

Object-Oriented Analysis, Design and Programming

Medialogy, 4th Semester, Aalborg

Wednesday 1 June 2011, 10.00-13.00

Instructions

You have 3 hours to complete this examination.

Neither written material nor electronic equipment may be brought into the examination room.

There are 20 questions and each question is worth 5 marks. The maximum possible score is therefore 100 marks. You must get at least 50 marks to pass.

Question 1

Briefly describe a large-scale software project that failed disastrously, Highlight the main factors that contributed to the failure of the project and suggest how these might have been avoided. Write no more than 300 words.

Question 2

Briefly define the meanings of the following terms when used in the context of software engineering.

- a. modularity
- b. encapsulation
- c. coupling
- d. interface
- e. abstraction

Question 3

Write down the output of the following Java program.

```
public class Question3 {
    public static void main(String[] args) {
        System.out.println(-7/5);
        System.out.println(-5 % 2);
        System.out.println(5 % -2);
        System.out.println(3 * 5 / 2);
        System.out.println(3 / 5 * 2);
    }
}
```

Question 4

What is the output of the following program? What would you have to change in order to make it print out the highest value in the array A?

```
public class Question4 {
    public static void main(String[] args) {
        int[] A = {5,6,2,8,3,9};
        int b = A[0];
        for(int i = 1; i < A.length; i++)
            if (A[i] < b) b = A[i];
        System.out.println(b);
    }
}
```

Question 5

Define 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 *B*:

```
A.msg();
```

This line of code instructs one object to send a message to another one. Write down

- (a) the message that is sent,
- (b) the object that sends the message and
- (c) the object that receives the message.

Question 6

Explain the difference between a structure diagram and a behavior diagram in UML. For each of the following UML diagram types, indicate whether it is a structure diagram or a behavior diagram.

- a. Class diagram
- b. State machine diagram
- c. Sequence diagram

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Question 7

Suppose the following is the content of a file called Point.java:

```
package dk.aau.medialogy.ooadpexam2011;
public class Point {
    public double x, y;
    public String toString() {
        return "("+x+", "+y+")";
    }
}
```

Suppose the following is the content of a file called Question7.java:

```
package dk.aau.medialogy.ooadpexam2011;
public class Question7 {
    public static void main(String[] args) {
        Point p = new Point();
        System.out.println(p);
        Point q = p;
        p.x += 2;
        p = null;
        System.out.println(q);
    }
}
```

The Question7 class uses the Point class defined in Point.java. Write down the output produced when the Question7 class is executed.

Exam continues on next page

Question 8

Suppose the following is the content of a file called Point2.java (the number at the beginning of each line gives the line number and is not part of the code):

```
1 package dk.aau.medialogy.ooadpexam2011;
2 public class Point2 {
3     public double x, y;
4     public Point2 (double x, double y) {
5         this.x = x;
6         this.y = y;
7     }
8     public String toString() {
9         return "("+x+", "+y+")";
10    }
11 }
```

Suppose the following is the content of a file called Question8.java:

```
1 package dk.aau.medialogy.ooadpexam2011;
2 public class Question8 {
3     public static void main(String[] args) {
4         Point2 p = new Point2(2.0,3.0);
5         Point2 q = new Point2();
6         System.out.println(p);
7         System.out.println(q);
8     }
9 }
```

The Question8 class uses the Point2 class defined in the file Point2.java.

The Question8 class will not run because of an error.

- Write down the line number of the line in which the error occurs in Question8.java.
- Write down the code that needs to be inserted into Point2.java in order to make Question8.java run. Use the line numbers to indicate the position at which this code needs to be inserted.
- Write down the output of Question8.java after Point2.java has been corrected.

Exam continues on next page

Question 9

Which line in the following program produces an error and why? (The number at the beginning of each line indicates the line number and is not part of the code.)

```
1    public class Question15 {
2        private final double x = 1.0;
3        private final double y, z;
4        public Question9(double x, double y) {
5            this.x = x;
6            this.y = y;
7            z = 2.0;
8        }
9    }
```

Question 10

Study the following Java code.

```
public interface A {
    int meth1(int a);
    float meth2(int b);
}

public interface B {
    double meth3();
}

public class Question10 implements A, B {
    public int XXX(int a) { return 0; }
    public double YYY() { return 0; }
    public float ZZZ(int b) { return 0; }
}
```

Write down the code that is needed to replace XXX, YYY and ZZZ in order to make this compile.

