Started on	Thursday, 5 January 2023, 09:01
State	Finished
Completed on	Thursday, 5 January 2023, 12:52
Time taken	3 hours 50 mins

Question 1

Complete

Marked out of 50.00

In the following you will find the description of a car service center in which it is possible to service cars and fill gas (gasoline). All the fields should be private and all the methods in the description should be public. In the implementation, you are not allowed to add methods which are not a part of the description unless the method is declared as private. We assume that the arguments in method calls have valid values and you do not need to use defensive programming (check for validity of arguments)

points: 50

1. Define the class **Car** with a field **plate** of type **String** representing a car's unique license plate. It also contains the integer fields **mileage** representing the number of kilometers the car has driven in its life time, **lastServiceMileage** representing the car's mileage when it was last serviced, **tankCapacity** representing the gas tank capacity in liters, and **gasLevel** representing the current amount of gas. Finally, it contains a field **consumption** of type **float** representing the number of liters of gas the car consumes per kilometer driven.

In the constructor of the class, initialise the fields **plate**, **tankCapacity** and **consumption** with parameters of the constructor and set all other fields to 0.

2. In **Car**, implement the methods **getPlate()**, **getTankCapacity()**, and **getGasLevel()**, which return the value of the corresponding fields in the class.

3. In **Car**, implement a method **kmSinceService()** that returns the number of kilometers the car has driven since the last service.

4. In **Car**, implement a method **fillTank(int gasAmount)** that increases the gas level in the tank with **gasAmount**, if this does not exceed (become strictly greater than) the tank capacity, and throws a **GasOverFlowException** otherwise.

The implementation of **GasOverFlowException** is attached at the end of this page.

5. In **Car**, implement a method **service()** which sets the value of **lastServiceMileage** to **mileage**.

6. In **Car**, implement a method **needsService()**, which returns **true** if the car has driven more than 30000 kilometers since its last service and **false** otherwise.

7. In **Car**, define a method **drive(int d)** that computes the amount of gas required to drive **d** kilometers, using **d** and **consumption**, and rounding the result to the nearest integer using **Math.round**. If there is enough gas in the tank then add **d** to **mileage**, remove the required gas from **gasLevel**, and return **true**. Otherwise do nothing and return **false**.

Math.round(float f) takes a floating point number **f** and rounds **f** to its nearest integer value.

8. Define a class **ServiceCenter** with fields **serviceQueue** of type **List<Car>, carsPriority** of type **Map<String, Integer>**, which maps a car license plate to a value representing a priority (higher value means higher priority) and **gasPrice** of type **int** that shows the price of each liter of gas. In the constructor, initialise **gasPrice** with the parameter of the constructor and **serviceQueue** and **carsPriority** as an empty list and an empty map, respectively.

9. In **ServiceCenter**, implement a method **addToServiceQueue(Car c),** that first checks whether the license plate of **c** is in the **carsPriority** keys, if yes then it adds **c** to the end of **serviceQueue**. Otherwise, it prints "Car <license plate> not found" where <license plate> is the license plate of **c**.

10. In **ServiceCenter**, implement a method **fillGas(Car c)** that fills the gas tank of car **c** to full capacity. This method returns an **int** value that is the total price of the gas that was filled in the tank of the car.

11. In **ServiceCenter**, implement a method **updatePriority(Car c, int p)** that updates the priority mapped to the license plate of the car **c**, in the **carsPriority** map, with priority **p**. If the license plate of the car is not in the map, it is added with priority **p**.

12. In **ServiceCenter**, implement a method **serviceCar(Car c)** that fills the gas tank, services the car if it needs service, and prints "Car <license plate> serviced for <price> dollars" where <license plate> is the license plate of **c** and <price> is the total price for the filled gas plus 500 if the car needed service.

13. In **ServiceCenter**, implement a method **serviceAll()** which services the cars in **serviceQueue** from the beginning to the end (using the **serviceCar** method). After servicing each car, the car is removed from the **serviceQueue**.

