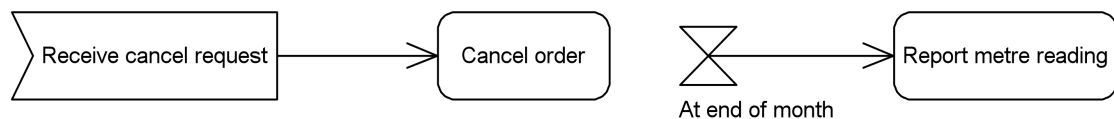
Study the following diagram and answer the questions that follow it.



- What kind of diagram is this?
- Is this a structure diagram or a behaviour diagram?
- Give an example of an activity state in this diagram.
- Under what conditions does the system enter the "Update hardware window" state?
- Under what conditions does the system enter the "Display new hardware window" state?

Question 17

Study the following two diagrams and answer the questions that follow.



- What kind of diagrams are these?
- What kind of thing is the element labelled "At end of month"? Explain the meaning of the diagram in which it occurs.
- What kind of thing is the element labelled "Receive cancel request"? Explain the meaning of the diagram in which it occurs.

continued

Question 18

Write down the output of the following program.

```
public class Question18 {
    int i;
    public Question18(String s) {
        for (int i = 0; i < s.length(); i++)
            if (!Character.isDigit(s.charAt(i)))
                throw new IllegalArgumentException(s);
        i = Integer.parseInt(s)+10;
        System.out.println(i);
    }
    public static void main(String[] args) {
        try {
            new Question18("23");
            new Question18("abc");
        } catch(IllegalArgumentException e) {
            System.out.println("Illegal argument!");
        }
    }
}
```

Question 19 (Worth 10 marks)

Study the following program.

```
public class Question19 {  
    private static TreeSet<SortedPoint> t = new TreeSet<SortedPoint>();  
    public static void main(String[] args) {  
        t.add(new SortedPoint(1,2,3));  
        t.add(new SortedPoint(3,2,1));  
        t.add(new SortedPoint(2,3,1));  
        System.out.println(t);  
    }  
}
```

When this program is run, it outputs the following:

[(1,2,3), (2,3,1), (3,2,1)]

Write down one possible definition of the SortedPoint class.

END OF EXAMINATION