MANOJ MORE

C-DAC MUMBAI

DAY 2

LOGIC BUILDING SESSION

AUGUST 2025

DATA TYPES

Bits and Bytes in Programming

- Bits and bytes are the smallest units of data in a computer.
- A bit is a single binary digit, with a value of either 0 or 1.
- A byte is a group of 8 bits.

- In computer memory, a bit is stored as electrical voltage, where a voltage above a certain threshold represents a 1, and a voltage below that threshold represents a 0.
- In hard disk drives, a bit is stored as magnetism, where an area magnetized in one orientation represents a 1, and a magnetized area in the opposite orientation represents a 0.
- In CDs, DVDs, and Blu-ray discs, a bit is stored as either a pit, or a flat area. A pit is an area where the surface is lower than the surrounding surface, and that represents a 1. A flat area is when there is no pit, and that represents a 0.

DATA TYPES

Bits and Bytes in Programming

What is a Byte?

- A byte is a group of 8 bits, like 10001011.
- Each bit can be either 0 or 1, and with 8 bits in a byte, there are 2^8 = 256 different values a byte can have.
- Using one byte, we can store:
  - A pixel with one out of 256 different colors.
  - An unsigned number from 0 to 255.
  - A signed number from -128 to 127.
  - A character from the ASCII table.

DECIMAL TO BINARY

123 / 2 = 61 remainder 1
61 / 2 = 30 remainder 1
30 / 2 = 15 remainder 0
15 / 2 = 7 remainder 1
7 / 2 = 3 remainder 1
3 / 2 = 1 remainder 1
1 / 2 = 0 remainder 1

Reading the remainders from bottom to top, the binary representation of 123 is 01111011

DATA TYPES

Java has eight primitive data types, each with a fixed size and range, ensuring platform independence.

Integer Types:

- byte: 1 byte (8 bits),
  - range -128 to 127.
- short: 2 bytes (16 bits),
  - range -32,768 to 32,767.
- int: 4 bytes (32 bits),
  - range -2,147,483,648 to 2,147,483,647.
- long: 8 bytes (64 bits),
  - range -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807.

Floating-Point Types:

- float: 4 byte (32 bits),
  - Stores fractional numbers. Sufficient for storing 6 to 7 decimal digits.
- double: 8 bytes (64 bits),
  - Stores fractional numbers. Sufficient for storing 15 to 16 decimal digit.

DATA TYPES

Java has eight primitive data types, each with a fixed size and range, ensuring platform independence.

Other Types:

- char: 2 byte (16 bits),
  - represents a single Unicode character, range 0 to 65,535

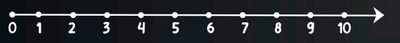
- boolean: 4 bytes (32 bits),
  - Size is not precisely defined by the JVM specification but is typically considered 1 byte for storage and manipulation, representing true or false.

VARIABLES

Variables are containers for storing data values.

String

stores text, such as "Hello". String values are surrounded by double quotes



int

stores integers (whole numbers), without decimals, such as 123 or -123

float

stores floating point numbers, with decimals, such as 19.99 or -19.99

char

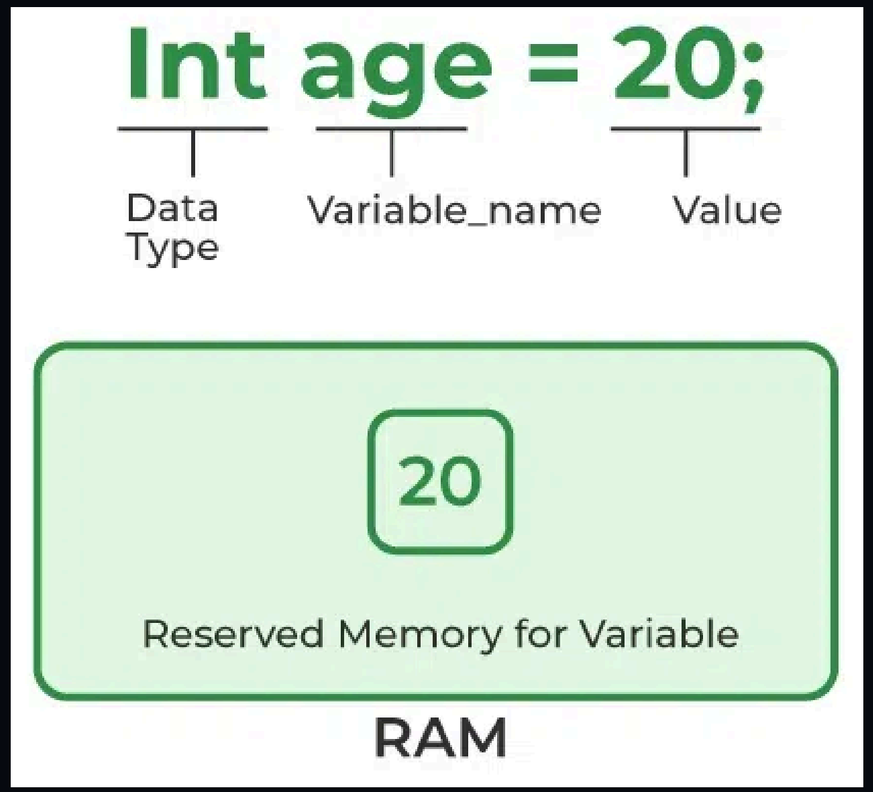
stores single characters, such as 'a' or 'B'. Char values are surrounded by single quotes

boolean

stores values with two states: true or false

DATA TYPES

- 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.

