

BİL 113/012 Computer Programming I

HOMEWORK 3 (30 Points)

Oct 31, 2020

1 [10 POINTS] CAR PRICE CALCULATOR

In Turkey, one has to pay two different taxes while buying a car: the Special Consumption Tax (*SCT*), and the Value Added Tax (*VAT*). The *SCT* rate on a car is a function of its base price and the engine capacity. *VAT*, on the other hand, is fixed and at the rate of %18 for all cars.

The *SCT* rate for cars with engine capacity less than or equal to 1600cc is as in the following:

1. If the base price is less than or equal to \$10,625, it is %45,
2. If the base price is more than \$10,625 but less than \$16,250, then it is %50,
3. If the base price is \$16,250 or higher, then it is %80.

The *SCT* rate for cars with engine capacity more than 1600cc but less than 2000cc is as in the following:

1. If the base price is less than \$21,250, it is %130,
2. If the base price is \$21,250 or higher, then it is %150.

Rate of *SCT* for cars with engine capacity of 2000cc or higher is %220.

Given the base price and the engine capacity of a car, its final price is calculated as follows. First, the *SCT* amount is computed according to the specifications above. And then the *VAT* amount is computed over the *SCT included price*, which is the sum of the base price and the *SCT* amount. The *final price* of the car is the sum of the *SCT included price* and the *VAT* amount.

In this question, you will write a Java program, which takes the base price and the engine capacity of a car as input from the user. Your program will calculate and output the SCT amount, VAT amount and the total amount of taxes as well as the final price of the car in U.S. currency format using the NumberFormat class of the java.text package. Your program will also output what percentage of the final price is paid for the SCT the VAT, respectively. Some samples runs for the program is provided below. **Make sure that your program outputs match those in the examples for the same inputs.**

```
Please enter the base price of the car:10625
Please enter the engine capacity:1500
Base price:$10,625.00
Special Consumption Tax:$4,781.25
Value Added Tax:$2,773.12
Total Tax:$7,554.38
Final Price:$18,179.38
Approximately 26% of the final price is Special Consumption Tax
Approximately 15% of the final price is Value Added Tax
```

```
Please enter the base price of the car:20000
Please enter the engine capacity:1800
Base price:$20,000.00
Special Consumption Tax:$26,000.00
Value Added Tax:$8,280.00
Total Tax:$34,280.00
Final Price:$54,280.00
Approximately 48% of the final price is Special Consumption Tax
Approximately 15% of the final price is Value Added Tax
```

```
Please enter the base price of the car:50000
Please enter the engine capacity:3000
Base price:$50,000.00
Special Consumption Tax:$110,000.00
Value Added Tax:$28,800.00
Total Tax:$138,800.00
Final Price:$188,800.00
Approximately 58% of the final price is Special Consumption Tax
Approximately 15% of the final price is Value Added Tax
```

P.S: Please set your locale to the U.S. format for convenience in writing your programs for the assignments. If it is not set to the U.S. format, you can do the following. Import *java.util.Locale*. Call the static *getCurrencyInstance* and *getPercentInstance* methods of the *NumberFormat* class to get your *NumberFormat* objects as in the *NumberFormat.getCurrencyInstance(new Locale("en", "US"))* and *NumberFormat.getPercentInstance(new Locale("en", "US"))*. Note that if your locale is already set to the U.S. format, you do not need to do this, you can use the *NumberFormat* methods as we did in class.

2 [5 POINTS] THE BIL113 NUMBERS

The *Bil113 Numbers* are 4–digit integers with the property that the sum of the first two digits divides the sum of the last two digits. Notice that 6684 and 2095 are BIL113 Numbers but 5902 and 2126 are not.

In this question, you will write a Java program, which takes a 4–digit positive integer as input and decides if the given number is a Bil113 Number or not. You can find example program inputs and outputs below. Green texts are inputs. Your programs output must match the examples below.

EXAMPLE 1

Please enter a 4-digit number:2127

2127 is a Bil113 Number.

EXAMPLE 2

Please enter a 4-digit number:2022

2022 is a Bil113 Number.

