Lesson:

Java Variables and Data types

PW SKILLS

List of Concepts Involved:

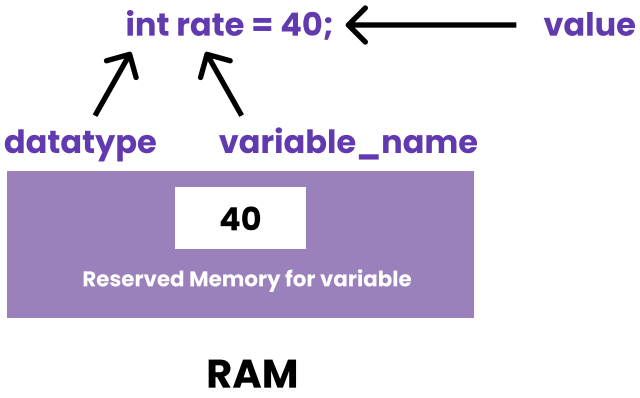
- Variables
- Identifiers
- Data types
- Sample output program
- How does a program work

A computer program/code consists of various components viz. variables, data types, identifiers, keywords, etc which help us to build a successful program. Let us learn each one of them in detail and then move to our first program.

Topic: Variables

A variable is the title of a reserved region allocated in memory. In other words, it may be referred to as the name of a memory location.
It is a container that holds the value while the Java program is executed.
Each variable should be given a unique name to indicate the storage area.
A variable is assigned with a data type(we will learn about it after this topic).

Syntax for Declaring a Variable:
Type variable_name [= value];
The variable_name is the name of a variable. We can initialize the variable by specifying an equal sign and a value (initialization i.e. assigning an initial value, is optional). However, the compiler never assigns a default value to an uninitialized local variable in Java.



Here, rate is an int data type variable with the value 40 assigned to it.
In the example above, the variable can only hold integer values, as indicated by the int data type.
Here, we assigned a value to the variable during the declaration process. However, as stated before, it is optional.
Variables can be declared and assigned separately. Example,

```
int rate;
rate = 40;
```

Changing values of variables

Interestingly, a variable's value can also be changed in the program. Look at the example below :

```
int rate = 50;
System.out.println(rate); // 50
rate = 60;
System.out.println(rate);    // 60
```

Initially, the value of rate was 50 but it has changed to 60 after the last updation, rate=60.

Naming Conventions for variables in Java

Like us, all java components are identified with their names. There are a few points to remember while naming the variable. They are as follows -

- Variable names should not begin with a number. For example
  int 2var; // 2var is an invalid variable .

- Whitespaces are not permitted in variable names. For example,
  `int cricket score;  // invalid variables.`
  There is a gap/whitespace between cricket and score.

- A java keyword (reserved word) cannot be used as a variable name. For example, int float; is an invalid expression as float is a pre-defined as a keyword(we will learn about them) in java.

- As per the latest coding practices, for variable names with more than one word the first word has all lowercase letters and the first letter of subsequent words are capitalized. For example, cricketScore, codePracticeProgram etc. This type of format is called camel case.

- While creating variables, it's preferable to give them meaningful names like- 'age', 'earning', 'value' etc. for instance, makes much more sense than variable names like a, e, and v.

- We use all lowercase letters when creating a one-word variable name. It's preferable(and in practice) to use physics rather than PHYSICS or pHYSICS.

Topic 3: Identifiers

An identifier is a name given to a package, class, interface, method, or variable. All identifiers must have different names.

In Java, there are a few points to remember while dealing with identifiers :

- **Rule 1** - All identifiers should begin with a letter (A to Z or a to z), $ and _ and must be unique.
- **Rule 2** - After the first character/letter, identifiers can have any combination of characters.
- **Rule 3** - A keyword cannot be used as an identifier.
- **Rule 4** - The identifiers are case-sensitive.
- **Rule 5** – Whitespaces are not permitted.
- Examples of legal identifiers: rank, $name, _rate, __2_mark.
- Examples of illegal identifiers: 102pqr, -name.

These variables, identifiers etc. consume memory units. Before proceeding ahead, let us have a look at the memory unit concept too. Here, we will only focus on the relevant concept of memory.

Basic Memory units:
It refers to the amount of memory or storage used to measure data.
Basic memory units are:

1.Bit
A bit (binary digit 0 or 1) is the smallest unit of data that a computer can process and store.
Symbols 0 and 1 are known as bits.Here, 0 indicates the passive state of signal and 1 indicates the active state of signal.
At a time, a bit can store only one value i.e 0 or 1. To have a greater range of value, we combine multiple bits.

2.Byte
A byte is a unit of memory/data that is equal to 8 bits.
You may think of a byte as one letter. For example, the letter 'f' is one byte or eight bits.

The bigger units are :

3.Kilobyte
A Kilobyte is a unit of memory data equal to 1024 bytes.

4.Megabyte
A Megabyte is a unit of memory data equal to 1024 kilobytes.

5.Gigabyte
A Gigabyte is a unit of memory data equal to 1024 Megabytes.