14. In **ServiceCenter**, implement a method called **findHighestPriority()** which returns the index of the car with highest priority in the **serviceQueue**. You may assume that priorities are strictly greater than 0 and return -1 if the queue is empty. If there are seve ↑ s with same priority, returns the smallest index.

15. In **ServiceCenter**, implement a method **serviceAllWithPriority()** which services the cars (using the **serviceCar** and/or **serviceAll** methods) in **serviceQueue** in order of priority. The cars with higher priority are serviced first. After servicing each car the car is removed from **serviceQueue**.

Helper file: GasOverFlowException.java

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

NeilosKotsiopoulos_20896.zip

Question **2**

Complete

Marked out of 15.00

In the following you will find the description of a project base system which keeps the title of a set of projects and can search in the titles with specific queries. All the fields should be private and all the methods in the description should be public. **In the implementation, you are not allowed to add methods which are not a part of the description unless the method is declared as private. We assume that the arguments in method calls have valid values and you do not need to use defensive programming (check for validity of arguments)**

points: 15

1. Define a class called **ProjectBase** which has a private field called **projectTitles** of type **List<String>**. In the constructor of the class, initialise **projectTitles** with the constructor parameter.

2. In **ProjectBase,** implement a method **addTitle(String t)** which adds the project title **t** to the **projectTitles**.

3. In **ProjectBase,** implement a method **search(String query)** which returns a set of titles (**Set<String>**) from **projectTitles** that contain **query**, meaning that **query** is a substring of each title in the returned set.

Hint: **s1.contains(s2)** returns **true** if **s2** is a substring of **s1** and **false** otherwise.

4. Implement a class called **AdvancedProjectBase** that extends the **ProjectBase** class.

5. In **AdvancedProjectBase,** implement a method **search(String query)** in which if **query** contains commas (","), it is split on these commas. For example, the query "q1,q2,q3" is split into three sub-queries "q1", "q2", and "q3". The method returns a set of titles (**Set<String>**) which contain at least one of the sub-queries (In the above example, titles that contain at least one of "q1", "q2" or "q3".)

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

NeilosKotsiopoulos_20896.zip

Question 3

Complete

Marked out of 1.00

Select the correct option(s).

- [x] a. Instances of an abstract class cannot be created
- [x] b. Each class can extend at most one class
- [ ] c. In good class design, we aim for low cohesion
- [x] d. Code duplication is not desirable in good class design

Question 4

Complete

Marked out of 1.00

Consider the code below. Select option(s) that show(s) creating an object of type Packet.

```
public class Packet{
  public Packet(String address, int size){...}
  public Packet(int size){...}
}
```

- [ ] a. new Packet("Denmark");
- [ ] b. new Packet(20, "Denmark, 22345");
- [x] c. new Packet(10);
- [x] d. new Packet("11134, Denmark", 12);

Question 5

Complete

Marked out of 1.00

Consider an ArrayList object **arr** which is initially empty. What is the value of the item in index 2 after executing the following statements?

```
arr.add(2);
arr.add(4);
arr.add(5);
arr.add(9);
arr.add(1);
arr.remove(4);
```

- a. 2
- b. 9
- c. 4
- d. 5

Question 6

Complete

Marked out of 1.00

Given the code below, select the correct option(s).

```
public class Message{
  private Button button;
  private static Frame frame;
  private boolean clicked;
  public void click(){
    clicked=true;
  }
 ...
}
```

- a. The class has fields of type **Button**, **Frame** and **boolean**
- b. **Button** is an object type
- c. The return value of the method **click** is **true**
- d. **clicked** is a local variable in method **click**

Question 7

Complete

Marked out of 1.00

Consider a method with header:

void myMethod(Map<Student,Integer> studentAges)

Given the method call **myMethod(new TreeMap<Student,Integer>())**, what are the static type and dynamic type of the **studentAges**?

