Data types in Java

The eight **primitive data types** in Java are the most basic building blocks for data manipulation.They are predefined by the Java language and are not objects.

Here's a breakdown of the primitive types, categorized by the type of data they hold:

🔢 Numeric Primitive Types

These types are used to store whole numbers or floating-point numbers.

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1. Integer Types (Whole Numbers)

These four types are used for representing integers (positive or negative whole numbers) and differ only in the amount of memory they use, which determines the range of values they can hold.

- **byte**:
  - **Size:** 8 bits[2]
  - **Range:** -128 to 127[3]
  - **Use Case:** Saving space in large arrays, especially where memory is a concern.[4]
- **short**:
  - **Size:** 16 bits[5]
  - **Range:** -32,768 to 32,767
  - **Use Case:** Useful for memory-constrained environments, like embedded systems.[6]
- **int**:
  - **Size:** 32 bits[7]
  - **Range:** Approximately ± 2 billion
  - **Use Case:** The most common and default choice for general integer values.

- **long**:
    - **Size:** 64 bits[8]
    - **Range:** Very large (approx. $\pm 9 \times 10^{18}$)
    - **Use Case:** Used when int is not large enough to hold the required value, like timestamps or large calculations.

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2. Floating-Point Types (Decimal Numbers)

These two types are used for representing numbers with fractional parts (decimal points).

- **float**:
    - **Size:** 32 bits[9]
    - **Use Case:** For values requiring up to 7 decimal digits of precision (single-precision).
- **double**:
    - **Size:** 64 bits
    - **Use Case:** The default choice for decimal values, offering up to 15 decimal digits of precision (double-precision). This is generally preferred for mathematical and scientific computations.

🔠 Other Primitive Types

3. Character Type

- **char**:
    - **Size:** 16 bits (stores unsigned Unicode characters)
    - **Use Case:** Storing a single character (e.g., 'A', '1', '$').

4. Boolean Type

- **boolean**:
    - **Size:** Not precisely defined by the JVM, but conceptually represents one bit of information.
    - **Values:** Only two possible values: **true** or **false**.
    - **Use Case:** For simple flags that track conditions, like the result of a test or a

loop control.

💡 Key Difference from Non-Primitives

The main difference between primitive types and **non-primitive** (reference) types, like `String` or arrays, is that:

- **Primitives** directly hold their value (e.g., `int x = 10;`).[10]
- **Non-primitives** hold a **reference** (an address) to an object in memory (e.g., `String s = "Hello";`).

Would you like to see a brief example of how each of these primitive types is declared in Java code?

Java

```
public class PrimitiveExamples {

    public static void main(String[] args) {

        // --- 1. Integer Types (Whole Numbers) ---
        // byte (8-bit)
        byte smallestNum = 100; // Value must be between -128 and 127
        System.out.println("byte: " + smallestNum);

        // short (16-bit)
        short mediumNum = 30000;
        System.out.println("short: " + mediumNum);

        // int (32-bit) - The default integer type
        int integerValue = 2000000;
        System.out.println("int: " + integerValue);

        // long (64-bit) - Use 'L' suffix to indicate it's a long literal
        long veryLargeNum = 9223372036854775807L;
        System.out.println("long: " + veryLargeNum);
```

```
        // --- 2. Floating-Point Types (Decimal Numbers) ---
        // float (32-bit) - Use 'f' or 'F' suffix to indicate a float literal
        float piFloat = 3.14159f;
        System.out.println("float: " + piFloat);

        // double (64-bit) - The default floating-point type (no suffix required)
        double piDouble = 3.1415926535;
        System.out.println("double: " + piDouble);

        // --- 3. Character Type ---
        // char (16-bit) - Holds a single Unicode character enclosed in single quotes
        char initial = 'J';
        char unicodeChar = '\u0041'; // Unicode for 'A'
        System.out.println("char: " + initial);
        System.out.println("char (Unicode): " + unicodeChar);

        // --- 4. Boolean Type ---
        // boolean - Holds only 'true' or 'false'
        boolean isJavaFun = true;
        boolean isRaining = false;
        System.out.println("boolean (true): " + isJavaFun);
        System.out.println("boolean (false): " + isRaining);
    }
}
```

📝 Key Takeaways from the Examples

- **Integer Literals:** Integer values without a decimal point are treated as **int** by default. You need the **L** or **l** suffix to denote a **long** literal (as seen in veryLargeNum).
- **Floating-Point Literals:** Decimal values are treated as **double** by default. You must use the **F** or **f** suffix to denote a **float** literal (as seen in piFloat).
- **char Syntax:** Characters are always enclosed in **single quotes (' ')**.
- **boolean Syntax:** The literals are the keywords **true** and **false**.

Do you have any specific Java concepts you'd like to explore next, like how primitive types are converted, or how they relate to their non-primitive **wrapper classes**?