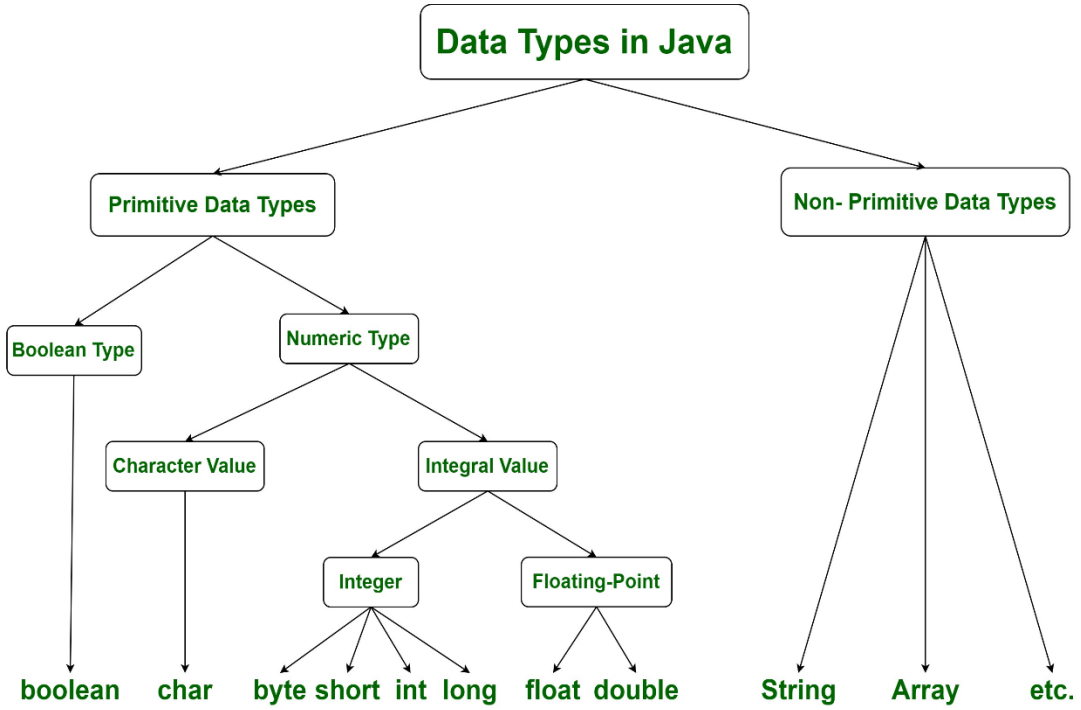
Data Types

Data types specify the different sizes and values that can be stored in the memory using by variable. The values, or data, contained in variables are classified into categories known as data types. In this chapter, you will learn about Java data types and variables and the operation that can be performed on them.

There are two major types of data types in Java.

1. ***Primitive data types:*** The primitive data types include Boolean, char, byte, short, int , long, float and double.
2. ***Non-primitive data types:*** The non-primitive data types Non-primitive data types are called reference types because they refer to objects like include Classes, Interfaces, and Arrays.



Difference between primitive and non-primitive Data Types

Primitive types are predefined (already defined) in Java. Non-primitive types are created by the programmer and is not defined by Java (except for String). Non-primitive types can be used to call methods to perform certain operations, while primitive types cannot. The size of a primitive type depends on the data type, while non-primitive types have all the same size. A primitive type has always a value, while non-primitive types can be null.

There are eight types of Primitive data types with memory size and data range.

Data Type	Size	Description
byte	1 byte	Stores whole numbers from -128 to 127
short	2 bytes	Stores whole numbers from -32,768 to 32,767
int	4 bytes	Stores whole numbers from -2,147,483,648 to 2,147,483,647
long	8 bytes	Stores whole numbers from -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
float	4 bytes	Stores fractional numbers. Sufficient for storing 6 to 7 decimal digits
double	8 bytes	Stores fractional numbers. Sufficient for storing 15 decimal digits
boolean	1 bit	Stores true or false values
char	2 bytes	Stores a single character/letter or ASCII values

Variables

In programming, a variable is a container (storage area) to hold data. To indicate the storage area, each variable should be given a unique name (identifier). Variable names are just the symbolic representation of a memory location. In a program you can put any value into it, and then retrieve the value later for use in calculation. Each variable will contain different values at different times, depending on the requirements. This mean variables can be change value during the execution of program.

Variables can store data of different types, and different data types can do different things. A variable's specific data type is very important in programming because the data type helps determine the manner in which the value is stored and how much memory the computer allocates for the data stored in the variable. The data type also governs the kinds of operations that can be performed on a variable.

Rules of variable name declarations:

The variable value can be change during the execution of program. The name you assign to a variable is called identifier**.** Some rules of variable declaration are following.

