Java Operators

Operators are symbols that perform operations on variables and values.

For example, + is an operator used for addition, while * is also an operator used for multiplication.

Operators in Java can be classified into below types:

1. Arithmetic Operators
2. Assignment Operators
3. Relational Operators
4. Logical Operators
5. Unary Operators
6. Bitwise Operators

1. Java Arithmetic Operators

Arithmetic operators are used to perform arithmetic operations on variables and data. For example,

a + b;
Here, the + operator is used to add two variables a and b. Similarly, there are various other arithmetic operators in Java.

Operator	**Operation**
+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Modulo Operation (Remainder after division)

2. Java Assignment Operators

Assignment operators are used in Java to assign values to variables. For example,

```
int age;
age = 5;
```

Here, = is the assignment operator. It assigns the value on its right to the variable on its left. That is, 5 is assigned to the variable age.

Let's see some more assignment operators available in Java.

Operator	Example	Equivalent to
=	a = b;	a = b;
+=	a += b;	a = a + b;
-=	a -= b;	a = a - b;
*=	a *= b;	a = a * b;
/=	a /= b;	a = a / b;
%=	a %= b;	a = a % b;

3. Java Relational Operators

Relational operators are used to check the relationship between two operands. For example,

```
// check is a is less than b
a < b;
```

Here, > operator is the relational operator. It checks if a is less than b or not.

It returns either true or false.

Operator	Description	Example
==	Is Equal To	3 == 5 returns false
!=	Not Equal To	3 != 5 returns true
>	Greater Than	3 > 5 returns false
<	Less Than	3 < 5 returns true
>=	Greater Than or Equal To	3 >= 5 returns false
<=	Less Than or Equal To	3 <= 5 returns true

4. Java Logical Operators

Logical operators are used to check whether an expression is true or false. They are used in decision making.

Operator	Example	Meaning
&& (Logical AND)	expression1 **&&** expression2	true only if both expression1 and expression2 are true
|| (Logical OR)	expression1 **||** expression2	true if either expression1 or expression2 is true
! (Logical NOT)	!expression	true if expression is false and vice versa

5. Java Unary Operators

Unary operators are used with only one operand. For example, ++ is a unary operator that increases the value of a variable by 1. That is, ++5 will return 6.

Different types of unary operators are:

Operator	**Meaning**
+	Unary plus: not necessary to use since numbers are positive without using it
-	Unary minus: inverts the sign of an expression
++	Increment operator: increments value by 1
--	Decrement operator: decrements value by 1
!	Logical complement operator: inverts the value of a boolean

6. Java Bitwise Operators

Bitwise operators in Java are used to perform operations on individual bits. For example,

Bitwise complement Operation of 35
35 = 00100011 (In Binary)
~ 00100011
____
11011100 = 220 (In decimal)

Here, ~ is a bitwise operator. It inverts the value of each bit (0 to 1 and 1 to 0).

Operator	**Description**
~	Bitwise Complement
<<	Left Shift
>>	Right Shift
>>>	Unsigned Right Shift
&	Bitwise AND
^	Bitwise exclusive OR

These operators are not generally used in Java.

Java instanceof Operator

The **instanceof** operator checks whether an object is an instanceof a particular class. For example,

```
class Main {
 public static void main(String[] args) {

   String str = "Programming";
   boolean result;

   // checks if str is an instance of
   // the String class
   result = str instanceof String;
   System.out.println("Is str an object of String? " + result);
 }
}
```

Java Ternary Operator

The ternary operator (conditional operator) is shorthand for the if-then-else statement.

For example,

variable = Expression ? expression1 : expression2

If the Expression is true, expression1 is assigned to the variable.

If the Expression is false, expression2 is assigned to the variable.

```
class Java {
 public static void main(String[] args) {

  int februaryDays = 29;
  String result;

  // ternary operator
  result = (februaryDays == 28) ? "Not a leap year" : "Leap year";
  System.out.println(result);
 }
}
```

Java Basic Input and Output

Java Output

In Java, you can simply use

System.out.println(); or

System.out.print(); or

System.out.printf();

to send output to standard output (screen).