EXAMPLE 3

Please enter a 4-digit number:3258

3258 is not a Bil113 Number.

EXAMPLE 4

Please enter a 4-digit number:4758

4758 is not a Bil113 Number.

3 [10 POINTS] GAMBLER'S RUIN

In this question, you are going to simulate the *Gambler's Ruin*, a statistical concept that is most commonly expressed as the fact that a gambler playing a negative expected value game will eventually go broke, regardless of their betting system.

We have a gambler that came to casino with n in his pocket. He wants to make his money m for some $m > n$, by playing as many rounds as needed of a particular game. In each round of the game, the gambler bets \$1, and wins \$1 with some probability p or loses \$1 with probability $1 - p$. Notice that at the end of a round, the gambler has one more dollar than the end of the previous round with probability p , and he has one less dollar than the end of the previous round with probability $1 - p$. The gambler plays this game until one of the following two things happens: (i) his money reaches the goal he set before coming to the casino, i.e., his money becomes m , which we refer to as a *win* for him, (ii) his money reaches \$0 and he is not permitted to play any more rounds, and we refer to this situation as a *lose* for him. As you will see, she has a very slim chance of winning if m is large for $p < 0.5$.

As simulations involves randomness, you will simulate this game several times and count how many times the gambler won and lost. Your program must take the following as input and output how many times the gambler won and lost.

- n : the initial money of the gambler,
- m : the goal of the gambler,
- p : the probability of winning at each round, and
- the number of times the game is to be simulated. Note that one simulation of the game consists of several rounds.

You can find example program inputs and outputs below. Green texts are inputs. **Since randomness is involved in the computation, the output of your program may not match the given output for these examples, however, the results should be similar.**

EXAMPLE 1

Initial money:100

Goal:200

Probability of winning in a round:0.49

Number of times the game will be simulated:1000

Win:18

Lose:982

EXAMPLE 2

Initial money:100

Goal:200

Probability of winning in a round:0.495

Number of times the game will be simulated:1000

Win:127

Lose:873

EXAMPLE 3

Initial money:500

Goal:1000

Probability of winning in a round:0.490

Number of times the game will be simulated:1000

Win:0

Lose:1000

EXAMPLE 4

Initial money:500

Goal:1000

Probability of winning in a round:0.495

Number of times the game will be simulated:1000

Win:0

Lose:1000

EXAMPLE 5

Initial money:500

Goal:1000

Probability of winning in a round:0.499

Number of times the game will be simulated:1000

Win:125

Lose:875

EXAMPLE 6

Initial money:100

Goal:200

Probability of winning in a round:0.51

Number of times the game will be simulated:1000

Win:979

Lose:21

4 [5 POINTS] MR. BİDİK AND GEOMETRY

It has been almost four years since you bought a shape sorter toy for Mr. Bıdık, your favorite nephew. You were very happy then since it has been the favourite toy of Mr. Bıdık for quite a while. That toy, Mr. Bıdık said, is what started my love for geometry.

Mr. Bıdık asked you to write a Java program that helps him in computing the volume of various 3-dimensional geometric shapes. Your program should prompt the user to choose among a set of geometric shapes. Depending on the choice of the user, your program should ask for the magnitude of several parameters needed to compute the volume. Your program should then report the volume of the chosen geometric shape.

- Your program should minimally include cube, cylinder, sphere, and rectangular prism.
- The relevant parameters of the shapes should not be necessarily integers.

EXAMPLE 1

Please enter the geometric shape which you wish to compute its volume:cube

Please enter the length of the cube:3.1

Volume of the cube is 29.791

EXAMPLE 2

Please enter the geometric shape which you wish to compute its volume:cylinder

Please enter the height and radius of the cylinder:2 3

Volume of the cylinder is 56.548667764616276

EXAMPLE 3

Please enter the geometric shape which you wish to compute its volume:sphere

Please enter the radius of the sphere:3

Volume of the sphere is 113.09733552923255

EXAMPLE 4

Please enter the geometric shape which you wish to compute its volume:rectangular prism

Please enter the length, height, and width of the rectangular prism:2 3 4

Volume of the rectangular prism is 24.0