

# Object-Oriented Analysis, Design and Programming

Medialogy, Semester 4

Monday 8 June 2009

9.00 – 12.00

*You have 3 hours to complete this examination. Neither written material nor electronic equipment may be brought into the examination room. The maximum time that you are advised to spend on each question is given. Later questions are longer. Answers must be in English or Danish.*

## Question 1. (3 minutes)

“In order to be considered ‘high quality’, a software system must be...”

Which **one** of the following is the best completion of the previous sentence?

- A. useful, powerful and reliable.
- B. fast, affordable and usable.
- C. reliable, flexible and affordable.
- D. available, flexible and efficient.

## Question 2. (3 minutes)

Which of the following was **not** a factor in the failure of Taurus?

- A. They tried to do too much in one go.
- B. Decisions were made by a small committee of powerful individuals without consulting all the stake-holders.
- C. They chose to use an expensive new system instead of modifying an existing one.
- D. Work was carried out by two competing consultancy firms.

## Question 3. (3 minutes)

Which of the following statements are false?

- A. A module  $A$  is dependent on another module  $B$  if a change in  $A$  might necessitate a change in  $B$ .
- B. A module  $A$  is dependent on another module  $B$  if a change in  $B$  might necessitate a change in  $A$ .
- C. If  $A$  depends on  $B$ , then  $A$  is a client of  $B$ .
- D. If  $A$  depends on  $B$ , then  $A$  provides services to  $B$ .

*continued*

**Question 4. (3 minutes)**

Represent the following Java code in UML.

```
public enum Priority {  
    HIGH,  
    MEDIUM,  
    LOW,  
}
```

**Question 5. (3 minutes)**

Correct the following program so that it prints out "Hello world!".

```
public class HelloWorld {  
    public void main(String args) {  
        System.out.println("Hello world!");  
    }  
}
```

**Question 6. (3 minutes)**

Write down the output of the following program:

```
public class Question6 {  
    public static void main(String[] args) {  
        int d = -5;  
        System.out.println("a" + d + d);  
        System.out.println(d + d + "a");  
    }  
}
```

**Question 7. (3 minutes)**

Correct the following code fragment so that it prints out the contents of the array, *a*, in reverse order.

```
int[] a = {1,2,3,4};  
for (int i = a.length; i >= 0; i--)  
    System.out.println(a[i]);
```

**Question 8. (3 minutes)**

Complete the following two sentences:

- A. The \_\_\_\_\_ of a modelling language is the set of rules describing how model elements can be put together to make legal models.
- B. The \_\_\_\_\_ of a modelling language is the set of rules governing how a legal diagram should be interpreted.

*continued*

**Question 9. (3 minutes)**

Name, in the correct order, the 5 main phases of the waterfall process.

**Question 10. (3 minutes)**

Which of the following statements is true?

- A. A class diagram is a behaviour diagram.
- B. A state-machine diagram is a behaviour diagram.
- C. An activity diagram is a structure diagram.
- D. A use-case diagram is a structure diagram.

**Question 11. (3 minutes)**

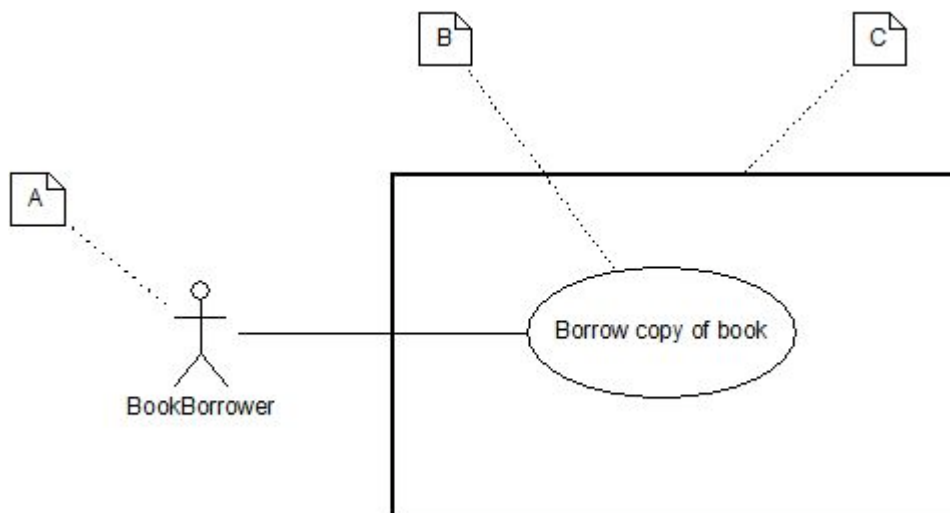
Study the following code.

```
public class Question13 {  
    int x;  
    public Question13(int x) {  
        XXXXXXX  
    }  
}
```