Here,

System is a class

out is a public static field: it accepts output data.

Difference between println(), print() and printf()

print() - It prints string inside the quotes.

println() - It prints string inside the quotes similar like print() method. Then the cursor moves to the beginning of the next line.

printf() - It provides string formatting (similar to printf in C/C++ programming).

Example: Printing Variables and Literals

```
class Variables {
   public static void main(String[] args) {

      Double number = -10.6;

      System.out.println(5);
      System.out.println(number);
   }
}
```

When you run the program, the output will be:

```
5
-10.6
```

Here, you can see that we have not used the quotation marks. It is because to display integers, variables and so on, we don't use quotation marks.

Example: Print Concatenated Strings

```
class PrintVariables {
   public static void main(String[] args) {

      Double number = -10.6;

      System.out.println("I am " + "awesome.");
      System.out.println("Number = " + number);
   }
}
```

Output:

```
I am awesome.
Number = -10.6
```

In the above example, notice the line,

```
System.out.println("I am " + "awesome.");
```

Java Input

Java provides different ways to get input from the user.
To get input from user using the object of Scanner class.

In order to use the object of Scanner, we need to import java.util.Scanner package.

```
import java.util.Scanner;
```

Then, we need to create an object of the Scanner class. We can use the object to take input from the user.

```
// create an object of Scanner
Scanner input = new Scanner(System.in);
// take input from the user
int number = input.nextInt();
```

Example: Get Integer Input From the User

```
import java.util.Scanner;
class Input {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("Enter an integer: ");
        int number = input.nextInt();
        System.out.println("You entered " + number);
        // closing the scanner object
        input.close();
    }
}
```

Note: We have used the close() method to close the object. It is recommended to close the scanner object once the input is taken.

Output:

```
Enter an integer: 2
You entered 2
```

In the above example, we have created an object named input of the Scanner class. We then call the nextInt() method of the Scanner class to get an integer input from the user.

Similarly, we can use nextLong(), nextFloat(), nextDouble(), and next() methods to get long, float, double, and string input respectively from the user.

Java Expressions, Statements and Blocks

Java Expressions

A Java expression consists of variables, operators, literals, and method calls.

```
int score;
score = 90;
```

Here, score = 90 is an expression that returns an int. Consider another example,

```
Double a = 2.2, b = 3.4, result;
result = a + b - 3.4;
```

Here, a + b - 3.4 is an expression.

```
if (number1 == number2)
   System.out.println("Number 1 is larger than number 2");
```

Here, number1 == number2 is an expression that returns a boolean value. Similarly, "Number 1 is larger than number 2" is a string expression.

Java Statements

In Java, each statement is a complete unit of execution. For example,

```
int score = 9*5;
```

Here, we have a statement. The complete execution of this statement involves multiplying integers 9 and 5 and then assigning the result to the variable score.

In the above statement, we have an expression 9 * 5. In Java, expressions are part of statements.

Expression statements

We can convert an expression into a statement by terminating the expression with a ;. These are known as expression statements. For example,

```
// expression
number = 10
// statement
number = 10;
```

In the above example, we have an expression number = 10. Here, by adding a semicolon (;), we have converted the expression into a statement (number = 10;).

Consider another example,

```
// expression
++number
// statement
++number;
```

Declaration Statements

In Java, declaration statements are used for declaring variables.

For example,

Double tax = 9.5;
The statement above declares a variable tax which is initialized to 9.5.

Java Blocks

A block is a group of statements (zero or more) that is enclosed in curly braces { }. For example,

```
class Main {
   public static void main(String[] args) {

      String band = "Beatles";

      if (band == "Beatles") { // start of block
         System.out.print("Hello ");
         System.out.print(“Bye");
      } // end of block
   }
}
```

Output:

```
Hello Bye
```

In the above example, we have a block if {....}.

