# Lab 04

# Selection Control Structures

This lab will give you practical implementation of different types of Selection Control Structures.

## Activity Outcomes:

On completion of this lab student will be able

- Construct boolean expressions to evaluate a given condition
- Construct if and if-else-if statements to perform a specific task
- Construct a switch statement

## Instructor Note:

As a pre-lab activity, read Chapter 04 from the text book "Java How to Program, Deitel, P. & Deitel, H., Prentice Hall, 2019".

# 1) Useful Concepts

**boolean Data Type:** The boolean data type declares a variable with the value either **true** or **false**.
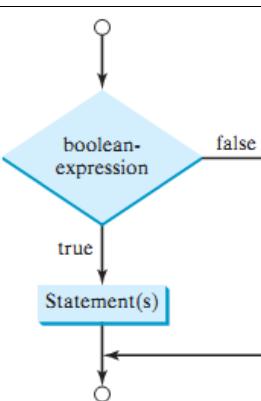
## Relational Operators

| Java Operator | Mathematics Symbol | Name | Example (radius is 5) | Result |
|---|---|---|---|---|
| < | < | less than | radius < 0 | false |
| <= | ≤ | less than or equal to | radius <= 0 | false |
| > | > | greater than | radius > 0 | true |
| >= | ≥ | greater than or equal to | radius >= 0 | true |
| == | = | equal to | radius == 0 | false |
| != | ≠ | not equal to | radius != 0 | true |

## Logical (Boolean) Operators

| Operator | Description |
|---|---|
| ! | not |
| && | and |
| \|\| | or |
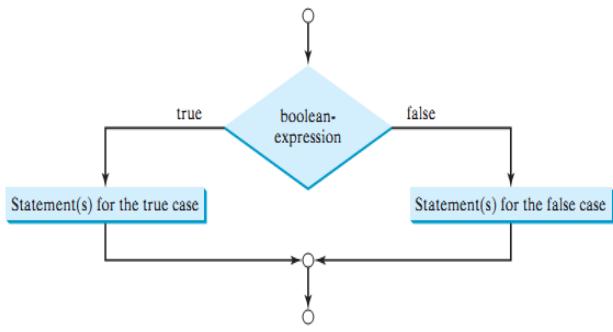
## if Statements

| Syntax | |
|---|---|
| `if(boolean-expression){`<br><br>    `statement(s);`<br><br>`}` |  |

## if-else Statements

**Syntax**

```
if (boolean-expression) {

   statement(s)-for-the-true-
case;

}

else {

   statement(s)-for-the-false-
case;

}
```



**if-else-if Statement**

**Syntax**

```
if (expression_1){
   statement
   statement
   etc.
}
else if (expression_2){

   statement
   statement
   etc.
}



Insert as many else if clauses as necessary
else{
   statement
   statement
   etc.
}
```

> *If expression_1 is true these statements are executed, and the rest of the structure is ignored.*

> *Otherwise, if expression_2 is true these statements are executed, and the rest of the structure is ignored.*

> *These statements are executed if none of the expressions above are true.*

**switch Statements**

A switch statement executes statements based on the value of a variable or an expression.

```
switch (switch-expression) {
   case value1:statement(s)1;
             break;
   case value2:statement(s)2;
             break;
```

```
          ...
  case valueN:statement(s)N;
              break;
  default:statement(s)-for-
         default;
}
```

**The Conditional operator**
You can use the conditional operator to create short expressions that work like if-else statements.

**Syntax**

```
BooleanExpression ? Value1: Value2;
```

**Example**

```
System.out.println("Your grade is: " + (score < 60 ? "Fail." : "Pass."));
```

## 2) Solved Lab Activites

| Sr.No | Allocated Time | Level of Complexity | CLO Mapping |
|-------|----------------|---------------------|-------------|
| Activity 1 | 15 mins | Midum | CLO-5 |
| Activity 2 | 15 mins | Midum | CLO-5 |
| Activity 3 | 15 mins | Midum | CLO-5 |
| Activity 4 | 15 mins | Midum | CLO-5 |
| Activity 5 | 15 mins | Medium | CLO-5 |

### Activity-1:
*This program illustrate the uses of logical operator to calculate Leap Year*

### Solution:
```java
import java.util.Scanner;
public class Activity1 {
     public static void main(String[] args) {
            Scanner input = new Scanner(System.in);
            System.out.print("Enter a year: ");
            int year = input.nextInt();
            boolean isLeapYear = (year % 4 == 0 && year % 100 != 0) ||
 (year % 400 == 0);
            System.out.println(year + " is a leap year? " +
 isLeapYear);
        }
}
```

### Output
```
Enter a year: 2008
2008 is a leap year? True
Enter a year: 1900
1900 is a leap year? False
```

### Activity-2:
*This program prompts the user to enter an integer. If the number is a multiple of 5, the program displays HiFive. If the number is divisible by 2, it displays HiEven*

### Solution:
```java
import java.util.Scanner;
public class Activity2 {
     public static void main(String[] args) {
            Scanner input = new Scanner(System.in);
            System.out.println("Enter an integer: ");
```

```java
        int number = input.nextInt();
        if (number % 5 == 0)
            System.out.println("HiFive");
        if (number % 2 == 0)
            System.out.println("HiEven");
    }
}
```

**Output**

```
Enter an integer: 4
HiEven
Enter an integer: 30
HiFive
HiEven
```

## Activity-3:

*The following program demonstrate **if-else** concept. It determines an employee's weekly wages. If the hours worked exceed 40, then wages include overtime payment*