Write down the code that should replace XXXXXXXX if we want this code to set the value of the instance variable called x to the value of the constructor argument called x.

**Question 12. (4 minutes)**

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

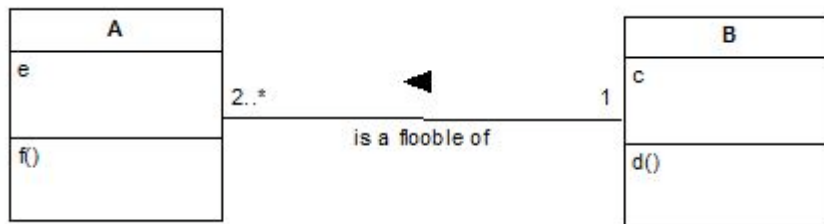


- a. What kind of diagram is this?
- b. What kind of thing is A?
- c. What kind of thing is B?
- d. What does C represent?

*continued*

**Question 13. (4 minutes)**

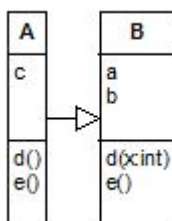
Study the following diagram and answer the questions below it.



- What kind of diagram is this?
- Does the diagram tell us that each object of class A is a flooble of an object of class B?
- How many objects of class A are associated with each object of class B?
- List the operations of class B.

**Question 14. (4 minutes)**

Study the following diagram and answer the questions below it.



- Is A a generalization or a specialization of B?
- Which operations in B are overridden in A?
- Which operations in B are overloaded in A?
- As far as we can tell from the diagram, what instance variables does an object of class A contain?

**Question 15. (4 minutes)**

What is the output of the following program?

```

public class Question16 {
    public static int i = 0;
    public Question16() {i++;}
    public static void main(String[] args) {
        for (int j = 3; j >= 0; j--) {
            new Question16();
            System.out.println(i);
        }
    }
}
  
```

*continued*

**Question 16. (4 minutes)**

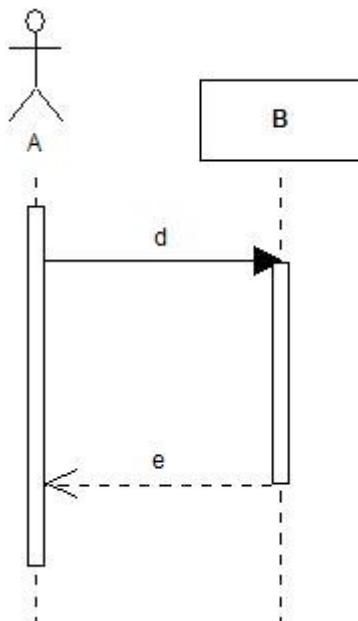
Study the following code.

```
interface A {  
    //The following method should always return 0.  
    int a();  
}  
  
public class Question17 implements A {  
    ZZZZZZ  
    public static void main(String[] args) {  
        new Question17();  
    }  
}
```

Write down the code that is needed to replace *ZZZZZZ* in order to make this program compile.

**Question 17. (4 minutes)**

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

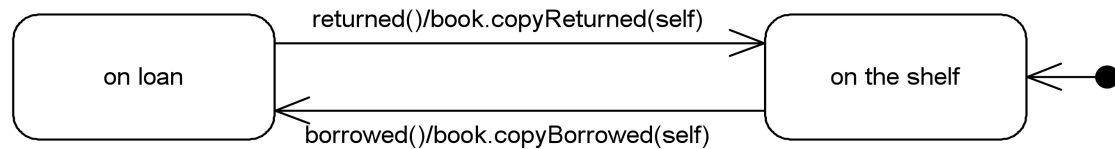


- What kind of diagram is this?
- What does arrow d represent?
- What are both A and B?
- What is e?