Here, inside the block we have two statements:

However, a block may not have any statements.

Java Comments

In computer programming, comments are a portion of the program that are completely ignored by Java compilers. They are mainly used to help programmers to understand the code. For example,

```
// declare and initialize two variables
int a =1;
int b = 3;

// print the output
System.out.println("This is output");
```

Here, we have used the following comments,

- declare and initialize two variables
- print the output

Types of Comments in Java

In Java, there are two types of comments:

1. single-line comment

2. multi-line comment

Single-line Comment

A single-line comment starts and ends in the same line. To write a single-line comment, we can use the // symbol. For example,

```
// "Hello, World!" program example
class Main {
    public static void main(String[] args) {
    {
        // prints "Hello, World!"
        System.out.println("Hello, World!");
    }
}
```

Here, we have used two single-line comments:

"Hello, World!" program example

prints "Hello World!"

The Java compiler ignores everything from // to the end of line. Hence, it is also known as **End of Line comment**.

Multi-line Comment

When we want to write comments in multiple lines, we can use the multi-line comment. To write multi-line comments, we can use the /*....*/ symbol. For example,

```
/* This is an example of  multi-line comment.
 * The program prints "Hello, World!" to the standard output.
 */

class HelloWorld {
   public static void main(String[] args) {
   {
      System.out.println("Hello, World!");
   }
}
```

1. Java Program to Print an Integer (Entered by the User)
2. Java Program to Add Two Integers
3. Java Program to Multiply two Floating Point Numbers
4. Java Program to Find ASCII Value of a character
5. Java Program to Compute Quotient and Remainder
6. Java Program to Swap Two Numbers
7. Java Program to Check Whether a Number is Even or Odd
8. Java Program to Check Whether an Alphabet is Vowel or Consonant
9. Java Program to Find the Largest Among Three Numbers
10. Java Program to Find all Roots of a Quadratic Equation
11. Java Program to Find the Frequency of Character in a String
12. Java Program to Remove All Whitespaces from a String
13. Java Program to Round a Number to n Decimal Places
14. Java Program to Check if a String is Empty or Null

Java Flow Control

Java if...else Statement

There are various forms of if...else statements in Java.

if statement

if...else statement

if...else if...else statement

Nested if...else statement

1. Java if (if-then) Statement

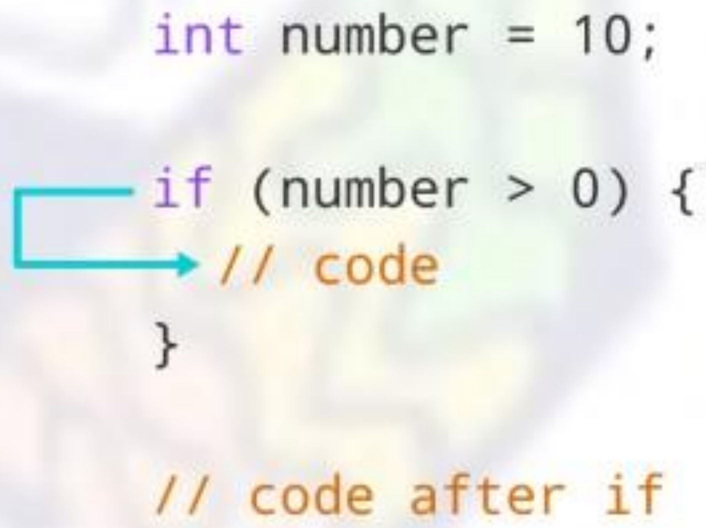
The syntax of a if-then statement:

```
if (condition) {
 // statements
}
```

Here, condition is a boolean expression. It returns either true or false.

