Started on	Thursday, 6 January 2022, 09:00
State	Finished
Completed on	Thursday, 6 January 2022, 13:15
Time taken	4 hours 15 mins

Question **1**

Complete

Marked out of 55.00

In the following you will find the description of the first programming problem that is about a smart garden. A smart garden assists taking care of house plants.

Please note that it is important that the naming of your classes, and signature of methods exactly follow the description. All fields must be private and all methods must be public.

1. Create a **Plant** class containing a field **name** of type **String** and three fields **moistureLevel**, **optimalMoistureLevel**, and **optimalLightingLevel** of type **int**. The **moistureLevel** field is the amount of water that the plant currently has whereas the **optimalMoistureLevel** represents the amount of water that the plant should typically have. (4 Points)

2. Create a constructor for **Plant** that takes the value of all four fields as arguments and initialises the fields of the class. (4 points)

3. Create the methods **getName()** and **getOptimalLightLevel()** that return the **name** and the **optimalLightLevel** of the plant, respectively. (2 points)

4. Create a method **getRequiredWater()** that returns how much water a plant must receive in order to reach its optimal moisture level. You may assume that the **moistureLevel** is smaller than or equal to the **optimalMoistureLevel**. (3 points)

5. Create a method **water(amountOfWater)** that given an argument of type **int** increases the **moistureLevel** of a plant by that amount. (3 points)

6. Generate the methods **equals()** and **hashCode()** for the **Plant** class (in VSCode **right click in source document -> Source Action -> generate hashCode() and equals()**). Do not try to create them yourself if you are not able to do this. Questions (12) and (14) will work incorrectly if you don't have these methods but rather use the default ones, but you will not be docked point from them. The implementation of the two methods are also attached in one file below the page. Using these implementations requires that the fields are defined exactly according to the description. (1 points)

7. Create **SmartGarden** class containing two fields **roomLight** and **waterTankLevel** of type **int** and a field **plants** of type **List<Plant>** (Points: 2)

8. In the **SmartGarden** class, create a constructor that takes values for the fields **roomLight** and **waterTankLevel** as arguments and initialises them. Your constructor should also include other code required to make instances of the class work properly. (Points: 3)

9. In the **SmartGarden** class, create a method **addPlant(plant)** that given an argument of type **Plant** adds that plant to the **plants** list. (Points: 4)

10. In the **SmartGarden** class, implement a method **waterPlants()** that goes through the **plants** list and waters all plants with the amount they require to reach their **optimalMoistureLevel**. Furthermore, decrease the value of the water tank level by the corresponding amount. However, if there is not enough water in the tank to water a plant then throw a **LowWaterLevelException** exception with the message **"there is not enough water"**. (The implementation of this exception is attached at the end of this page.) (Points: 7)

11. In the **SmartGarden** class, create a method **checkLighting()** that compares the room light level with the required light for each of the plants in the **SmartGarden**. For every plant in the smart garden print:

- **"plant <name> requires more light"** if the light level of the room is strictly smaller than the optimal light level for the plant
- **"plant <name> requires less light"** if the light level of the room is strictly greater than the optimal light level for the plant
- **"plant <name> has the prefect amount of light"** otherwise.

In all cases **<name>** refers to the actual name of the plant. (Points: 6)

12. In the **SmartGarden** class, create a method **numberOfPlants()** that returns a map of type **Map<Plant, Integer>** containing a plant as a key and the number of times that plant appears in the garden as its value. (Points: 6)

13. In the **Plant** class, create a method **printReport()** that prints the **name**, the **moistureLevel**, the **optimalMoistureLevel**, and the **optimalLightingLevel** of the plant using the format:

"plantName: <name>, current water: <moistureLevel>, required water: <optimalMoistureLevel>, required light: <optimalLightingLevel>". (Points: 5)

14. In the **SmartGarden** class, implement a method **printReport()** that prints the plant description for all the plants in the smart garden using the **printReport** method of the **Plant** class. However, you should only print a plant with the same name once. Hint: Use the **numberOfPlants()** method. (Points: 5)

Helper files: LowWaterLevelException
hashcode(),equals() implementations

Uploading: Add the **SmartGarden.java** and **Plant.java** files in one folder called YourName_YourStudentID. Upload the compressed folder as a .zip file below (use the box with drag and drop files sign).