- [x] a. static: Map<Student,Integer>, dynamic: TreeMap<Student, Integer>
- [ ] b. static: Student, dynamic: TreeMap<Student, Integer>
- [ ] c. static: Map<Student,Integer>, dynamic: Map<Student, Integer>
- [ ] d. static: TreeMap<Student,Integer>, dynamic: Student

Question 8

Complete

Marked out of 1.00

Running which of the following option(s) result(s) in creating an array of String such that the size of the array is 10?

- [x] a. var s= new String[10];
- [ ] b. var s = new String.size(10);
- [ ] c. String[10] s = new String[];
- [x] d. String[] s = {"1","2","3","4","5","6","7","8","9","10"};

Question 9

Complete

Marked out of 1.00

Consider the following code, which of the option(s) is/are correct?

```
public class Stock{
    private static double rate = 5.0;
    public double getValue(double num){ return num/rate ; }
    public void changeRate(double r){ rate=r; }
}
```

- [ ] a. The value of **rate** cannot change once it is initialised
- [x] b. The field **rate** has the same value in all instances of class **Stock**
- [ ] c. Result of printing **Stock.rate** is always 5.0

Question 10

Complete

Marked out of 2.00

Assuming that **a.get(1).add(2);** runs successfully. Which of the following option(s) can be the type of **a**?

- a. Set<String>
- b. List<Set<Integer>>
- c. List<List<Integer>>
- d. Map<List<Integer>,Integer>

Question 11

Complete

Marked out of 1.00

Consider the code below. Which option(s) can be placed at (1) in order to increase the value of the field **num** with the method parameter **num.**

```
public class Article{
  protected int num;
  public void changeNum(int num){
  (1)
  }
}
```

- a. this.num+=num;
- b. num+=num;
- c. num=num+this.num;
- d. this.num=num;

Question 12

Complete

Marked out of 1.00

Consider the code below. Assuming **var lab=new Lab();** Select the correct option(s).

```
public class Lab{
   private int ages;
   public void update(int a){
            int ages =0;
            ages+=a;
            this.ages+=a;
    }
}
```

- [x] a. Running **lab.update(0);** does not change the value of the field **ages**
- [ ] b. Running **lab.update(10);** always assigns value 10 to the field **ages**
- [x] c. After running **lab.update(10); lab.update(9);** the value of the field **ages** is 19
- [ ] d. The value of the field **ages** is always equal to the method parameter **a**

Question 13

Complete

Marked out of 2.00

Consider the code fragment:
public class A extends B{...}
public class B extends C{...}
Which of the following assignment(s) can be executed successfully (assume the constructor of all classes do not take any parameter)?

- [ ] a. B b = new C();
- [x] b. B b = new A();
- [ ] c. A a = new C();
- [x] d. C c = new B();

Question 14

Complete

Marked out of 1.00

Consider the code fragment:

```
public class Card{
  protected String msg="Congrat!";
  public void setMsg(String m){msg = m;}
  public String getMsg(){return msg;}
}
public class EspCard extends Card {...}
```

Which of the following option(s) is/are correct?

- [x] a. The field **msg** is visible for all subclasses of **Card**
- [ ] b. At least two methods should be implemented in **EspCard**
- [ ] c. In the first line of every method in class **EspCard**, **super** should be called
- [ ] d. **EsPCard** constructor should receive at least one parameter

Question 15

Complete

Marked out of 1.00

Assume that **myList** is an ArrayList with size 20. Consider the code below:

```
var it = myList.iterator();
```

Which of the following option(s) show(s) the correct removal of the element in index 1?

- [ ] a. it.next().next().remove();
- [ ] b. myList.next().remove();
- [x] c. it.next(); it.next(); it.remove();
- [ ] d. myList.next(); it.remove();

Question **16**

Complete

Marked out of 1.00

Consider the code fragment below:

```
public (1) myMethod (int a){
    return a+"2022";
}
```

What is the return type of **myMethod** that should replace (1)?