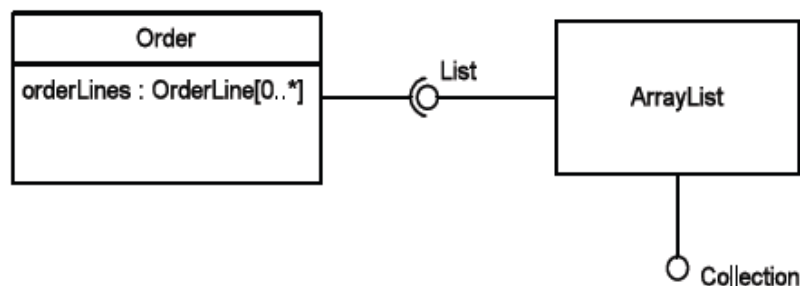
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Question 11

A modelling language has both *syntax* and *semantics*. Explain the meaning of the terms “syntax” and “semantics” in this context, with reference to examples from the UML modelling language.

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

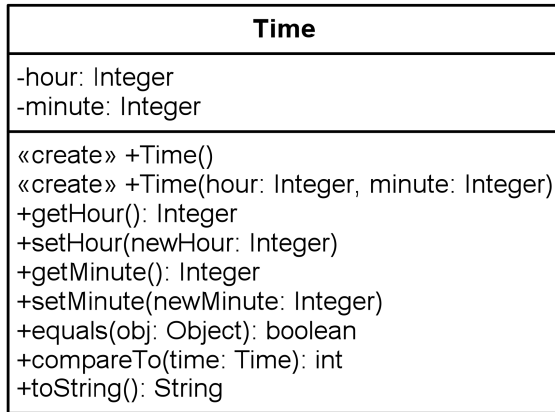
Represent the following Java code in UML. Leave out details about how each method is implemented.

```
public class Question4 {  
    private int x = 0;  
    public int getX() { return x; }  
    public void setX(int y) { x = y; }  
}
```

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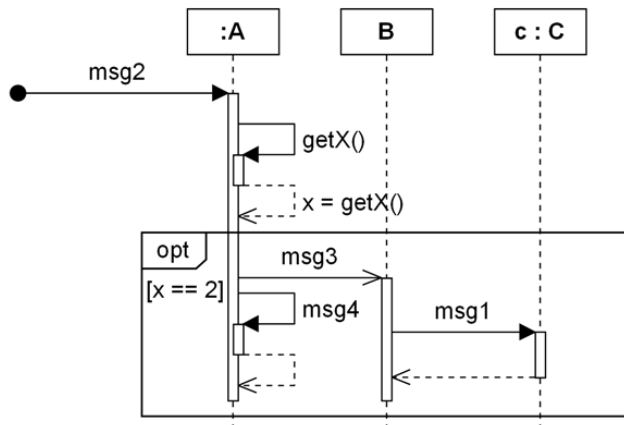
Question 14