PeterLøffmann_19997.zip

Question **2**

Complete

Marked out of 15.00

In this programming problem:

1. Implement a class **Person.** Define a field **name** of type **String** and a field **idNumber** also represented using a **String**. We assume that each **idNumber** by default has 10 digits. Both fields are initialised in the constructor. (Points: 1)

2. In class **Person**, implement a method **toString()** which returns a **String**. The **String** includes the name of the person and the **idNumber** such that the last 4 digits are replaced with four X. For example, for a person with **name** "Alex" and **idNumber** "9210019774", the method returns the following **String:** "Name: Alex, Id number: 921001XXXX" (Points: 6)

3. Implement a class **Student** that is a subclass of **Person.** The class has a field **studyProgram** of type **String.** The field is initialised in the constructor. Additionally, the constructor receives **String** parameters used for initialising **idNumber** and **name** of the super class. (Points: 3)

4. In the class **Student**, implement a **toString** method that returns a **String**. This **String** includes the **name** and **ideNumber** of a student in addition to the **studyProgram**. The format of the String is same as the one explained above just at the end the study program is added. For example: "Name: Alex, Id number: 921001XXXX, Study program: Software Design" (Points: 3)

5. In a class called **Main,** implement a method **printInfo** which receives a **List** of person and prints the information of each person per line. (Points: 2)

Uploading: Add the **Main.java**, **Student.java** and **Person.java** files in one folder called YourName_YourStudentID. Upload the compressed folder as a .zip file below (use the box with drag and drop files sign).

Question_2.zip

Question **3**

Complete

Marked out of 1.00

Which of the following statements is correct?

Select one:

a. Classes should depend closely on many details of each other

b. A class has high cohesion if it is responsible for multiple logical tasks

c. Cohesion is only defined for classes

d. Low coupling is desirable in class design

Question **4**

Complete

Marked out of 1.00

Assume that we want to keep 25 objects of type **Student**. Which one of these is correct?

Select one:

a. Student[] list = new Student[]();

b. Student[] list = new Student[25];

c. Student[25] list = new Student[25];

d. Student[25] list= new Student();

Question 5

Complete

Marked out of 2.00

```
void myMethod (List<Card> list, boolean flag){
   var iter = list.iterator();
   while (iter.hasNext()) {
        var item = iter.next();
        if (flag) {
            (1)}
       }
 }
```

Consider the code above. Which of the following can be used at (1)?

a. iter.remove();

b. list.remove(item);

c. list.remove();

d. iter.remove(item);

Question 6

Complete

Marked out of 2.00

```
void myMethod(Records[] r){
 int sum=0;
 Map<String,Integer> m=new HashMap<>();
    for(int i=1;i<10;i++){
          m.put(i+"x2",i*2);
    }
  for(int i=1;i<5;i++)
    sum+=m.get(i+"x2");
 (1)
}
```

Consider the code above. Which of the following can be value of variable sum in (1) according to the definition of Maps?

Select one:

a. 50

b. 20

c. 24

d. 30

Question 7
Complete
Marked out of 2.00

Assuming that x is of type TreeMap<Student,String[]>. Given var y=x.get(s), what is the type of y and s, respectively?

Select one:

a. String[], Student
b. String, Student
c. Student, String
d. TreeMap<Student,String[]>, Student

Question 8
Complete
Marked out of 2.00

```
List<Integer> list = new ArrayList<>();
for(int i=1;i<20;i++){
   if (i % 3==0){
        list.add(i);
    }
}
Collection<Integer> col = list;
```

Consider the code above. What is the value of the elements which will be removed by calling list.remove(3); and col.remove(3);, respectively?

Select one:

a. 12, 12
b. 6, 3
c. 12, 3
d. 3,15

Question 9
Complete
Marked out of 2.00

Assume that m is an empty set of type Set<Integer>. After running

```
for(int j=0;j<15;j++){m.add(j%3);}
```

What is the value of m.size()?

Select one:

a. 3
b. 2
c. 15
d. 1

Question 10
Complete
Marked out of 2.00

Consider a method:

```
double myMethod(double[] arr){
  double d=0.0;
  for(double a: arr){d=(1.0/a);}
   return d;
}
```

Assuming **b** is a variable of type **double**. Which one of the following is correct about the value of:

```
myMethod(new double[] {1.0,0.0,2.0}) / b
```

Select one or more:

- a. The result cannot have a negative value
- b. An **ArithmeticException** can raise
- c. The result can be **NaN**
- d. The result can be **+Inf**

Question 11
Complete
Marked out of 2.00

```
public class MyClass {
 public int method(int[] a, int i) {
  try {
    throw new Exception("New exception!");}
  catch (Exception e) {
     if(a[i]<0){
           throw new MyException("New myException!");}
      else{i++; return a[i];}
   }
  finally { System.out.print(a[i]); }
 }
}
```

Consider the code above. What is the result of running:

```
MyClass m=new MyClass();
m.method(new int[]{-1,4,7,-11,19},1);
```

Select one:

