



Module 02

Partha Pratim
Das

Objectives &
Outline

Hello World
Add numbers
Square Root
Standard Library
Sum Numbers
Using bool

Summary

Module 02: Programming in C++

Programs with IO & Loop

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Module Objectives

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Hello World
Add numbers
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Summary

- Understand differences between C and C++ programs
- Appreciate the ease of programming in C++



Module Outline

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Hello World
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Summary

- Contrast differences between C and C++ programs for:
 - I/O
 - Variables
 - Using math library
 - Standard Library – Headers
 - Loop
 - bool type



Program 02.01: Hello World

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C Program	C++ Program
<pre>// FileName:HelloWorld.c: #include <stdio.h> int main() { printf("Hello World in C"); printf("\n"); return 0; }</pre>	<pre>// FileName:HelloWorld.cpp: #include <iostream> int main() { std::cout << "Hello World in C++"; std::cout << std::endl; return 0; }</pre>
Hello World in C	Hello World in C++
<ul style="list-style-type: none">● IO Header is <code>stdio.h</code>● <code>printf</code> to <i>print</i> to console● Console is <code>stdout</code> file● <code>printf</code> is a variadic function● <code>\n</code> to go to the new line● <code>\n</code> is escaped newline character	<ul style="list-style-type: none">● IO Header is <code>iostream</code>● <code>operator<<</code> to <i>stream</i> to console● Console is <code>std::cout ostream</code> (in <code>std</code> namespace)● <code>operator<<</code> is a binary operator● <code>std::endl</code> (in <code>std</code> namespace) to go to the new line● <code>std::endl</code> is stream manipulator (newline) functor



Program 02.02: Add two numbers

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C Program

```
// FileName:Add_Num.c:
#include <stdio.h>
int main() {
    int a, b;
    int sum;

    printf("Input two numbers:\n");
    scanf("%d%d", &a, &b);

    sum = a + b;

    printf("Sum of %d and %d", a, b);
    printf(" is: %d\n", sum);

    return 0;
}
```

Input two numbers:
3 4
Sum of 3 and 4 is: 7

- `scanf` to *scan (read)* from console
- Console is `stdin` file
- `scanf` is a variadic function
- Addresses of `a` and `b` needed in `scanf`
- All variables `a`, `b` & `sum` declared first (C89)
- Formatting (`%d`) needed for variables

C++ Program

```
// FileName:Add_Num_c++.cpp:
#include <iostream>
int main() {
    int a, b;

    std::cout << "Input two numbers:\n";
    std::cin >> a >> b;

    int sum = a + b; // Declaration of sum

    std::cout << "Sum of "
        << a << " and "
        << b << " is: "
        << sum << std::endl;

    return 0;
}
```

Input two numbers:
3 4
Sum of 3 and 4 is: 7

- `operator>>` to *stream* from console
- Console is `std::cin` istream (in `std` namespace)
- `operator>>` is a binary operator
- `a` and `b` can be directly used in `operator>>` operator
- `sum` may be declared when needed
- Formatting is derived from type (`int`) of variables



Program 02.03: Square Root of a number

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C Program

```
// FileName:Sqrt.c:
#include <stdio.h>
#include <math.h>

int main() {
    double x;
    double sqrt_x;

    printf("Input number:\n");
    scanf("%lf", &x);

    sqrt_x =
        sqrt(x);

    printf("Sq. Root of %lf is:", x);
    printf(" %lf\n", sqrt_x);

    return 0;
}
```

Input number:
2
Square Root of 2.000000 is: 1.414214

- Math Header is math.h (C Standard Library)
- Formatting (%lf) needed for variables
- sqrt function from C Standard Library
- Default precision in print is 6

C++ Program

```
// FileName:Sqrt_c++.cpp:
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    double x;

    cout << "Input number:" << endl;
    cin >> x;

    double sqrt_x =      // Declaration of sqrt_x
        sqrt(x);

    cout << "Sq. Root of " << x;
    cout << " is: " << sqrt_x << endl;

    return 0;
}
```