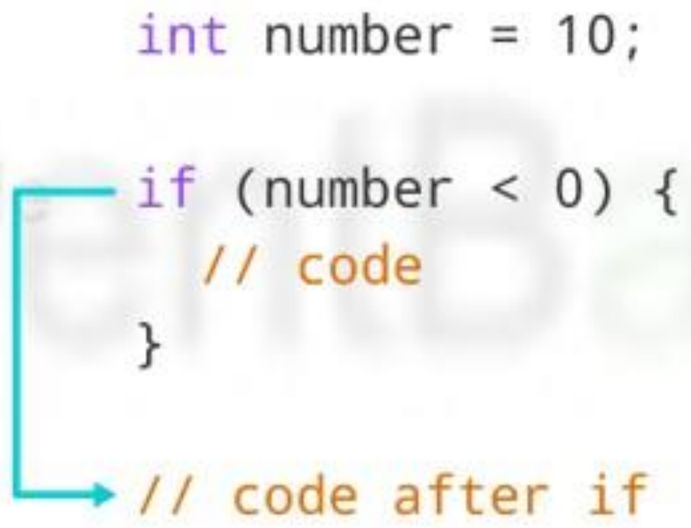
if condition evaluates to true, statements inside the body of if are executed
if condition evaluates to false, statements inside the body of if are skipped

Condition is true



```
int number = 10;

if (number > 0) {
  // code
}

// code after if
```

Condition is false



```
int number = 10;

if (number < 0) {
  // code
}

// code after if
```

```
class IfStatement {
 public static void main(String[] args) {

  int number = 10;

  // checks if number is greater than 0
  if (number > 0) {
   System.out.println("The number is positive.");
  }

  System.out.println("Statement outside if block");
 }
}
```

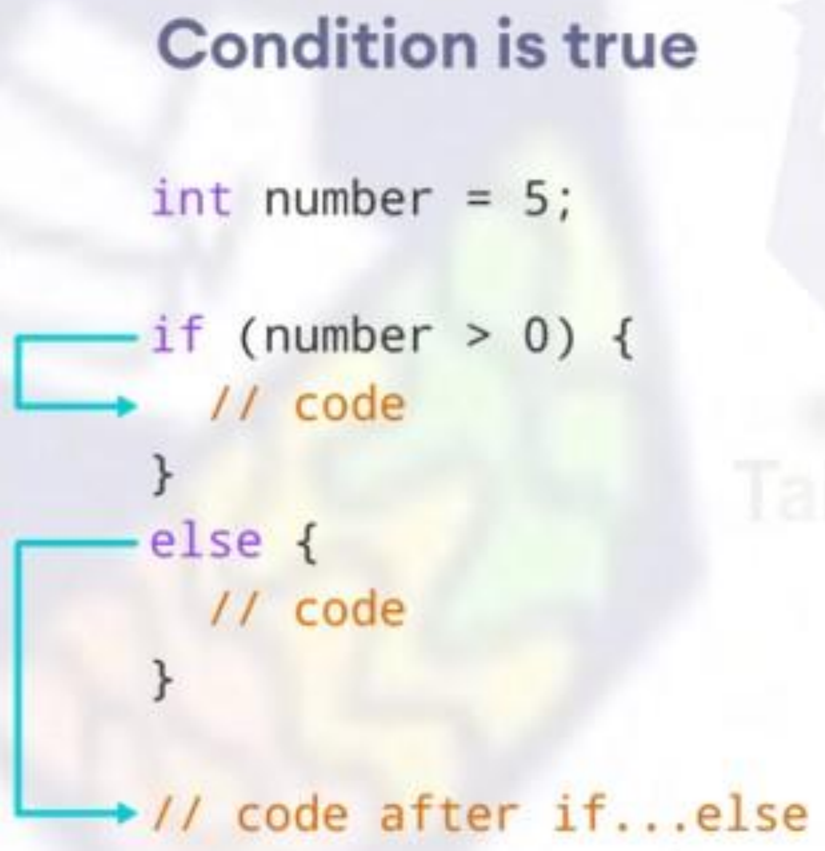
```
class Main {
 public static void main(String[] args) {
  // create a string variable
  String language = "Java";

  // if statement
  if (language == "Java") {
   System.out.println("Best Programming Language");
  }
 }
}
```