*continued*

**Question 18. (4 minutes)**

Study the following diagram.



- What kind of diagram is this?
- Give an example of an event in this diagram.
- Give an example of an action in this diagram.
- Give an example of a state in this diagram.

**Question 19. (6 minutes)**

The following code is the contents of a file called Question12.java. It will not compile. Something has to be inserted in order to make it compile. Write down the code that has to be inserted and state where it has to be inserted. The number at the beginning of each line indicates the line number and is not part of the code.

```

1 package dk.aau.imi.med4.ooadp2009.exam;
2
3 class Point {
4     public int x, y;
5     public Point(int x, int y) {
6         this.x = x;
7         this.y = y;
8     }
9 }
10
11 public class Question12 {
12     public static void main(String[] args) {
13         Point p = new Point();
14         System.out.println(p.x);
15     }
16 }
  
```

*continued*

**Question 20. (6 minutes)**

What is the output of the following program?

```
public class Question20 {
    static class WibbleException extends Exception {
        private static final long serialVersionUID = 1L;
        public WibbleException() {super();}
        public WibbleException(String s) {super(s);}
    }
    static void splurge(int i) throws WibbleException {
        throw new WibbleException("Oops! (" + i + ")");
    }
    public static void main(String[] args) {
        try { splurge(5);
        } catch (WibbleException e) {
            System.out.println("Wibble exception: "
                + e.getMessage());
        }
    }
}
```

**Question 21. (6 minutes)**

The following Java code fragment should use insertion sort to sort the double values in the array, ar, into non-decreasing order. Write down the three tokens that are needed to replace XXX, YYY and ZZZ.

```
for(int j = 1; j < ar.length; j++) {
    double k = ar[j];
    int i = j - 1;
    while (i XXX 0 && ar[i] YYY k) {
        ar[i+1] = ar[i];
        ZZZ;
    }
    ar[i+1] = k;
}
```

**Question 22. (10 minutes)**

According to Grady Booch, an “object is a \_\_\_\_\_ that has \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_”. Fill in the blanks and briefly explain the meaning of each of the four terms.

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**Question 23. (15 minutes)**

Study the following three class definitions and draw a UML class diagram that describes them and the relationships between them. Put as much detail in your diagram as you can, but do not provide the implementations of the class operations in your diagram. Assume that the three classes are defined in separate files in the same package.

```
public class X {
    private Y a;
    public Y getA() {return a;}
    public void setA(Y x) {a = x;}
}
public class Y {
    private int a,b;
    public int getA() {return a;}
    public void setA(int x) {a = x;}
    public int getB() {return b;}
    public void setB(int x) {b = x;}
}
public class Z extends Y {
    private int c;
    public int getC() {return c;}
    public void setC(int x) {c = x;}
}
```

**Question 24. (15 minutes)**

- What is the main disadvantage of the waterfall process?
- Draw a simple diagram that summarises the main ideas behind the spiral development process.
- "We are doing one analysis iteration followed by two design iterations." Explain why this statement implies that the speaker is not using an iterative process.

**Question 25. (20 minutes)**

Write a short account of a software disaster. Briefly describe the background and the nature of the failure, the consequences, the possible causes and ways in which it might have been avoided. Write no more than 300 words (in English or Danish).

*continued*



**Question 26. (20 minutes)**

Study the following program.

```
public class Question25 {
    public static void main(String[] args) {
        Circle c = new Circle();
        System.out.println(c);
        Circle d = new Circle(2,3,4);
        System.out.println(d);
        Circle e = new Circle(2,3,3);
        Circle f = new Circle(2,4,4);
        Circle g = new Circle(3,3,4);
        Circle h = new Circle(2,3,4);
        System.out.println(d.compareTo(e));
        System.out.println(d.compareTo(f));
        System.out.println(d.compareTo(g));
        System.out.println(d.compareTo(h));
    }
}
```

Now write a Circle class so that when the above program is run, it produces the following output:

```
Centre is (1.0,2.0), diameter is 3.0
Centre is (2.0,3.0), diameter is 4.0
1
-1
-1
0
```

END OF EXAM