JAVA CONTROL FLOW STATEMENTS LAB 4

1. Objectives:

- Design simple classes to illustrate Java control flow statements (Car, CarDriver and RadarSpeedMonitor)
- The "*if-then",* "*if-then-else"* conditional statements
- The *"for"*, "*while"*, "*do-while"* loop statements
- The "*switch"* conditional statement

2. The Car, CarDriver and RadarSpeedMonitor classes

- Create a new Java Project with Eclipse**.**
- Add a new **Car** class representing a car object. The **Car** class contains:
    - A *private* attribute representing its current speed (type: int).
    - A *private* attribute representing the registration year (type: int).
    - A constructor to create instances of **Car** with specific registration year. Note that when a new car is created, the current speed is expected to be 0 km/h.
    - A method to get the current speed
    - A method to set the current speed
    - A method to get the date of registration

- Add a new **CarDriver** class representing a person driving a car. The **CarDriver** class contains:
    - A *private* attribute representing the number of points remaining on the car driver's driving license (type: int).
    - A *private* attribute representing the number of months the driver holds a driving license (type: int).
    - A *private* attribute representing its car (type: Car)
    - A constructor to create instances of **CarDriver**. The constructor has 3 arguments used to initialize the attributes described above.
    - A method to get the number of points on the driving license
    - A method to set the number of points on the driving license
    - A method to get the number of months the driver holds a driving license
    - A method to get a reference to the driver's car

- Add a new **RadarSpeedMonitor** class. This class represents a Radar Speed Monitor that detects if the speed of a car exceeds the speed limit.
- The **RadarSpeedMonitor** class contains:
    - A *private* attribute representing the speed limit.
    - A constructor to create instances of **RadarSpeedMonitor** with the specified speed limit.

2.1. "if-then" & "if-then-else" statements

- In **RadarSpeedMonitor,** add a *public* method "`speedLimitExceeded(Car car)`" that returns the boolean "true" if the speed of a Car exceeds the speed limit. This method shall use an "**if-then**" structure.
- Test your **RadarSpeedMonitor** class by writing a simple program that creates a **RadarSpeedMonitor** instance with a speed limit of 130 km/h and checks whether the speed of a car exceeds or not that speed limit. Below is a possible implementation:

```
public class TestRadarSpeedMonitor {

   public static void main(String[] args) {
         //Create a RadarSpeedMonitor with speed
         //limit set to 130 km/h
         RadarSpeedMonitor radar = new RadarSpeedMonitor(130);
         //Create a car registered in 2001
         Car car = new Car(2001);
         //The car speed reaches 100 km/h
         car.setCurrentSpeed(100);
         //Does this car exceed the speed limit?
         System.out.println(radar.speedLimitExceeded(car));
         //The car speed reaches 140 km/h
         car.setCurrentSpeed(140);
         //Does this car exceed the speed limit?
         System.out.println(radar.speedLimitExceeded(car));
   }
}
```

- Using an "**if-then-else**" structure, modify the **TestRadarSpeedLimit** to:
    - Print an alert message on the standard output **and** decrease the car's speed appropriately, when the car speed exceeds the speed limit
    - Print a "Speed Ok" message on the standard output, when the car does not exceed the speed limit

- In **RadarSpeedMonitor,** add a *public* method "`getLostPoints(CarDriver driver)`" that returns the number of points lost by a car driver when he exceeds the speed limit. This method applies the following rule:
    - +1 km to +10 km/h, driver looses 1 pts on his driving license.
    - +11 km to +20 km/h, driver looses 2 pts on his driving license.
    - +21 km to +30 km/h, driver looses 4 pts on his driving license.
    - +31 km to + 40 km/h, driver looses 6 pts on his driving license.
    - +41 km and above, driving looses 12 pts on his driving license.

  Implement this method using a **nested "if-then-else"** structure.