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



Question 15

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

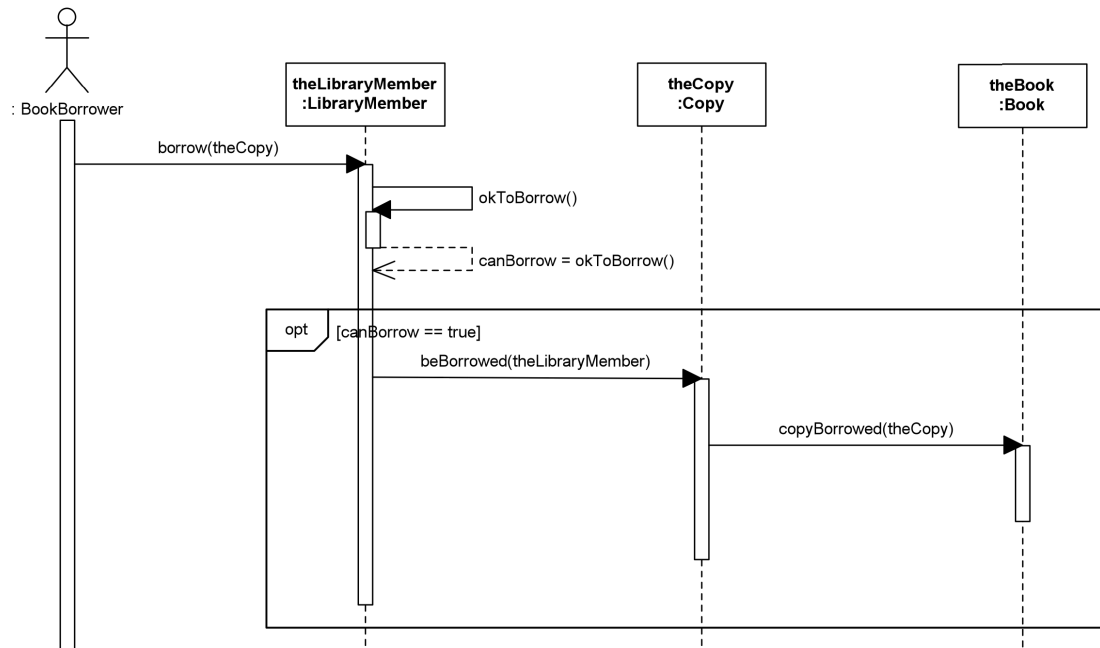


- What kind of diagram is this?
- What does the black disk on the left-hand end of msg2 indicate?
- What kind of thing is msg3?
- What kind of thing is msg1?
- Under what condition is msg3 sent?
- What kind of thing is B?
- What kind of thing is c?
- What kind of thing is A?
- Which is sent first, msg1 or msg4?
- Which is sent first, msg3 or msg1?

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Question 16

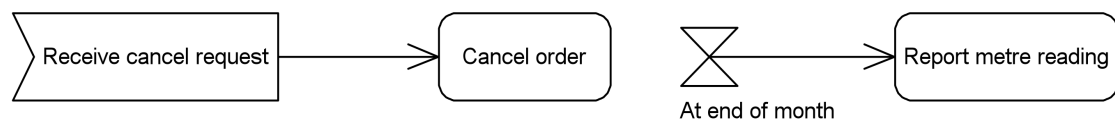
Study the following diagram and answer the questions that follow it.