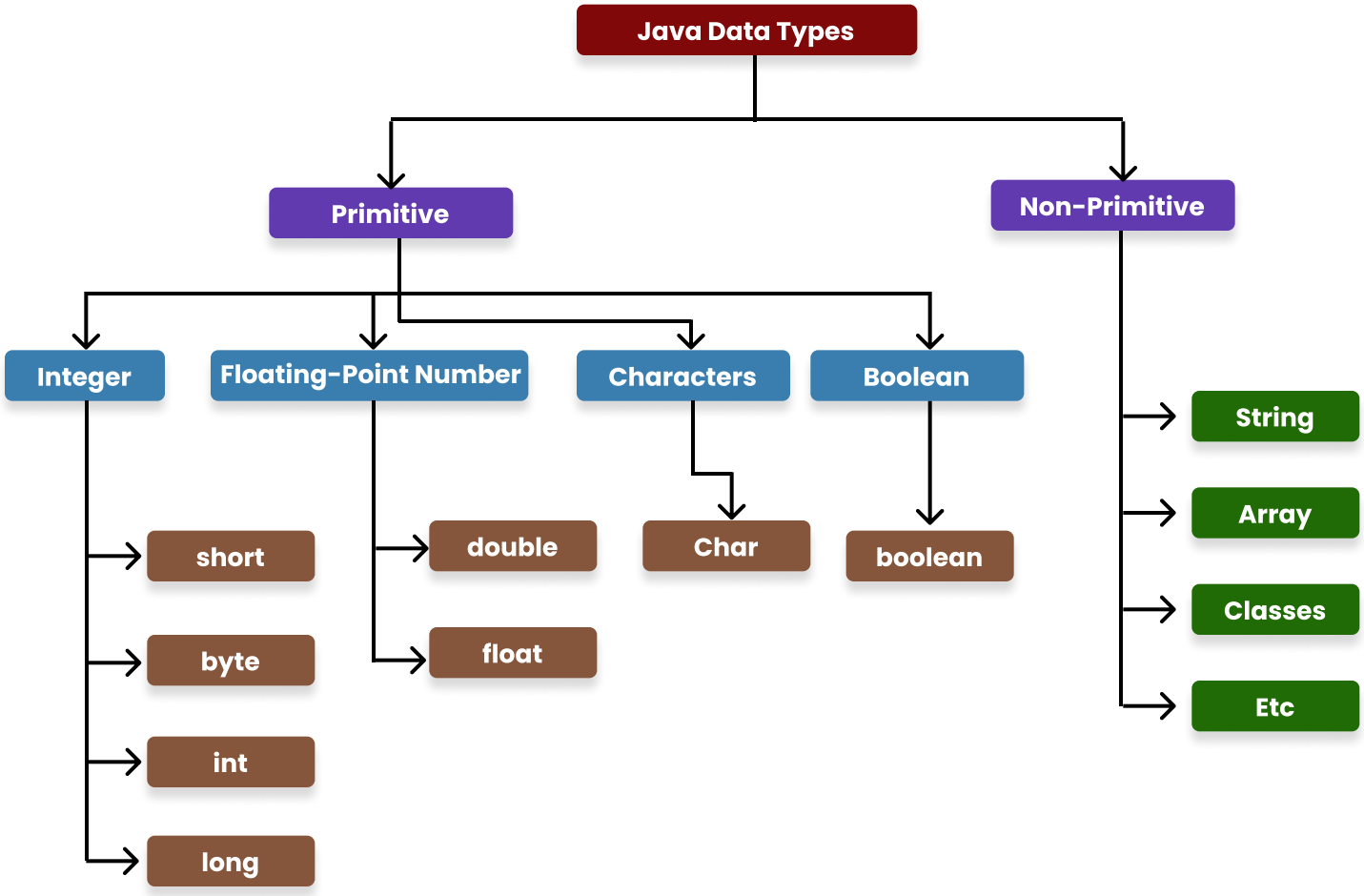
Lets us now move to the most important concept - data type

Topic: Data Types

Data types specify the different sizes and values that can be stored in the variable. Based on the data type of a variable, the operating system allocates memory and decides what can be stored in the reserved memory. Hence, by assigning different data types to variables, we can store integers, decimals, or characters in these variables.

There are two 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 include Classes, Strings,Interfaces, and Arrays.



Primitive data types

A primitive type is predefined by the language and is named by a reserved keyword.

1. **Boolean Type**
   - The Boolean data type can have two values– true or false and hence are typically used in true/false situations.

     For example,
     ```
     Boolean flag=true;
     ```

2. **Byte Type**
   - Values for the byte data type range from -128 to 127 (8-bit signed two's complement integer, you will know more about it once we move to programs and applications).
   - A byte type is used in place of an int to save memory when it is certain that the value of a variable will be between -128 and 127.

     For example,
     ```
     byte range=105;
     ```

3. Short Type

- The short data type can have values ranging from -32768 to 32767 (16-bit signed two's complement integer).
- If the value of a variable is certain to be between -32768 and 32767, short is used in place of other integer data types (int, long).