- a. Runtime exception
- b. -14
- c. 7
- d. 4

Question 12
Complete
Marked out of 2.00

Consider the following

```
String[] tokens="Hello World!!".split("\\s");
```

What is the result of running:

```
for (int i = 0; i < tokens.length; i++){
    final int num = i;
    System.out.print(num);
}
```

Select one:

a. Compiler error as the value of a final variable cannot be changed
b. 12
c. 21
d. 01

Question 13
Complete
Marked out of 1.00

```
public class Circle{
    private String color;
    public Circle(){this.color="blue ";}
    public String getColor(){return this.color;}
    public void setColor(String s){color=s;}
}
public class myCircle1 extends Circle{
    private Center c;
    public myCircle1(){setColor("red ");}
    public void print(){
        System.out.print(super.getColor());
     }
}
public class myCircle2 extends myCircle1{
    private int radius;
     public myCircle2(int r){radius=r;}
    public static void main(String[] arg){ (1) }
 }
```

Consider the code above and assume that the definition of the class **Center** is available. What is the result of running the following in (1)?

```
var a=new myCircle1(); var b= new myCircle2(3); a.print();b.print();
```

Select one:

a. blue blue

b. red blue

c. red red

d. blue red

Question 14

Complete

Marked out of 2.00

Assume that B implements A. Given that method1 and method2 are the only two methods in A. Which of the following can be correct?

Select one or more:

a. method1 should be an abstract method

b. B has at most 2 methods

c. B can extend a class C

d. B has at least 2 methods

Question 15

Complete

Marked out of 1.00

Consider the following statements:

a. If A is a subtype of B; then variables of type B can point to objects of type A.

b. If A is an abstract class; then a variable can be declared as A a=new A(...).

c. All methods in an interface are default.

d. An interface can be extended by another interface.

Which of them hold?

Select one:

a. a,c,d

b. a,d

c. a,b,d

d. b,c

Question 16

Complete

Marked out of 2.00

```
public static void main(String[] args){
    CoffeeMachine machine = new CoffeeMachine(5);
    Cup cup = new Cup();
    machine.select(cup);
  }
```

Given the code above, which of the following can be considered correct?

Select one or more:

a. **main** is both a class and a method
b. **Cup** has a method called **select**
c. **CoffeeMachine** is a type and **cup** is an object
d. **CoffeeMachine** has a constructor that receives a whole number

Question **17**
Complete
Marked out of 1.00

Consider the code below. Which of the following should be in (1) to increase the value of **processNum** by one?

```
public class Process {
   private Context cont=new Context("Init");
   private static int processNum;
   private int id=0;
   public Process(){
       (1)
       this.id=processNum;
   }
...
}
```

Select one:

a. processNum += processNum;
b. The value of **processNum** can not change as it is **static**
c. processNum+1;
d. processNum++;

Question **18**
Complete
Marked out of 2.00

Consider the code below. Which of the following can be used in (2) and (3)?

```
public class Process {
   private Context cont=new Context("Init");
   private static int processNum;
   private int id=0;
   public (2) newNum( (3) num){
      String s="#";
      processNum=num;
      System.out.print(cont.toString()+" "+s+num);
   }
  ...
}
```

Select one:

a. int, String
b. void, String
c. String, void
d. void, int

Question 19
Complete
Marked out of 2.00

Consider the code below and that as a result of running the main method, 4 is printed out. Which of following can be in (4)?

```
public class Process {
   private Context cont=new Context("Init");
   private static int processNum;
   private int id=0;
   public Process(int id){ this.id=id; processNum=processNum+2;}
   public static int getNum(){ return processNum;}
   public static void resetNum(){ processNum=0; }
   public static void main(String[] args){
      Process.resetNum();
      (4)
      System.out.println(Process.getNum());
   }
}
```

Select one or more:

a. new Process(2);
b. new Process(0);new Process(4);
c. new Process(1);new Process(2);
d. new Process(2);

Question 20
Complete
Marked out of 2.00

```
public class Process{
   private static int processNum;
   public Process(){ processNum=processNum+2; }
   public static int getNum(){ return processNum;}
}
public class SpecProcess extends Process{
   public int parentId;
   public SpecProcess(int pid){
      parentId=pid;
```

```
    parentId=pid;
  }
  public static void main(String[] args){
  Process.resetNum();
    (1)
  }
}
```

Consider the code above. Assuming that in (1) we have the following statements, what is the result of running the main method?

