Objectives:

The students should learn how to:

1. Program using selection statements with combined conditions.

2. Combine conditions using logical operators (**!**, **&&**, and **||**)

3. Write expressions using the conditional expression

Submission Instructions:

1. ***Due date: Saturday, October 2nd, 2021 at 11:59 pm***

2. You can discuss answers with your colleagues. **But no copying.**

3. Submit it to lms.ksu.edu.sa. **Email submissions will not be accepted**.

4. All classes in one java project. The project name must be:
   Lab04_ID_FirstName_LastName.zip. For example:
   Lab04_123456789_Marwan_Almaymoni.zip

5. Use the default package.

6. Write your name and university ID as a comment at the start of all java
   files.

Lab Exercise 1

How cold is it outside? Temperature by itself is not enough. In 2001, the National Weather Service (NWS) in the United States implemented the new **wind-chill temperature** to measure the coldness using temperature and wind speed. The formula is

$$t_{wc} = 35.74 + 0.6215t_a - 35.75v^{0.16} + 0.4275t_a v^{0.16}$$

where t_a is the outside temperature measured in degrees Fahrenheit and v is the speed measured in miles per hour. t_{wc} is the wind-chill temperature. **The formula cannot be used** for wind <u>speeds below 2 mph</u> or <u>temperatures below -58°F or above 41°F</u>.

Write a program that prompts the user to enter a temperature and a wind speed. The program displays the wind-chill temperature if the input is valid; otherwise, it displays a message indicating whether the temperature and/or wind speed is invalid. Use the class name **WindChill**.

Sample Runs

```
Enter the temperature in Fahrenheit: 32 ↵
Enter the wind speed miles per hour: 30 ↵
The wind chill index is 17.59665069469402
```

```
Enter the temperature in Fahrenheit: 80 ↵
Temperature must be between -58F and 41F
```

```
Enter the temperature in Fahrenheit: 20 ↵
Enter the wind speed miles per hour: 1 ↵
Speed must be greater than or equal to 2
```

Lab Exercise 2

The two roots of a quadratic equation 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 <u>discriminant</u> 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**". Use the class name **QuadEquation**.

Note that you can use `Math.pow(x, 0.5)` to compute $\sqrt{x}$.

Here are some sample runs:

```
Enter a, b, c: 1 3 1 ↵
The equation has two roots -0.3819660112501051 and -2.618033988749895
```

```
Enter a, b, c: 1 2 1 ↵
The equation has one root -1.0
```

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

Lab Exercise 3

Write a program that reads an unspecified number of integers, determines how many positive and negative values have been read, and computes the total and average of the input values (not counting zeros). Your program ends with the input 0. Display the average as a floating-point number. Use the class name **UnspecifiedNumbers**.

Here are some sample runs:

```
Enter integers ending with 0: 4 2 -1 3 -2 0 ↵
The number of positives is 3
The number of negatives is 2
The total is 6
The average is 1.2
```

```
Enter integers ending with 0: 0 ↵
no numbers are entered except 0
```

Lab Exercise 4

Write a program that prompts the user to enter the number of students and each student's name and score (at least two students), and finally displays the student with the highest score and the student with the second-highest score. Use the class name **TopStudents**.

Here are sample runs:

```
Enter the number of students: 4 ↵
Enter a student name: Mohammed ↵
Enter a student score: 75 ↵
Enter a student name: Ali ↵
Enter a student score: 85 ↵
Enter a student name: Fahad ↵
Enter a student score: 98 ↵
Enter a student name: Khalid ↵
Enter a student score: 65 ↵
Top two students:
Fahad's score is 98.0
Ali's score is 85.0
```

```
Enter the number of students: 1 ↵
Need at least two students.
```