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

Question 17

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

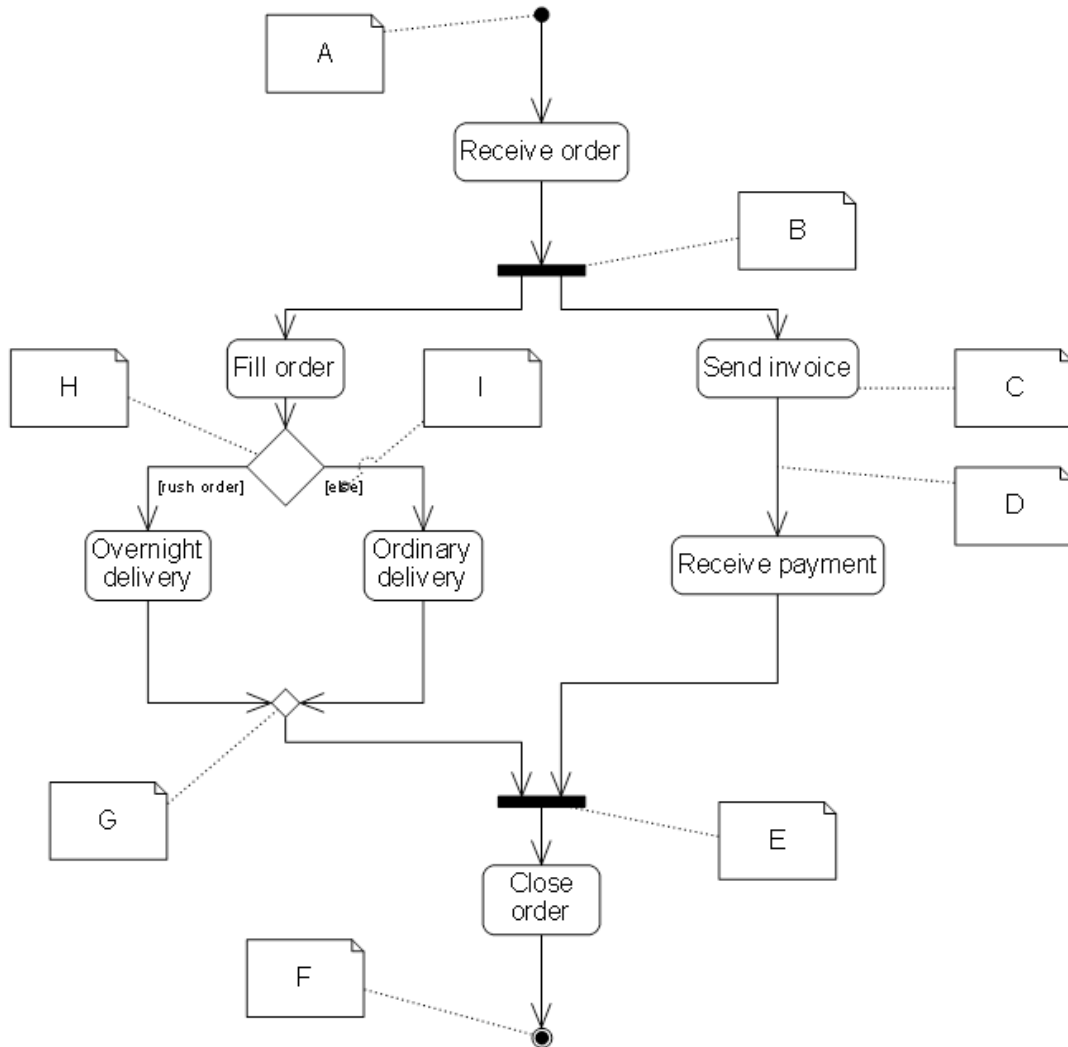


- What kind of diagrams are these?
- What kind of thing is the element labelled “At end of month”? Explain the meaning of the diagram in which it occurs.
- What kind of thing is the element labelled “Receive cancel request”? Explain the meaning of the diagram in which it occurs.

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Question 18

Study the following diagram and answer the questions that follow it

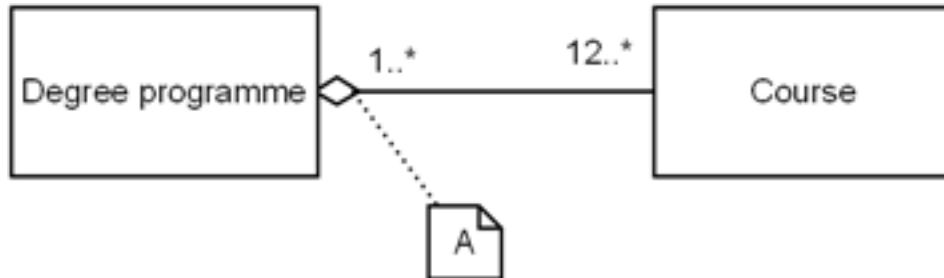


- What sort of diagram is this?
- Write down what each of the labels A-I should say.

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Question 19

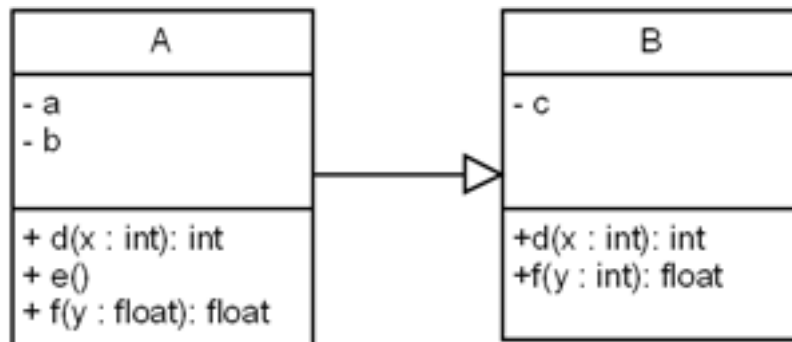
Study the following diagram and answer the questions below it.



- What kind of diagram is this?
- What does the diamond labelled A tell us?
- How many courses are there in each degree programme?
- How many degree programmes can each course belong to?
- If a degree programme is deleted, what happens to its courses?

Question 20

Study the following diagram and answer the questions below it.



- Is A a subclass or a superclass of B?
- Which operations in B are overridden in A?
- Which operations in B are overloaded in A?
- Is variable c visible in objects of class A?

END OF EXAMINATION