Java Variables

in Java, variables are containers that store data in memory. Understanding variables plays a very important role as it defines how data is stored, accessed, and manipulated.

Key Components of Variables in Java:

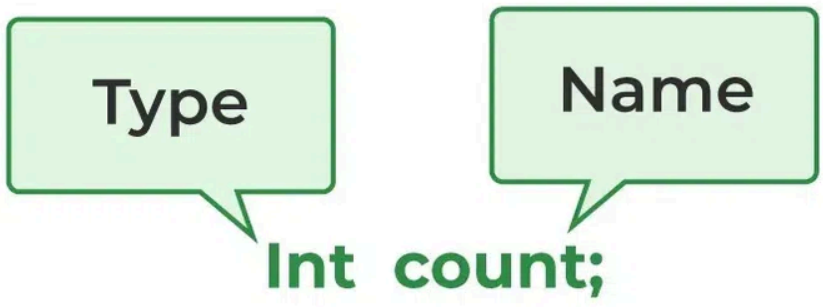
A variable in Java has three components, which are listed below:

- **Data Type:** Defines the kind of data stored (e.g., int, String, float).
- **Variable Name:** A unique identifier following Java naming rules.
- **Value:** The actual data assigned to the variable.

Note: There are three types of variables in Java: **Local, Instance** and **Static**.

How to Declare Java Variables?

The image below demonstrates how we can declare a variable in Java:



From the image, it can be easily perceived that while declaring a variable, we need to take care of two things that are:

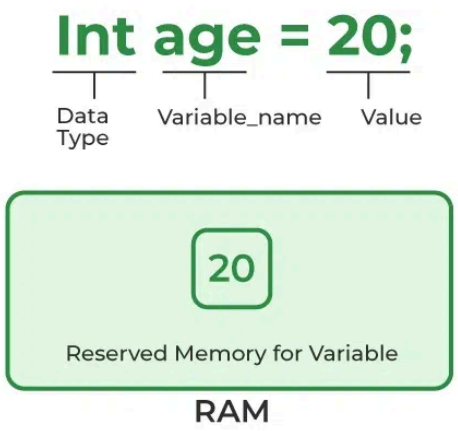
1. **data type**: In Java, a data type define the type of data that a variable can hold.
2. **variable name:** Must follow Java naming conventions (e.g., camelCase).

In this way, a name can only be given to a memory location. It can be assigned values in two ways:

- Variable Initialization
- Assigning value by taking input

How to Initialize Java Variables?

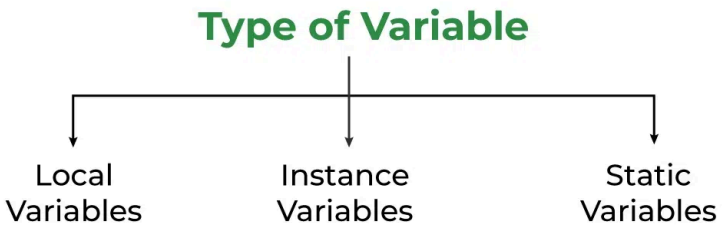
It can be perceived with the help of 3 components explained above:



Types of Java Variables

Now let us discuss different types of variables which are listed as follows:

- Local Variables
- Instance Variables
- Static Variables



1. Local Variables

A variable defined within a block or method or constructor is called a local variable.

- The Local variable is created at the time of declaration and destroyed when the function completed its execution.
- The scope of local variables exists only within the block in which they are declared.
- We first need to initialize a local variable before using it within its scope.

2. Instance Variables

Instance variables are known as non-static variables and are declared in a class outside of any method, constructor, or block.

- Instance variables are created when an object of the class is created and destroyed when the object is destroyed.
- Unlike local variables, we may use access specifiers for instance variables. If we do not specify any access specifier, then the default access specifier will be used.
- Initialization of an instance variable is not mandatory. Its default value is dependent on the data type of variable. For *String* it is *null,* for *float* it is *0.0f,* for *int* it is *0,* for Wrapper classes like *Integer* it is *null, etc.*
- Scope of instance variables are throughout the class except the static contexts.

- Instance variables can be accessed only by creating objects.
- We initialize instance variables using constructor while creating an object. We can also use instance blocks to initialize the instance variables.

3. Static Variables

Static variables are also known as class variables.

- These variables are declared similarly to instance variables. The difference is that static variables are declared using the static keyword within a class outside of any method, constructor, or block.
- Unlike instance variables, we can only have one copy of a static variable per class, irrespective of how many objects we create.
- Static variables are created at the start of program execution and destroyed automatically when execution ends.
- Initialization of a static variable is not mandatory. Its default value is dependent on the data type of variable. For *String* it is *null*, for *float* it is *0.0f*, for *int* it is *0*, for *Wrapper classes* like *Integer* it is *null,* etc.
- If we access a static variable like an instance variable (through an object), the compiler will show a warning message, which won't halt the program. The compiler will replace the object name with the class name automatically.
- If we access a static variable without the class name, the compiler will automatically append the class name. But for accessing the static variable of a different class, we must mention the class name as 2 different classes might have a static variable with the same name.
- Static variables cannot be declared locally inside an instance method.
- Static blocks can be used to initialize static variables.

Instance Variables vs Static Variables

Now let us discuss the differences between the Instance variables and the Static variables:

- Each object will have its own copy of an instance variable, whereas we can only have one copy of a static variable per class, irrespective of how many objects we create. Thus, **static variables** are good for **memory management**.
- Changes made in an instance variable using one object will not be reflected in other objects as each object has its own copy of the instance variable. In the case of a static variable, changes will be reflected in other objects as static variables are common to all objects of a class.
- We can access instance variables through object references, and static variables can be accessed directly using the class name**.**
- Instance variables are created when an object is created with the use of the keyword 'new' and destroyed when the object is destroyed. Static variables are created when the program starts and destroyed when the program stops.

Common Mistakes to Avoid

The common mistakes that can occur when working with variables in Java are listed below:

- **Using uninitialized local variables:** Accessing a local variable without initializing it leads to a compile-time error.
- **Confusing == and .equals() for Strings:** == is used to compare object references, while .equals() is used to compare the content of the strings.
- **Modifying static variables incorrectly:** Changing static variables in a multi-threaded environment can lead to thread safety issues