For example,

```
short loss=-50;
```

4. Int Type

- Values for the int data type range from -2^{31} to $2^{31}-1$(32-bit signed two's complement integer, you will know about it as we move to programs)
- In Java SE 8 and later, you can use the int data type to represent an unsigned 32-bit integer, which has a minimum value of 0 and a maximum value of $2^{32}-1$.

For example,

```
int profit=5000;
```

5. Long Type

- Values for the long data type range from - 2^{63} to $2^{63}-1$ (64-bit signed two's complement integer).
- You can use an unsigned 64-bit integer with a minimum value of 0 and a maximum value of $2^{64}-1$, if you're using Java 8 or later.

For example:

```
long profit=455559990;
```

6. Double Type

- The double data type is a 64-bit floating-point data type with double precision.
- It should never be used for exact values like currency.

For example:

```
double height=12.5;
```

7. Float Type

- The float data type is a 32-bit single-precision floating-point value. If you're curious, you can learn more about single-precision and double-precision floating-point.
- It should never be used for precise values like money.

For example:

```
float depth=-32.3f;
```

8. Char Type

- It's a Unicode (an international character encoding standard that provides a unique number for every character across languages and scripts) 16-bit character.
- The char data type has a minimum value of 'u0000' (0) and a maximum value of 'uffff'.

For example:

```
char temp='a';
```

The **non-primitive** data types are a little advanced concepts which we will cover once we have mastered the primitives and are well versed with the programming principles of Java.

Now that we have learned all the relevant concepts, let us go ahead and write our very first program!

Topic: Java Output/Display Program

Let us take a look at how the Java 'HelloWorldJava' program works.

```
//  First Program
class HelloWorldJava {
    public static void main(String[] args)
{
        System.out.println("Hello World Program in Java");
}}
```

Output
Hello World Program in Java

How Does this program Work?

Compiler:- In computing, a compiler is a computer program that is primarily used to translate source code from a high-level programming language to a lower-level language to create an executable program.

1. **// First Program**
   Any line that begins with // is a comment. Comments are intended to help users reading the code understand the program's intent and functionality. The Java compiler completely disregards it.

2. **class HelloWorldJava**
   Every Java application starts with a class definition. The class in the program is called HelloWorldJava, and its definition is as follows:

   ```
   class HelloWorldJava {
    …..
     }
   ```

   We have to keep in mind that every Java application has a class definition, and the class name should match the name of the file in Java.

3. **Public static void main(String[] args) { … }**
   This is the most widely used method. The main method is required in every Java application. All Java programs begin execution by calling the main() function.
   Let's understand the key terms:

a. **Public:** This is a visibility/access specifier that defines the component's visibility. The term ‘public’ refers to a parameter or component that is visible to everyone.
b. **Static:** The keyword ‘static’ indicates that the method/ object/ variable that follows this keyword is static and can be invoked/called without the object or the dot (.) operator. The presence of the static keyword before the main method indicates that the main method is static.
c. **Void:** The keyword ‘void’ indicates that the method returns nothing.
d. **Main:** The keyword ‘main’ denotes the main method, which is the starting point for any Java program. As mentioned before, a Java program's execution begins with the main method. The curly braces {} indicate start and end of main.
e. **String[] args:** The command line arguments are stored in the string array args.

4. **System.out.println (IMPORTANT)**
   System.out.println() function is used to print messages on the screen. In Java, the system is a class. The PrintStream class is represented by the parameters "out" and "println." Println is a method, whereas "out" is an object.
   The built-in method print() is used to display the string which is passed to it.
   This output string is not followed by a newline, i.e. the next output will start on the same line.The built-in method println() is similar to print(), except that println() prints the output in a newline after each call.

Example Code:

```
public static void main(String[] args) {
     System.out.println("Hello World");
     System.out.println(“Welcome to Physics Wallah");
}
```

Output:
Hello World
Welcome to Physics Wallah

```
Run these examples on your system and check for outputs.

Congratulations! You are officially a programmer now !
```

MCQs

1. Compiler assigns a default value to uninitialized local variables in Java Programming.
This statement is true or false ?

a. True

b. False

Ans b) false

Explanation:
In java, it's mandatory to initialize any local variable before using it because compilers don't assign any default value to variables.

2. Which of the following data type can store the longest decimal number ?
Options:

a. boolean

b. double

c. float

d. long

Ans : b) double

Explanation:
Out of all given options, only float and double can hold decimal numbers and double is the longest data type with 64-bit defined by Java to store floating-point values.

3. Which of the following cannot be stored in character data type?
Options

a. Special symbols

b. Letter

c. String

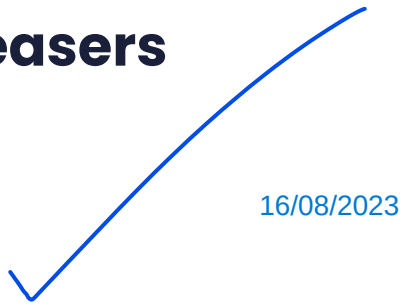
d. Digit

Ans c) String

Explanation:
String is a collection of characters and is stored in a variable of String data type.

Upcoming Class Teasers

- Taking input from the user



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