



## 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

Partha Pratim Das

Department of Computer Science and Engineering  
Indian Institute of Technology, Kharagpur

*ppd@cse.iitkgp.ernet.in*

Tanwi Mallick  
Srijoni Majumdar  
Himadri B G S Bhuyan



# Module Objectives

## Module 02

Partha Pratim  
Das

### Objectives & Outline

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

Summary

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



# Module Outline

## Module 02

Partha Pratim  
Das

### Objectives & Outline

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

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

## Module 02

Partha Pratim  
Das

Objectives &  
Outline

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

Summary

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



# Program 02.02: Add two numbers

## Module 02

Partha Pratim Das

## Objectives & Outline

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

## Summary

### 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

## Module 02

Partha Pratim Das

### Objectives & Outline

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

### Summary

#### 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

## Module 02

Partha Pratim Das

### Objectives & Outline

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

### Summary

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



# Standard Library Header Conventions

## Module 02

Partha Pratim Das

### Objectives & Outline

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

### Summary

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

## Module 02

Partha Pratim  
Das

### Objectives & Outline

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

### Summary

C Program	C++ Program
<pre>// FileName:Sum_n.c: #include &lt;stdio.h&gt;  int main() {     int n;     int i;     int sum = 0;      printf("Input limit:\n");     scanf("%d", &amp;n);      for (i = 0; i &lt;= 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 &lt;iostream&gt; using namespace std;  int main() {     int n;      int sum = 0;      cout &lt;&lt; "Input limit:" &lt;&lt; endl;     cin &gt;&gt; n;      for (int i = 0; i &lt;= n; ++i) // Local Decl.         sum = sum + i;      cout &lt;&lt; "Sum of " &lt;&lt; n ;     cout &lt;&lt; " numbers is: " &lt;&lt; sum &lt;&lt; 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

## Module 02

Partha Pratim Das

### Objectives & Outline

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

### Summary

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



# Module Summary

## Module 02

Partha Pratim  
Das

### Objectives & Outline

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

### 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

## Module 02

Partha Pratim  
Das

Objectives &  
Outline

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

Summary

Name	Mail	Mobile
Partha Pratim Das, <i>Instructor</i>	ppd@cse.iitkgp.ernet.in	9830030880
Tanwi Mallick, <i>TA</i>	tanwimallick@gmail.com	9674277774
Srijoni Majumdar, <i>TA</i>	majumdarsrijoni@gmail.com	9674474267
Himadri B G S Bhuyan, <i>TA</i>	himadribhuyan@gmail.com	9438911655