2. Java if...else (if-then-else) Statement

The syntax of the if...else statement is:

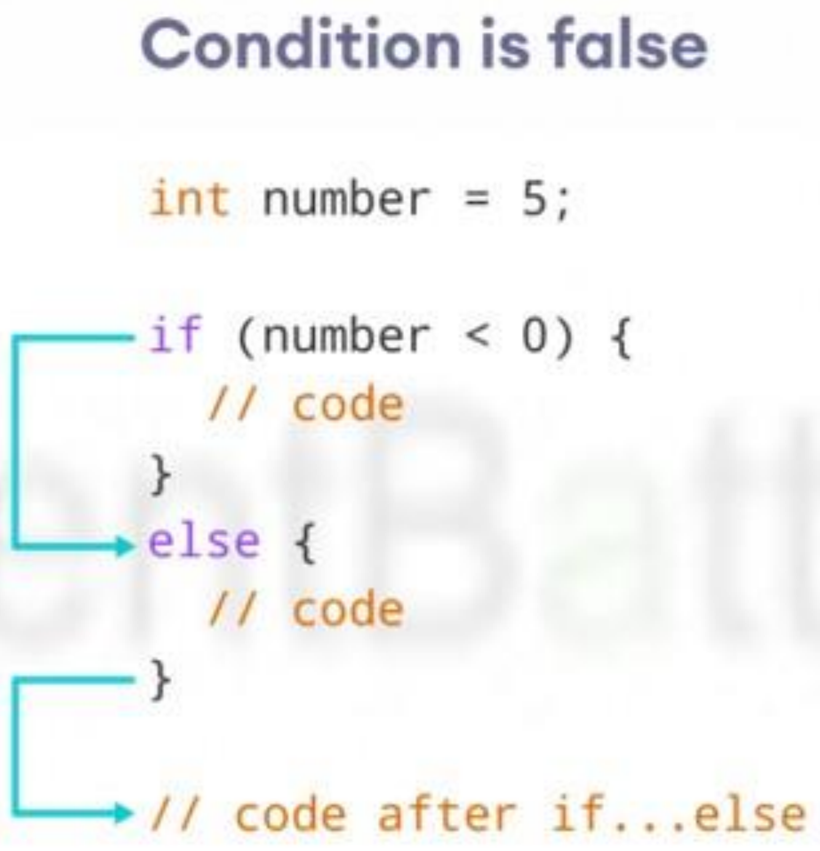
```
if (condition) {
 // codes in if block
}
else {
 // codes in else block
}
```

Here, the program will do one task (codes inside if block) if the condition is true and another task (codes inside else block) if the condition is false.



Condition is true

```
int number = 5;

if (number > 0) {
  // code
}
else {
  // code
}

// code after if...else
```



Condition is false

```
int number = 5;

if (number < 0) {
  // code
}
else {
  // code
}

// code after if...else
```

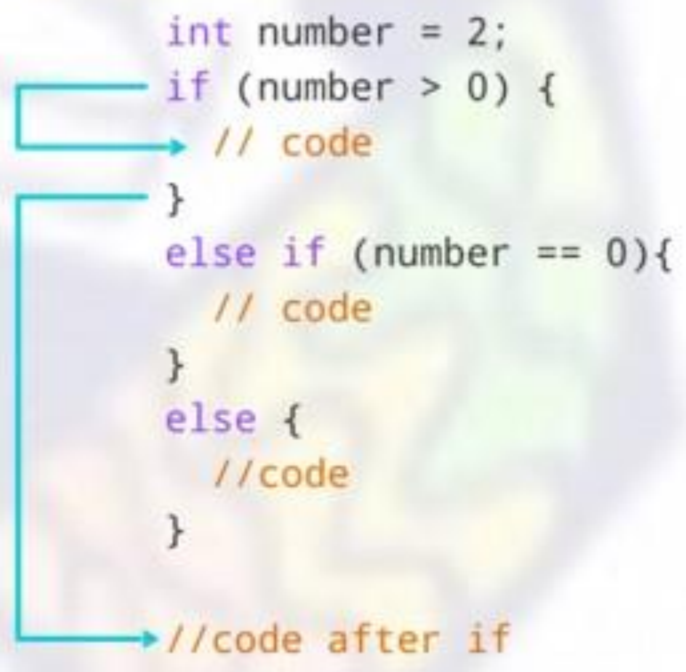
```
class Main {
 public static void main(String[] args) {
  int number = 10;

  // checks if number is greater than 0
  if (number > 0) {
   System.out.println("The number is positive.");
  }

  // execute this block
  // if number is not greater than 0
  else {
   System.out.println("The number is not positive.");
  }

  System.out.println("Statement outside if...else block");
 }
}
```