- a. String
- b. int
- c. null
- d. Non of above options

Question **17**

Complete

Marked out of 1.00

Assume that **nums** is an array of **int**. What is the value of variable **x** (that is of type **int**) after executing the following code?

```
int i=0;
int x = -1;
for(var item: nums){
   if(item==4) { x=i; }
   i++;
}
```

- a. The largest index among items in **nums** that are equal to 4, or -1 if no such index exists.
- b. 4
- c. The smallest index among items in **nums** that are equal to 4, or -1 if no such index exists.
- d. -1

Question **18**

Complete

Marked out of 1.00

Assume **isEmpty** method should return **true** if the parameter **myList** is an empty list. Select option(s) showing a correct body for the isEmpty method?

```
public boolean isEmpty(List<Student> myList){
...
}
```

- [ ] a. return myList.size()==null;
- [x] b. return myList.size()-1;
- [x] c. return myList.size()==0;
- [ ] d. return myList.size();

Question **19**

Complete

Marked out of 1.00

Consider the code below. Which of the following return(s) 2?

```
public class MyClass{
    private int limit;
    private int count;
    public MyClass(int limit, int count){
        this.limit=limit;
        this.count = count;
   }
    public int increase(){ ++count; return check();}
    public int check(){ return count%limit; }
}
```

- [ ] a. new MyClass(3,1).increase();
- [ ] b. new MyClass(2,2).increase();
- [x] c. new MyClass(1,2).increase();
- [ ] d. new MyClass(3,0).increase();

Question 20

Complete

Marked out of 2.00

Assume that the code below runs successfully. Running which of the following option(s) yields the same value for variable x?

```
int x=0;
int y=12;
for(int i=0; i<y; i++){
   x+=i;
}
```

- [ ] a.
```
int x=0;
for(int i=12; i>0; i--){x+=i;}
```
- [ ] b.
```
int i=0;
int x=0;
int y=12;
while(y>0){x=x+i; y--;}
```
- [x] c.
```
int x=0;
int y=12;
int i=0;
while(y>0){x+=i; i++; y--;}
```
- [x] d.
```
int x=0;
int i=0;
while(i<12){x=x+i; i++;}
```

Question 21

Complete

Marked out of 1.00

Consider running var arr = new Student[20]; then what is the value of arr[10]?

- [x] a. null
- [ ] b. 0
- [ ] c. false
- [ ] d. Student[10]

Question 22

Complete

Marked out of 1.00

Printing which of the following option(s) result(s) "5 and 4" assuming that:

```
int i = 5;
```

- a. (--i) +" and "+ (i--)
- b. (--i) +" and "+ (--i)
- c. (i--) +" and "+ (i--)
- d. (--i) +" and "+ (i)

Question 23

Complete

Marked out of 1.00

Consider the following method

```
public static void f(boolean b) {
    try { System.out.print("A");
          if(b) { throw new MyException(); }
          System.out.print("B");
     }
    catch (MyException e) { System.out.print("C"); }

    catch (RuntimeException e) { System.out.print("D"); }

    finally { System.out.print("E"); }

    System.out.print("F");
}
```

which letters are printed if you run f(false);

- a. D
- b. C
- c. E
- d. B
- e. F
- f. A

Question 24

Complete

Marked out of 2.00

Which of the following option(s) calculate(s) the sum of values in the ArrayList **myList** that are greater than 10.

a.
```
int sum=0;
for(var item : myList){
  if( item > 10 )
      sum+=item;
}
```

b.
```
int sum=0;
for(int i=0; i<myList.size(); i++){
  if( myList.get(i) >= 11)
      sum+=myList.get(i);
}
```

c.
```
int sum=0
for(int i=0; i<myList.size(); i++){
  if( myList.get(i) < 10)
      sum+=myList.add(i);
}
```

d.
```
int sum=0
for(var item : myList){
  if( item <= 10 )
      sum+=item;
}
```

Question **25**

Complete

Marked out of 1.00

Consider a list **nums** of type **List<Integer>** and method **check** defined as follows:

```
public class Main{
  public static boolean check(int val){
      return val>5;
  }
}
```

Given **nums.stream().(1).toList(),** which of the following option(s) can replace (1) to create a list containing all elements from **nums** which are greater than 5?

