Programming Fundamentals II

Lab 3: Assignment

Lab Guidelines:

- Feel free to utilize **any IDE** for completing this laboratory assignment.
- This lab comprises **4 problems** that necessitate resolution.
- Please ascertain that your code adheres to proper formatting and is adequately commented.
- Submit the code for each problem under its corresponding exercise number in a .java file.(e.g Exercise1.java).

Note: *If you have any inquiries, please feel free to reach out to us via the discussion platform accessible to participants of this lab.*

Exercise 1:

Assume the income tax of the employees of a company is calculated based on two factors: the total income and the number of children. Tax is calculated as follows:

- **10%** if the income is less than **30,000**.
- **20%** if the income is greater or equal to **30,000** and the employee has three children or more.
- **30%** if the income is greater or equal to **30,000** and the employee has fewer than three children.

Write a program that asks the user to enter his/her income and number of children then calculates and prints the net salary (salary after deducting the tax).

Exercise 2:

(*Cost of shipping*) A shipping company uses the following function to calculate the cost (in dollars) of shipping based on the weight of the package (in pounds).

$$c(w) = \begin{cases} 2.5, \text{ if } 0 < w <= 2 \\ 4.5, \text{ if } 2 < w <= 4 \\ 7.5, \text{ if } 4 < w <= 10 \\ 10.5, \text{ if } 10 < w <= 20 \end{cases}$$

Write a program that prompts the user to enter the weight of the package and display the shipping cost. If the weight is greater than 20, display a message "the package cannot be shipped."

Exercise 3:

Write an application to read the wattage (or watts) of a standard light bulb and assign to a variable called lumens the expected brightness of that bulb. Use this table:

Watts	Brightness (lumens)
15	125
25	215
40	500
60	880
75	1000
100	1675

Assign the value `-1` if the value of *watts* is not in the table. *[Hint: use the **switch** statement]*

Exercise 4:

(*Algebra: solve quadratic equations*) The two roots of a quadratic equation $ax^2 + bx + c = 0$ can be obtained using the following formula:

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$b^2 - 4ac$ is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

Write a program that prompts the user to enter values for a, b, and c and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is `0`, display one root. Otherwise, display "The equation has no real roots."

Note you can use `Math.pow(x, 0.5)` to compute $\sqrt{x}$. Here are some sample runs:

```
Enter a, b, c: 1.0 3 1 ↵Enter
The equation has two roots -0.381966 and -2.61803
```

```
Enter a, b, c: 1 2.0 1 ↵Enter
The equation has one root -1.0
```

```
Enter a, b, c: 1 2 3 ↵Enter
The equation has no real roots
```

End of Lab!