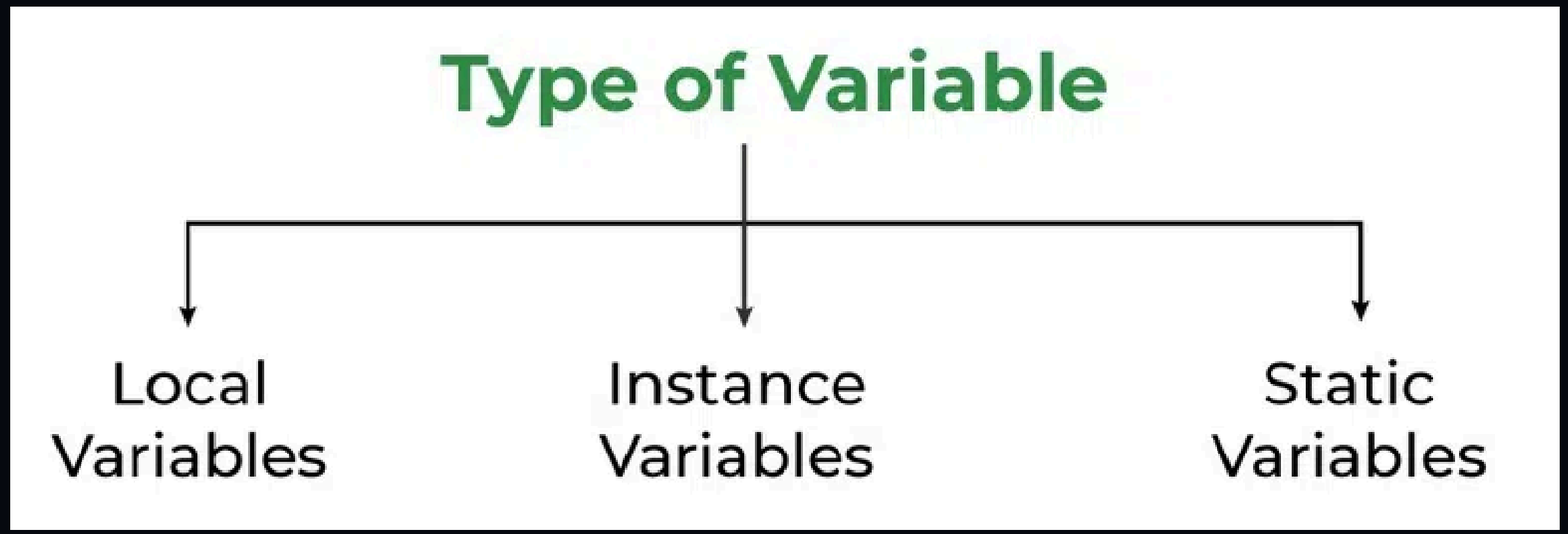


RULES TO DEFINE VARIABLES

- A variable name can consist of Capital letters A-Z, lowercase letters a-z digits 0-9, and two special characters such as _ underscore and $ dollar sign.
- The first character must not be a digit.
- Blank spaces cannot be used in variable names.
- Java keywords cannot be used as variable names.
- Variable names are case-sensitive.
- There is no limit on the length of a variable name but by convention, it should be between 4 to 15 chars.
- Variable names always should exist on the left-hand side of assignment operators.

TYPES OF JAVA VARIABLES

- Local Variables: Defined within a block or method or constructor
- Instance Variables: non-static variables and are declared in a class outside of any method, constructor, or block
- Static Variables: 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.



JAVA OPERATORS

Java operators are special symbols that perform operations on variables or values.

Arithmetic Operators

* : Multiplication
/ : Division
% : Modulo
+ : Addition
- : Subtraction

Unary Operators

- , Negates the value.
+ , Indicates a positive value (automatically converts byte, char, or short to int).
++ , Increments by 1.
-- , Decrements by 1.
! , Inverts a boolean value.

JAVA OPERATORS

Java operators are special symbols that perform operations on variables or values.

Assignment Operator

+= , Add and assign.
-= , Subtract and assign.
*= , Multiply and assign.
/= , Divide and assign.
%= , Modulo and assign.

Relational Operators

== , Equal to.
!= , Not equal to.
< , Less than.
<= , Less than or equal to.
> , Greater than.
>= , Greater than or equal to.

JAVA OPERATORS

Java operators are special symbols that perform operations on variables or values.

Logical Operators

&&, Logical AND: returns true when both conditions are true.
||, Logical OR: returns true if at least one condition is true.
!, Logical NOT: returns true when a condition is false and vice-versa

Ternary operator

The Ternary Operator is a shorthand version of the if-else statement.
It has three operands and hence the name Ternary. The general format is,

condition ? if true : if false