- [ ] a. .filter(r==5 -> r=check(x))
- [ ] b. .map(x->Main.check(x)==false)
- [x] c. .filter(x->Main.check(x)==true)
- [ ] d. .map(x->Main.check(x)==true)

Question **26**

Complete

Marked out of 1.00

Consider the following code that results in assigning a value to variable **x**. Which of the following option(s) assign(s) the same value to **x.** (assume all variables are of type **int**)

```
if (a-b * 5 > 0)
    x=a;
else
   x=b/2;
```

- [ ] a. x = a - b/2;
- [ ] b. x = a-b * 5 ==0 ? a : b/2;
- [ ] c. x = a-b * 5 > 0 ? b/2 : a;
- [x] d. x = a-b * 5 > 0 ? a : b/2;

Question 27

Complete

Marked out of 1.00

Which of the following (whole) strings match the regular expression below?

$a^+b^+a^*$

- [x] a. abb
- [ ] b. bbb
- [ ] c. aaaaa
- [x] d. abaaa

Question 28

Complete

Marked out of 1.00

Select any of the following regular expressions (implemented in java) that match the whole string below:

"123LetsGo"

- [ ] a. \\W*
- [x] b. \\d\\d\\d\\w*
- [x] c. \\w*
- [ ] d. \\d*

Question 29

Complete

Marked out of 1.00

Using which of the following test input sets for **myMethod** lead(s) to covering all branches?

```
public int myMethod(int a, int b){
  if(b*a > 10) return a;
  else return b;
}
```

- [x] a. {a=2,b=5}, {a=5,b=6}
- [ ] b. {a=1,b=2}, {a=4,b=2}
- [ ] c. {a=4,b=3},{a=2,b=8}
- [x] d. {a=2, b=5}, {a=4,b=1}

Question 30

Complete

Marked out of 1.00

Consider the following code fragment:

```
public class Process{
  public static int checkId(int a, int b){
       if(a<b) return a;
       else return b;
    }
}
```

which option(s) can be used for testing the **checkId** method?

- [ ] a. assertFalse(5,Process.checkId(5,10))
- [x] b. assertEquals(5,Process.checkId(5,10))
- [ ] c. assertTrue(10,Process.checkId(10,12))
- [ ] d. assertEquals(12,Process.checkId(12,10))

Question 31

Complete

Marked out of 2.00

Consider the method below. Which of the following option(s) can replace (1) so that the method returns the number of times value of b appears in myList?

```
public int myMethod(List<Integer> myList, Integer b){
  (1)
  return x;

}
```

a.
```
int x=1;
for(var i : myList){
  if(i == b){x++;}
}
```

b.
```
int x=0;
for(var i : myList){
  if(i .equals(b)){x++;}
}
```

c.
```
int x=0;
for(var i : myList){
  if(i.equals(b)){x++; return x;}
}
```

d.
```
int x=0;
for(var i : myList){
  if(i == b){x++;}
}
```

Question 32

Complete

Marked out of 1.00

Consider the method below:

```
double myMethod(double d){
   return d*3.0;
}
```

Given **b** is a variable of type **double** and that value of **b** is 0.0; Select option(s) that can be a valid value for **myMethod(b)/b** ?

- [ ] a. 0.0
- [x] b. +Inf
- [ ] c. -3.0
- [ ] d. Nan