1. **Basic Data Types**
2. **Data type→ Every value in c++ have some type that is called datatype**

1.1 Integer Types

These types store whole numbers (both positive and negative).

- **int**: Standard integer type.
    - **Bit size**: 4 bytes (32 bits)
    - **Range**: -2,147,483,648 to 2,147,483,647
    - **Default value**: Compiler-dependent, usually 0 in global scope
    - **Example**:

cpp

```
int number = 10;
```

- **short**: Shorter integer type.
    - **Bit size**: 2 bytes (16 bits)
    - **Range**: -32,768 to 32,767
    - **Default value**: 0 (in global scope)
    - **Example**:

cpp

```
short smallNumber = 100;
```

- **long**: Longer integer type.
    - **Bit size**: 8 bytes (64 bits) on most modern systems (but can be 4 bytes on others)
    - **Range**: -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
    - **Default value**: 0 (in global scope)
    - **Example**:

cpp

```
long largeNumber = 1000000L;
```

- **long long**: Extended long integer type (introduced in C++11).
    - **Bit size**: 8 bytes (64 bits)
    - **Range**: Same as long

    - **Default value**: 0 (in global scope)
    - **Example**:

cpp

```
long long veryLargeNumber = 9000000000LL;
```

1.2 Unsigned Integer Types

These types store only non-negative integers.

- **unsigned int**: Integer without sign.
    - **Bit size**: 4 bytes (32 bits)
    - **Range**: 0 to 4,294,967,295
    - **Default value**: 0
    - **Example**:

cpp

```
unsigned int positiveNumber = 300;
```

- **unsigned short**, **unsigned long**, and **unsigned long long** work similarly to the signed versions but only store non-negative values.

1.3 char: Character type

- **Bit size**: 1 byte (8 bits)
- **Range**: -128 to 127 (or 0 to 255 for unsigned char)
- **Default value**: \0 (null character)
- **Example**:

cpp

```
char letter = 'A';
```

1.4 Floating Point Types

These types store real numbers (numbers with a fractional part).

- **float**: Single-precision floating-point.
    - **Bit size**: 4 bytes (32 bits)
    - **Range**: ±3.4e–38 to ±3.4e+38
    - **Default value**: 0.0 (in global scope)

- **Example**:

cpp

```
float decimalNumber = 3.14f;
```

- **double**: Double-precision floating-point.
  - **Bit size**: 8 bytes (64 bits)
  - **Range**: ±1.7e–308 to ±1.7e+308
  - **Default value**: 0.0 (in global scope)
  - **Example**:

cpp

```
double pi = 3.141592653589793;
```

- **long double**: Extended precision floating-point.
  - **Bit size**: 8 or 16 bytes (depends on the system)
  - **Range**: Compiler-dependent, usually larger than double
  - **Default value**: 0.0 (in global scope)
  - **Example**:

cpp

```
long double veryPreciseNumber = 3.14159265358979323846264338327 9;
```

2. Boolean Type

- **bool**: Stores true or false.
  - **Bit size**: 1 byte (typically)
  - **Default value**: false (in global scope)
  - **Example**:

cpp

```
bool isTrue = true;
```

3. Void Type

- **void**: Represents the absence of any type.
  - **Bit size**: Not applicable

- **Usage**: Used primarily in functions to indicate that they return no value.
- **Example**:

cpp

```
void doNothing() {
    // No return value
}
```

4. Derived Data Types

4.1 Pointers

Pointers store the memory address of another variable.

- **Bit size**: 4 bytes (32-bit systems) or 8 bytes (64-bit systems)
- **Default value**: nullptr
- **Example**:

cpp

```
int num = 10;
int* ptr = &num;
```

4.2 Arrays

Arrays store multiple values of the same type.

- **Bit size**: Depends on the data type and the number of elements
- **Example**:

cpp

```
int arr[5] = {1, 2, 3, 4, 5};
```

5. Example Program

Here is a small program illustrating the use of various data types:

cpp

```
#include <iostream>
using namespace std;
```

```
int main() {
    int number = 10;
    float decimalNumber = 3.14f;
    char letter = 'A';
    bool isTrue = true;

    cout << "Integer: " << number << endl;
    cout << "Float: " << decimalNumber << endl;
    cout << "Character: " << letter << endl;
    cout << "Boolean: " << (isTrue ? "true" : "false") << endl;

    return 0;
}
```

Output:

```
Integer: 10
Float: 3.14
Character: A
Boolean: true
```

Summary:

Data Type	**Bit Size**	**Range**	**Default Value**
int	4 bytes (32 bits)	-2,147,483,648 to 2,147,483,647	0
short	2 bytes (16 bits)	-32,768 to 32,767	0
long	8 bytes (64 bits)	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807	0
char	1 byte (8 bits)	-128 to 127 or 0 to 255 (unsigned)	\0

Data Type	Bit Size	Range	Default Value
float	4 bytes (32 bits)	±3.4e–38 to ±3.4e+38	0.0
double	8 bytes (64 bits)	±1.7e–308 to ±1.7e+308	0.0
bool	1 byte	true or false	false