- Identifier/Variable name must be start a character or underscore like salary, Name1, Father_Name etc.
- Identifier/Variable may contain uppercase and lowercase Letters, Numbers, or underscore
- Identifier/Variable cannot contain special character and spaces.
- Identifier/Variable are case sensitive.
- Identifier/Variable cannot contain reserve words or keywords of Java language.

Convention Of variable:

variableName = Content ;

Father_Name = Content;

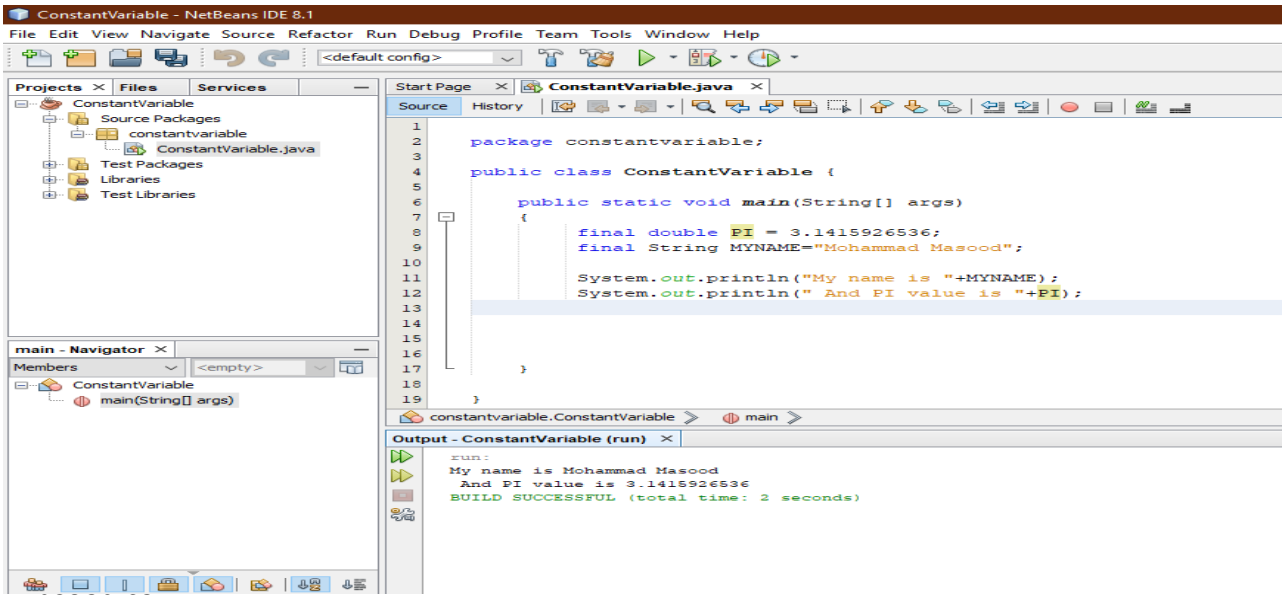
ConvanceAllownace = Content;

Constants/Literals

A constant is a value or an identifier whose value cannot be altered during the execution of the java program. A constant is a variable whose value cannot change once it has been assigned. If you try to change the constant in the program, javac (the Java Compiler) sends an error message. This happens because you can only assign a value to a constant once. A constant can make our program more easily read and understood by others. To define a variable as a constant, we just need to add the keyword "final" in front of the variable declaration. As a rule, we write constants in capital letters to differentiate them from ordinary variables.