- Complete the **TestRadarSpeedMonitor** program to validate the "`getLostPoints(CarDriver driver)`" method. Below is an example:

```
CarDriver driver = new CarDriver(12, 18, car);

//Car speed is now 140 km/h
car.setCurrentSpeed(140);
//How many points lost?
System.out.println("driver has lost: "+radar.getLostPoints(driver)+"
points");

//Car speed is now 150 km/h
car.setCurrentSpeed(150);
//How many points lost?
System.out.println("driver has lost: "+radar.getLostPoints(driver)+"
points");
//Please complete to cover all possible cases ...
```

2.2. The "for" loop statement

- In **TestRadarSpeedMonitor** program, use a "**for**" statement to rewrite the piece of code in charge of validating the "`getLostPoints(CarDriver driver)`" method.

```
//Create a driver that holds a driving license for 18 months with 12
points.
CarDriver driver2 = new CarDriver(12, 18, car);
//This driver's car reaches speed = speed limit
int currentSpeed = radar.getSpeedLimit();
//For loop
for (...){
   currentSpeed= ...;
   driver2.getCar().setCurrentSpeed(...);
   System.out.println("Car speed is "+...+" plm/h");
   System.out.println("driver has lost "+…+" points");
```

```
}
```

- Ensure the "for" loop designed previously increases the car speed up to 180 km/h. Modify the "for" loop code to update the number of points on the driver's license, each time points are lost.

  The program should exit the "**for"** loop as soon as there are less than 6 points remaining on the driver's driving license. Use the **"break"** keyword.

2.3. The "while" loop statement

- In **TestRadarSpeedMonitor** program, write a **"while"** loop that increases the driver's car speed (step = 1km/h) until reaching the speed limit set on the radar. Test your code.

```
//Create a driver that holds a driving license for 6 months with 12
points.
CarDriver driver3 = new CarDriver(12, 6 , new Car(2002));
int carSpeed = driver3.getCar().getCurrentSpeed();
System.out.println("Before loop: car speed is "+ carSpeed);
while (...) {
   carSpeed+=...;
   dr.getCar().setCurrentSpeed(...);
   System.out.println("In loop: car speed is "+ ... );
}
System.out.println("After loop: car speed is "+ ...);
```

- Modify the code inside the loop, to exit the loop when a driver holding a license for less than 12 months reaches a speed >= (80%speed limit). Use the **"break"** keyword. Test your code.
- Modify the "**while**" loop code to print the car speed on the standard output for each iteration. Modify again to skip this print operation for every odd speed value. Use the **"continue"** keyword

2.4. The "do - while" loop

- What is the result of following code execution? Explain.

```
CarDriver driver4 = new CarDriver(12, 6 , new Car(2002));
d.getCar().setCurrentSpeed(140);
int speed = driver4.getCar().getCurrentSpeed();
System.out.println("Before loop: car speed is "+ speed);
do {
   speed +=10;
   d.getCar().setCurrentSpeed(speed);
   System.out.println("car speed is:"+d.getCar().getCurrentSpeed());
}
while(speed <= 130));
```

- What would happen if a "while" statement was used instead?

2.5. The “switch” statement

- When exceeding the speed limit, not only the driver looses points on his driving license but has to pay a speeding ticket (fine) as well. In our example, the cost of the ticket is evaluated according to the following rule:
  - 1 points = 50$
  - 2 points = 100$
  - 3 points = 130$,
  - 4, 5 and 6 points = 300 $
  - 7, 8 and 9 points = 400$
  - 10, 11 and 12 points = 500$

- Add a public “`getSpeedingTicketCost(int nbPointsLost)`” method to the **RadarSpeedMonitor** class. This method returns the cost of the speeding ticket depending on the number of points lost by a driver. Use the “**switch**” statement.

- Complete the **TestRadarSpeedMonitor** program to test your code. Complete the following test example:

```
for (int nbPointsLost = ...; nbPointsLost <= ...;
nbPointsLost ++){
      int cost = radar.getSpeedingTicketCost(...);
      System.out.println("Points lost: "+ ...+ " Speeding ticket
      cost: "+cost+"$");
}
```