3. Java if...else...if Statement

In Java, we have an if...else...if ladder, that can be used to execute one block of code among multiple other blocks.

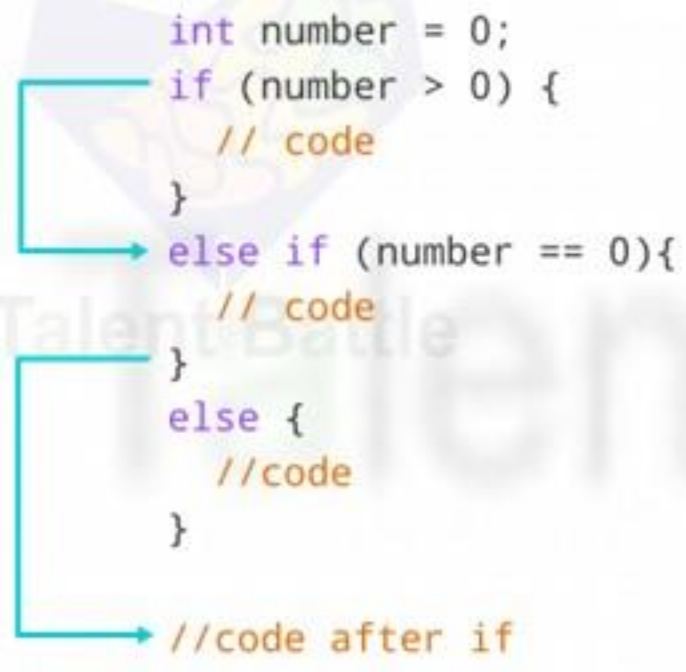
```
if (condition1) {
 // codes
}
else if(condition2) {
 // codes
}
else if (condition3) {
 // codes
}
.
.
else {
 // codes
}
```

1st Condition is true



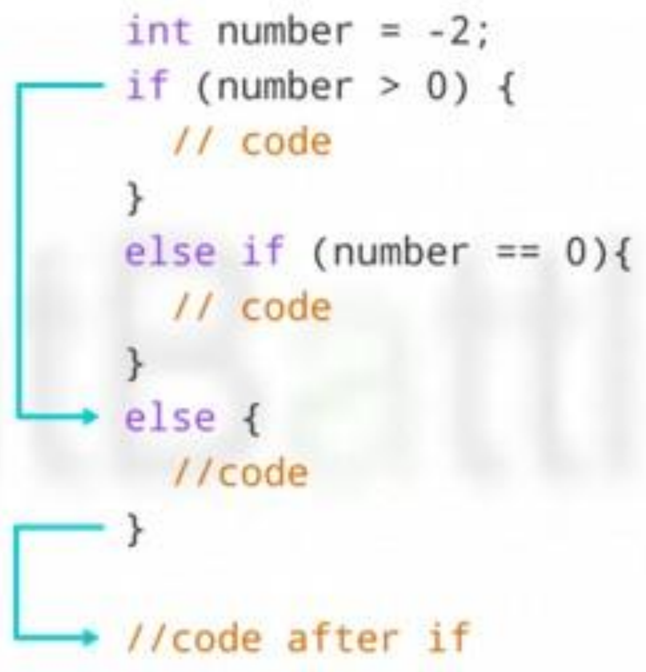
```
int number = 2;
if (number > 0) {
  // code
}
else if (number == 0){
  // code
}
else {
  //code
}

//code after if
```