Syntax: ***final double PI = 3.1415926536;***

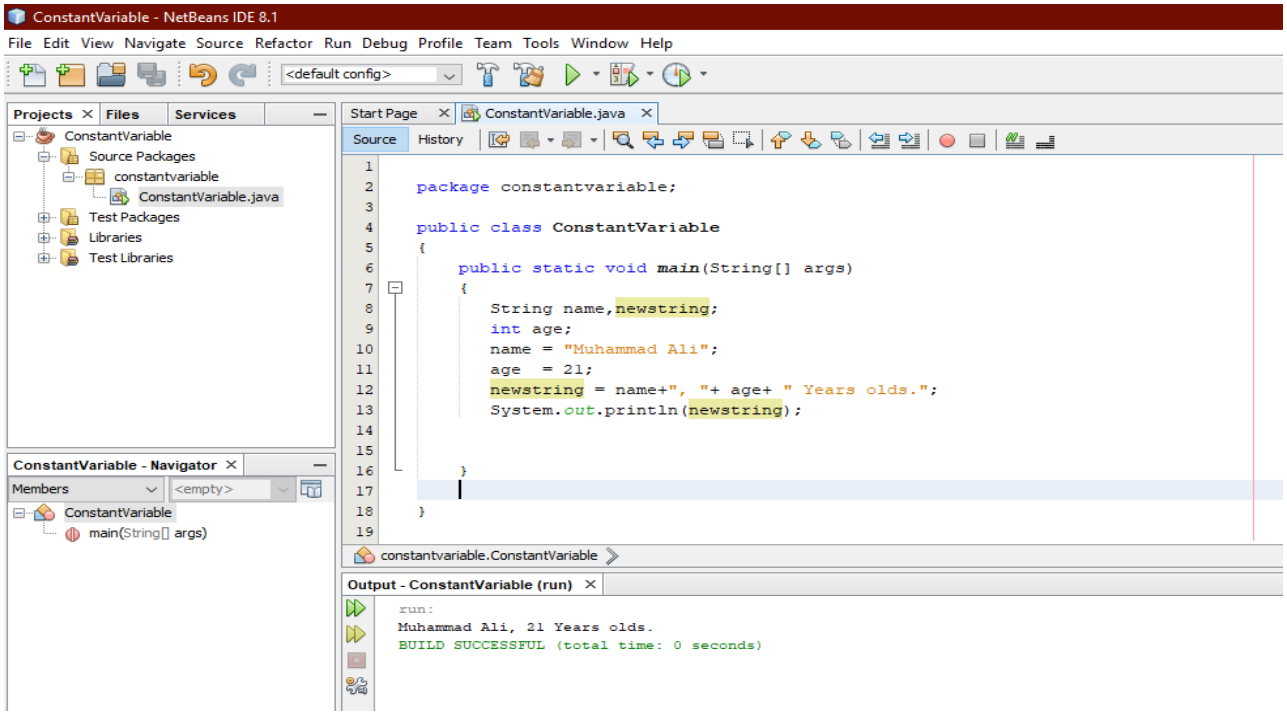
Example



Concatenation

The JAVA concatenation operator (+) is used to combine two string or other type's values to create one string.

```
public static void main(String[] args)
 { String name ,newstring;
     name = "Muhammad Ali";
    int age  = 21;
    newstring = name+", "+ age+ " Years olds.";
    System.out.println(newstring);
 }
```



Declaring and Initializations of variable:

The process of specifying and creating a variable name is called declaring the variable. In Java you must declare and it could be initialize a variable in the same line statement.

Syntax: DataType *Variable_Name* = *value Initialize;*

The value you assign to a variable can be a literal string, a integer number or character or a Boolean value or floating point value etc.

Explanation:

Name = "Sara Khan";

Here "Sara Khan " is a string value assign in variable Name

BasicSalary = 45000;

Here 45000 is a integer numeric value assign in variable BasicSalary.

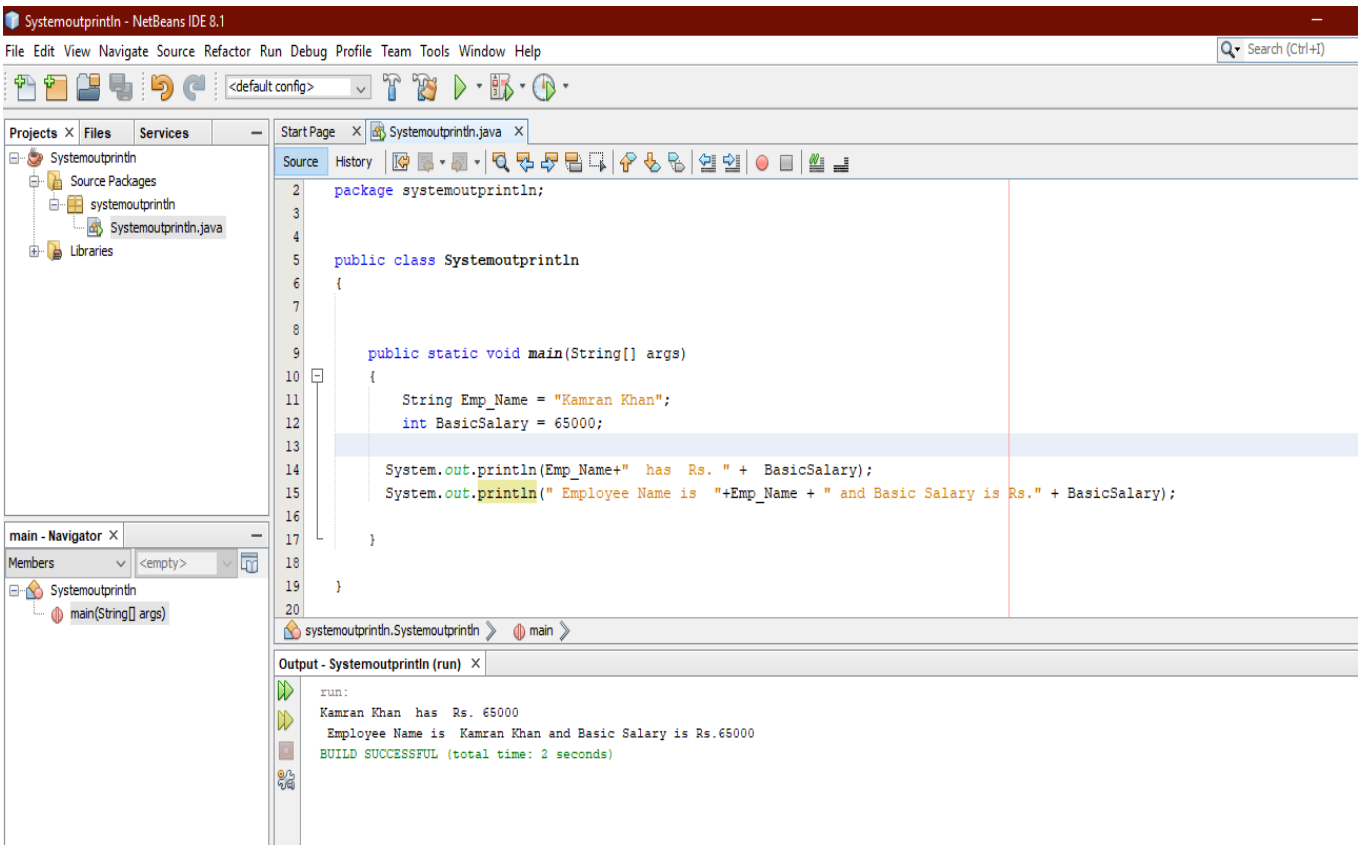
Male = True;

