Tutorial 4 - Variable Scope & Data Types in C++

Key Concepts:

1. **Variable Scope**
   - **Definition**: The region in a program where a variable is valid and accessible.
   - **Types**:
     - **Local Variables**:
       Declared inside a function and accessible only within that function.
       Example:

```
void func() {
    int localVar = 10; // Local variable
}

```

     - **Global Variables**:
       Declared outside any function and accessible throughout the program.
       Example:

```
int globalVar = 20; // Global variable

```

2. **Data Types**
   - **Definition**: Defines the type of data a variable can store.
   - **Categories**:
     - **Built-in**: `int`, `float`, `char`, `double`, `bool`.
     - **User-Defined**: `struct`, `union`, `enum`.
     - **Derived**: `array`, `pointer`, `function`.
       (User-defined and derived types will be discussed later.)

Practical Examples:

Variable Scope Example:

```
#include <iostream>
using namespace std;
int glo = 6; // Global variable
void sum() {
    cout << glo << endl; // Access global variable
}
int main() {
    int glo = 9; // Local variable
    glo = 78;    // Update local variable
    sum();
    cout << glo << endl; // Access local variable
    return 0;
}

```

Output:

```
6
78

```

Explanation:

- In `sum()`, the global `glo` is accessed since no local variable exists there.
- In `main()`, the local `glo` is used, as it overrides the global variable.

Data Types Example:

```cpp
#include <iostream>
using namespace std;
int main() {
    int a = 14, b = 15; // Integer variables
    float pi = 3.14;    // Floating-point variable
    char c = 'd';       // Character variable
    bool is_true = false; // Boolean variable
    cout << "Value of a: " << a << "\nValue of b: " << b << endl;
    cout << "Value of pi: " << pi << "\nValue of c: " << c << endl;
    cout << "Boolean value: " << is_true << endl;
    return 0;
}

```

Output:

```
Value of a: 14
Value of b: 15
Value of pi: 3.14
Value of c: d
Boolean value: 0

```

Short Notes for Notebook:

Variable Scope:

1. **Local Variables**: Declared inside a function, accessible only within that function.
2. **Global Variables**: Declared outside functions, accessible throughout the program.

Data Types:

1. **Built-in**: Predefined in C++.
   - `int`: Stores integers (e.g., `-10`, `20`).
   - `float`: Stores decimal numbers (e.g., `3.14`).
   - `char`: Stores a single character (e.g., `'a'`).
   - `double`: Stores high-precision decimals.
   - `bool`: Stores `true` or `false`.
2. **User-Defined**: Custom-defined types (`struct`, `union`, `enum`).
3. **Derived**: More advanced types (`array`, `pointer`, `function`).

Rules for Declaring Variables:

1. Names must start with a letter or `_` (underscore).

2. Can contain letters and numbers after the first character.
3. Case-sensitive (`a` ≠ `A`).
4. No spaces or special characters allowed.
5. Reserved keywords can't be used as variable names.