**Solution:**

```java
import java.util.*;
public class Activity3{
    static Scanner console = new Scanner(System.in);
    public static void main(String [] args){
        double wages, rate, hours; //Line 1
        System.out.print("Line 2: Enter the working "+ "hours: ");
        hours = console.nextDouble();
        System.out.println();
        System.out.print("Line 5: Enter the pay "+ "rate: ");
        rate = console.nextDouble();
        System.out.println();
        if (hours > 40.0)
            wages = 40.0 * rate +1.5 * rate * (hours - 40.0);
        else
            wages = hours * rate; //Line 11
        System.out.printf("Line 12: The wages are $%.2f
%n",wages);
        System.out.println();
    }
}
```

**Output**

```
Line 2: Enter working hours: 60
Line 5: Enter pay rate: 10
Line 12: The wages are $700
```

## Activity-4:

*This program illustrate the usage of `else-if` concept. It calculates the grade based on the score entered by the user*

## Solution:

```java
import java.util.*;
public class Activity4{
      static Scanner console = new Scanner(System.in);
      public static void main(String [] args){
            int score;
            System.out.print("Enter score: ");
            score = console.nextInt();
            if (score >= 90)
                  System.out.println("The grade is A");
            else if (score >= 80)
                  System.out.println("The grade is B");
            else if (score >= 70)
                  System.out.println("The grade is C");
            else if (score >= 60)
                  System.out.println("The grade is D");
            else
                  System.out.println("The grade is F");
      }
}
```

## Output

```
Enter score: 80
The grade is B
```

## Activity-5:

*This program demonstrates the working of switch statement.*

## Solution:

```java
import java.util.Scanner;
public class Activity5{
      public static void main(String[] args){
            int number;
            Scanner input = new Scanner(System.in);
            System.out.print("Enter 1, 2, or 3: ");
            number = input.nextInt();
            switch (number){
                  case 1:
                        System.out.println("You entered 1.");
                        break;
                  case 2:
```

```java
                    System.out.println("You entered 2.");
                    break;
                case 3:
                    System.out.println("You entered 3.");
                    break;
                default:
                    System.out.println("That's not 1, 2, or 3!");
            }
        }
    }
```

**Output**

```
Enter 1, 2, or 3: 2 [enter]
You entered 2.
```

# 3) Graded Lab Tasks

*Note: The instructor can design graded lab activities according to the level of difficult and complexity of the solved lab activities. The lab tasks assigned by the instructor should be evaluated in the same lab.*

## Lab Task 1

*Suppose that x, y, and z are* int *variables and x = 10 , y = 15 , and z = 2 0. Determine whether the following expressions evaluates to* true *or* false *.*

```
!(x > 1 0)
x <= 5 || y < 15
(x != 5 ) && (y != z)
x >= z || (x + y >= z)
(x <= y - 2) && (y >= z) || (z - 2 != 20)
```

## Lab Task 2

*Suppose that x, y, z,and w are* int *variables and x = 3, y = 4, z = 7,and w =1. What is the output of the following statements?*

```
System.out.println("x == y: " + (x == y ));
System.out.println("x != z: " + (x != z ));
System.out.println("y == z - 3: " + (y == z - 3) );
System.out.println("!(z > w): " + ! (z > w));
System.out.println("x + y < z: " + (x + y < z));
```

## Lab Task 3

*Consider the following code segment. Determine the value of **b3***

```
boolean b1=true;
boolean b2=false;
boolean b3=(b1==b2);
```

## Lab Task 4

   a) ***Minimum of two numbers:*** *Given two integers, print the smaller value.*
   b) ***Minimum of two numbers:*** *Given two integers, print the smaller value.*
   c) ***Sign function:*** *For the given integer X print 1 if it's positive, -1 if it's negative, or 0 if it's equal to zero.*
   d) ***Minimum of three numbers:*** *Given three integers, print the smallest value.*

## Lab Task 5

***Equal numbers:*** Given three integers, determine how many of them are equal to each other. The program must print one of these numbers: 3 (if all are the same), 2 (if two of them are equal to each other and the third is different) or 0 (if all numbers are different).

```
Sample Input: 10 5 10                    Output: 2
```

## Lab Task 6

*Write a program that prompts the user to enter a number within the range of 1 through 10. The program should display the Roman numeral version of that number. If the number is outside the range of 1 through 10, the program should display an error message. The following table shows the Roman numerals for the numbers 1 through 10*

## Lab Task 7

*The area of a rectangle is the rectangle's length times its width. Write a program that asks for the length and width of two rectangles. The program should tell the user which rectangle has the greater area, or if the areas are the same.*

## Lab Task 8

*The date June 10, 1960, is special because when it is written in the following format, the month times the day equals the year:* **6/10/60**

*Design a program that asks the user to enter a month (in numeric form), a day, and a two-digit year. The program should then determine whether the month times the day equals the year. If so, it should display a message saying the date is magic. Otherwise, it should display a message saying the date is not magic.*

## Lab Task 9

*Create a change-counting game that gets the user to enter the number of coins required to make exactly one dollar. The program should prompt the user to enter the number of pennies, nickels, dimes, and quarters. If the total value of the coins entered is equal to one dollar, the program should congratulate the user for winning the game. Otherwise, the program should display a message indicating whether the amount entered was more than or less than one dollar.*

## Lab Task 10

*Serendipity Booksellers has a book club that awards points to its customers based on the number of books purchased each month. The points are awarded as follows:*

- *If a customer purchases 0 books, he or she earns 0 points.*
- *If a customer purchases 1 book, he or she earns 5 points.*
- *If a customer purchases 2 books, he or she earns 15 points.*
- *If a customer purchases 3 books, he or she earns 30 points.*
- *If a customer purchases 4 or more books, he or she earns 60 points.*

*Write a program that asks the user to enter the number of books that he or she has purchased this month and displays the number of points awarded.*