Here True is a Boolean value in Male variable

Displaying the Variable value

To display a variable with the System.out.println() statement, you simply pass the variable name to the System.out.println() statement, as follows.

```
String Emp_Name = "Kamran Khan";
int BasicSalary = 65000;
System.out.prinln(Emp_Name+"  has  Rs. " +  BasicSalary);
System.out.println( " Employee Name is  ",$Emp_Name , " and Basic Salary is Rs.", BasicSalary);
```



Strongly/Static typed Programming

Strongly or Static typed programming language is in every variable must be declared with a data type and data type cannot be change after declaration. Java and C++ are strongly or Static typed programming languages.

Loosely/Dynamic typed Programming

A loosely typed Programming is a programming language that does not require a variable to be defined. You can declare a variable, but it doesn't require you to classify the type of variable. Loose typing is also known as dynamic typing because the data type for a variable can be change after it has been declared. PHP and Perl is a loosely typed programming language.

Exercise

Theory Questions:

1. What difference between variables and constant?
2. Name and describe the four data type in JAVA.
3. Explain the purpose of the Boolean data type.
4. What do you mean by strongly and loosely typed programming?
5. What is Concatenation?

Practical Questions:

1. Write a simple program of the following output using Constants.

   Student Roll Number is 001

   Student Name is ABC XYZ

   Student Address is R-77 Block 17 B. Area AL-Noor Society Karachi

   Father Salary of students is Rs. 68,000

2. Write make a simple program to set your G.R No. and Name in the variables and display G.R No. and name by System.out.prinln() method/ functions.

Objective & MCQ's

1. Positive and negative number and 0 with no decimal places belong to which data type.
   a) Double
   b) Float
   c) String
   d) Integer
2. Which of the following is a valid variable name?
   a) TotalSalary ;
   b) Total Salary;
   c) $TotalSalary;
   d) Total-Salary;
3. Which is the correct syntax for declaring a variable and assigning it a string?
   a) Name="Muhammad";
   b) Name=Muhammad;
   c) "Muhmmad"= Name;
   d) Name = "Muahammad"

4. How many decimal places does an integer store
   a) One decimal
   b) Two decimal
   c) Three decimal
   d) Integer does not store decimal places.
5. Variable name could be starting which symbol.
   a) _ (underscore)
   b) @
   c) $
   d) %
6. Combine the two or more string or other value by using concatenation___ symbol
   a) &
   b) *
   c) +
   d) . (dot)
7. String constant value
   a) Must be enclosed in double quotes
   b) Must be enclosed in commas
   c) Must be enclosed in round parentheses
   d) Must be square brackets
8. A constant is case-sensitive by default. By convention, constant identifiers are should be___.
   a) Lower case
   b) Camel case
   c) Upper case
   d) Normal case
9. We use the _____ keyword to create constant.
   a) define()
   b) Include
   c) final
   d) constant
10. A loosely typed programming language _____.
   a) Does not required data typed of a variable to be declared.
   b) Requires data types of variables to be declared
   c) Does not have variable
   d) Does not have different data types.