2nd Condition is true



```
int number = 0;
if (number > 0) {
  // code
}
else if (number == 0){
  // code
}
else {
  //code
}

//code after if
```

All Conditions are false



```
int number = -2;
if (number > 0) {
  // code
}
else if (number == 0){
  // code
}
else {
  //code
}

//code after if
```

```
class Main {
 public static void main(String[] args) {
  int number = 0;
  // checks if number is greater than 0
  if (number > 0) {
   System.out.println("The number is positive.");
  }
  // checks if number is less than 0
  else if (number < 0) {
   System.out.println("The number is negative.");
  }
  // if both condition is false
  else {
   System.out.println("The number is 0.");
  }
 }
}
```

4. Java Nested if..else Statement

In Java, it is also possible to use if..else statements inside an if...else statement. It's called the nested if...else statement.
Here's a program to find the largest of 3 numbers using the nested if...else statement.

```
class Main {
 public static void main(String[] args) {
  // declaring double type variables
  Double n1 = -1.0, n2 = 4.5, n3 = -5.3, largest;
  // checks if n1 is greater than or equal to n2
  if (n1 >= n2) {
   // if...else statement inside the if block
   // checks if n1 is greater than or equal to n3
   if (n1 >= n3) {
    largest = n1;
   }
   else {
    largest = n3;
   }
  } else {
   // if..else statement inside else block
   // checks if n2 is greater than or equal to n3
   if (n2 >= n3) {
    largest = n2;
   }

   else {
    largest = n3;
   }
  }
  System.out.println("Largest Number: " + largest);
 }
}
```

Java switch Statement

The switch statement allows us to execute a block of code among many alternatives.
The syntax of the switch statement in Java is:

```
switch (expression) {
 case value1:
  // code
  break;
 case value2:
  // code
  break;
 ...

 default:
  // default statements
 }
```

```
// Java Program to check the size using the switch...case statement

class Main {
 public static void main(String[] args) {
  int number = 44;
  String size;
  // switch statement to check size
  switch (number) {
   case 29:
    size = "Small";
    break;
   case 42:
    size = "Medium";
    break;
   // match the value of week
   case 44:
    size = "Large";
    break;
   case 48:
    size = "Extra Large";
    break;
   default:
    size = "Unknown";
    break;
  }
  System.out.println("Size: " + size);
 }
}
```

Java Program to Make a Simple Calculator Using switch...case

```java
class Main {
  public static void main(String[] args) {

    char operator;
    Double number1, number2, result;

    // create an object of Scanner class
    Scanner input = new Scanner(System.in);

    // ask users to enter operator
    System.out.println("Choose an operator: +, -, *, or /");
    operator = input.next().charAt(0);

    // ask users to enter numbers
    System.out.println("Enter first number");
    number1 = input.nextDouble();

    System.out.println("Enter second number");
    number2 = input.nextDouble();

    switch (operator) {

      // performs addition between numbers
      case '+':
        result = number1 + number2;
        System.out.println(number1 + " + " + number2 + " = " + result);
        break;

      // performs subtraction between numbers
      case '-':
        result = number1 - number2;
        System.out.println(number1 + " - " + number2 + " = " + result);
        break;

      // performs multiplication between numbers
      case '*':
        result = number1 * number2;
        System.out.println(number1 + " * " + number2 + " = " + result);
        break;

      // performs division between numbers
      case '/':
        result = number1 / number2;
        System.out.println(number1 + " / " + number2 + " = " + result);
        break;

      default:
        System.out.println("Invalid operator!");
        break;
    }

    input.close();
  }
}
```