Process proc1= new Process();

for(int i=0;i<3;i++) new SpecProcess(2);

System.out.println(proc1.getNum());

Select one:

a. 2
b. 3
c. 6
d. 8

Question 21
Complete
Marked out of 1.00

Consider the code below. Which of the following can replace (1)?

```
Car myMethod (Map<String,ArrayList<Car>> map, Car car)
  {
  String s = "parking1";
  map.get(s).add(car);
  return (1);
  }
```

Select one:

a. map.get(s).get(0)
b. map.get(0).get(s)
c. map.get(car).get(0)
d. map.get(s)

Question 22
Complete
Marked out of 1.00

```
void myMethod (List<Card> list, boolean flag){
  (1) iter = list.iterator();
  while (iter.hasNext()) {
```

```
        (2) item = iter.next();
      }
  }
```

Consider the code above. Which of the following options can replace (1) and (2), respectively?

Select one:

a. Iterator<Card>,Card
b. List<Card>, Card
c. Card, Card
d. Iterator, List

Question **23**
Complete
Marked out of 2.00

Which of following represent a loop with 10 iterations?

Select one or more:

a. for(int i=10; i>=0; i--){/*do nothing*/}
b. for(int i=1; i<=10; i++){/*do nothing*/}
c. int i=1; while(i<=10){++i; /*do nothing*/}
d. for(int i=9; i>=0; i--){/*do nothing*/}

Question **24**
Complete
Marked out of 1.00

Assume x and y are variables of type **boolean**. Which of the following expressions evaluate to the same result as (x && y) || !x?

Select one:

a. x && y
b. !x || y
c. y
d. !x

Question **25**
Complete
Marked out of 2.00

Which of the following has the same result as running lines in the following code?

```
static List<Integer> intList = ...;
intList.stream()
.forEach(MyClass::method);
```

Select one or more:

a.
```
static List<Integer> intList = ...;
for(Integer i: intList)
```

MyClass.method(i);

b. static List<Integer> intList = ...;
intList.stream()
.forEach(x->MyClass.method(x));

c. Non of the above has the exact same result

d. static List<Integer> intList = ...;
intList.stream()
.map(x->MyClass.method(x));

Question 26
Complete
Marked out of 2.00

Consider a list of String named **mylist**. Assume that **myMethod** is a method that receives a **String** and returns the first character in the String. Given **mylist.stream().(1)** Which one of the following can replace (1) to create a list containing all elements from **myList** that start with 'T'?

Select one:

a. .filter(x->Main.myMethod(x)=='T')

b. .map(x->Main.myMethod(x)=='T')

c. .reduce(x->Main.myMethod(x).equals('T'))

d. .map(r=='T'-> r=myMethod(x))

Question 27
Complete
Marked out of 2.00

Assume that **Pattern p=Pattern.compile("\\.");** and that **var s=p.split("10.11.09.1");**. What is the value of **s.length**?

Select one:

a. 4

b. 5

c. 3

d. 1

Question 28
Complete
Marked out of 2.00

Consider the regular expression (**\\d*\\w\\w**) . which of the following can match this expression?

Select one or more:

a. 1\\a\\b

b. 367

c. 3rd

d. 22\\e\\q

Question 29
Complete
Marked out of 1.00

Consider the final project. Assume that the dataset has 20300 webpages and the query is a string "this OR sentence OR in OR this". Furthermore, the word "this" appears in the dataset "1003245" times. What is the number of times the word "this" appears in the inverted index?

Select one:

a. 2 times, which is equal to the number of times it appears in the query
b. 20300 times, which is equal to the unique number of webpages
c. one time in the inverted index
d. 1003245 times, which is equal to the number of times it appears in the dataset

Question 30
Complete
Marked out of 2.00

What is the result of calling **myMethod** implemented as follows?

```
void myMethod(){
    String x="a";
    String y=x;
    String z="aa";
    if(z==x+y) System.out.print("true,");
    else System.out.print("false,");
    if(x.equals(y)) System.out.print("true");
    else System.out.print("false");
}
```

Select one:

a. false,false
b. true,false
c. true,true
d. false,true

Question 31
Complete
Marked out of 2.00

```
void myMethod(int i){
    switch(i) {
     case 0:
            // code block
            break;
      case 5:
             // code block
            break;
      default:
             // code block
```

```
    }
}
```

Consider the code above. If we want to have full branch coverage, which of the following are appropriate values for **i** as test input?

Select one or more:

a. -5, 0, 10
b. 10, -1, 1
c. 0, 5, -1
d. 5, 0, 10

Question **32**

Complete

Marked out of 1.00

```
public class MyClass{
  public boolean myMethod(boolean a, boolean b){
      return (a || b) && (!a || !b);
    }
}
```

Consider the code above. Assume that **c** is an object of type **MyClass**. Which of the following can be used for testing **myMethod**?

Select one:

a. assertEquals(c.myMethod(false,true),false);
b. assertEquals(false, c.myMethod(true,true));
c. assertTrue(true,c.myMethod(false,true));
d. assertTrue(true,c.myMethod(true,false));