Input number:
2
Square Root of 2 is: 1.41421

- Math Header is cmath (C Standard Library in C++)
- Formatting is derived from type (double) of variables
- sqrt function from C Standard Library
- Default precision in print is 5 (different)



namespace std for C++ Standard Library

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C Standard Library	C++ Standard Library
<ul style="list-style-type: none">• All names are global• stdout, stdin, printf, scanf	<ul style="list-style-type: none">• All names are within std namespace• std::cout, std::cin• Use using namespace std; to get rid of writing std:: for every standard library name
W/o using	W/ using
<pre>#include <iostream> int main() { std::cout << "Hello World in C++" << std::endl; return 0; }</pre>	<pre>#include <iostream> using namespace std; int main() { cout << "Hello World in C++" << endl; return 0; }</pre>



Standard Library Header Conventions

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	C Header	C++ Header
C Program	Use .h. Example: <code>#include <stdio.h></code> <i>Names in global namespace</i>	Not applicable
C++ Program	Prefix c, no .h. Example: <code>#include <cstdio></code> <i>Names in std namespace</i>	No .h. Example: <code>#include <iostream></code>

- Any C standard library header is to be used in C++ with a prefix 'c' and without the .h. These symbols will be in std namespace. Like:

```
#include <cmath> // In C it is <math.h>
...
std::sqrt(5.0); // Use with std::
```

It is possible that a C++ program include a C header as in C. Like:

```
#include <math.h> // Not in std namespace
...
sqrt(5.0); // Use without std::
```

This, however, is not preferred.

- Using .h with C++ header files, like `iostream.h`, is disastrous. These are deprecated. It is dangerous, yet true, that some compilers do not error out on such use. Exercise caution.**



Program 02.04: Sum n natural numbers

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C Program	C++ Program
<pre>// FileName:Sum_n.c: #include <stdio.h> int main() { int n; int i; int sum = 0; printf("Input limit:\n"); scanf("%d", &n); for (i = 0; i <= n; ++i) sum = sum + i; printf("Sum of %d", n); printf(" numbers is: %d\n", sum); return 0; }</pre>	<pre>// FileName:Sum_n_c++.cpp: #include <iostream> using namespace std; int main() { int n; int sum = 0; cout << "Input limit:" << endl; cin >> n; for (int i = 0; i <= n; ++i) // Local Decl. sum = sum + i; cout << "Sum of " << n ; cout << " numbers is: " << sum << endl; return 0; }</pre>
Input limit: 10 Sum of 10 numbers is: 55	Input limit: 10 Sum of 10 numbers is: 55
● i must be declared at the beginning (C89)	● i declared locally in for loop



Program 02.05: Using bool

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C Program		C++ Program
<pre>// FileName:bool.c: #include <stdio.h> #define TRUE 1 #define FALSE 0 int main() { int x = TRUE; printf ("bool is %d\n", x); return 0; }</pre>	<pre>// FileName:bool.c: #include <stdio.h> #include <stdbool.h> int main() { bool x = true; printf ("bool is %d\n", x); return 0; }</pre>	<pre>// FileName:bool_c++.cpp: #include <iostream> using namespace std; int main() { bool x = true; cout << "bool is " << x; return 0; }</pre>
bool is 1	bool is 1	bool is 1
<ul style="list-style-type: none">● Using int and #define for bool● May use _Bool (C99)	<ul style="list-style-type: none">● stdbool.h included for bool● _Bool type & macros (C99): bool which expands to _Bool true which expands to 1 false which expands to 0	<ul style="list-style-type: none">● No additional headers required <p>bool is a built-in type true is a literal false is a literal</p>



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Summary

- Understanding differences between C and C++ for:
 - IO
 - Variable declaration
 - Standard Library
- C++ gives us more flexibility in terms of basic declaration and input / output
- Many C constructs and functions are simplified in C++ which helps to increase the ease of programming



Instructor and TAs

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