C++ Tutorial

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Contents

1 Day 1

1.1 aa_hello_world.c

```c
// C program to print "Hello World".
//
// Rajeev Singh
// 2013-03-27

#include <stdio.h>

int main() {
    printf("Hello World from C\n");
    return 0;
}
```

1.2 ab_hello_world.cpp

```cpp
// C++ program to print "Hello World".
//
// Rajeev Singh
// 2013-03-27

#include <iostream>

int main() {
    std::cout << "Hello World from C++";// << std::endl;
    return 0;
}
```

1.3 ac_hello_world.cpp

```cpp
// C++ program to print "Hello World".
//
// Rajeev Singh
// 2013-03-27

#include <iostream>

using namespace std;

int main() {
    cout << "Hello World from C++" << endl;
    return 0;
}
```

1.4 ad_powers_of_integer.cpp

```cpp
// Program to calculate powers of given integer.
//
// Rajeev Singh
// 2013-03-27

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

int main() {
    //int given_number;
    long int given_number;
    cout << "Enter an integer: ";
    cin  >> given_number;

    cout << "Given number = " << given_number << endl
         << "Square       = " << pow(given_number,2) << endl
         << "Cube         = " << pow(given_number,3) << endl
         << "Forth power  = " << pow(given_number,4) << endl;

    return 0;
}
```

1.5   ae_powers_of_real.cpp

```cpp
// Program to calculate powers of given integer.
//
// Rajeev Singh
// 2013-03-27

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

int main() {
    double given_number;
    //long double given_number;
    cout << "Enter a real number : ";
    cin  >> given_number;

    cout << "Given number = " << given_number << endl
         << "Square       = " << pow(given_number,2) << endl
         << "Square root   = " << pow(given_number,1./2) << endl
         << "Cube         = " << pow(given_number,3) << endl
         << "Forth power  = " << pow(given_number,4) << endl;

    return 0;
}
```

2 Day 2

2.1 af_pointer.cpp

```cpp
// Program to illustrate pointers.
//
// Rajeev Singh
// 2013-03-28

#include <iostream>
using namespace std;

int main() {
    int *np = NULL;
    int n = 10;

    cout << "Initial" << endl
        << "n    = " << n    << endl
        << "np   = " << np   << endl
        << "*np = " << "since np is NULL, printing *np gives segmentation fault"
<< endl << endl;

    np = &n;
    cout << "After: np = &n" << endl
        << "n    = " << n    << endl
        << "np   = " << np   << endl
        << "*np = " << *np << endl << endl;

    *np = 22;
    cout << "After: *np = 22" << endl
        << "n    = " << n    << endl
        << "np   = " << np   << endl
        << "*np = " << *np << endl << endl;

    return 0;
}
```

2.2 ag_reference.cpp

```cpp
// Program to illustrate the use of references (special pointers).
//
// Rajeev Singh
// 2013-03-28

#include <iostream>
using namespace std;

int main() {
    int   n = 5;
    int & r = n;
    int   m;

    cout << "Initial" << endl
         << "n = " << n << endl
         << "r = " << r << endl
         << "m = " << m << endl << endl;

    m = r + 3;      // m == n + 3
    cout << "After: m = r + 3" << endl
         << "n = " << n << endl
         << "r = " << r << endl
         << "m = " << m << endl << endl;

    r = m;          // r still points to n and n == m
    cout << "After: r = m" << endl
         << "n = " << n << endl
         << "r = " << r << endl
         << "m = " << m << endl << endl;

    m = 0;          // r and n are unchanged
    cout << "After: m = 0" << endl
         << "n = " << n << endl
         << "r = " << r << endl
         << "m = " << m << endl << endl;

    int & s = m;
    r = s;          // r still points to n and n == m (== 0)
    cout << "After: r = s where s is new reference to m" << endl
         << "n = " << n << endl
         << "r = " << r << endl
         << "m = " << m << endl << endl;

    return 0;
}
```

2.3 ah_arithmetic_operators.cpp

```cpp
// Program to illustrate basic arithmetic operators.
//
// Rajeev Singh
// 2013-03-28

#include <iostream>
using namespace std;

int main() {
    int m = 100,
        n = 200;

    cout << "Initial" << endl
         << "m = " << m << endl
         << "n = " << n << endl
         << "m + n = " << m + n << endl
         << "m - n = " << m - n << endl
         << "m * n = " << m * n << endl
         << "m / n = " << m / n << endl
         << "m % n = " << m % n << endl << endl;

    //m = m + 200;
    m += 200;          // both this commands are same
    cout << "After: m += 200" << endl
         << "m = " << m << endl
         << "n = " << n << endl
         << "m + n = " << m + n << endl
         << "m - n = " << m - n << endl
         << "m * n = " << m * n << endl
         << "m / n = " << m / n << endl
         << "m % n = " << m % n << endl << endl;

    m++;
    cout << "After: m++" << endl
         << "m = " << m << endl
         << "n = " << n << endl
         << "m + n = " << m + n << endl
         << "m - n = " << m - n << endl
         << "m * n = " << m * n << endl
         << "m / n = " << m / n << endl
         << "m % n = " << m % n << endl << endl;

    return 0;
}
```

2.4 ai_relational_logical.cpp

```cpp
// program to illustrate logical and relational operators.
//
// Rajeev Singh
// 2013-03-28

#include <iostream>
using namespace std;

int main() {
    int   x = 2;
    int   y = 4;
    int   z = 4;
    bool  b;

    cout << "x = " << x << endl
         << "y = " << y << endl
         << "z = " << z << endl << endl;

    // z == 4 is not tested
    b = ( x == 2 && y == 3 && z == 4 );
    cout << "b = ( x == 2 && y == 3 && z == 4 )" << endl
         << "b = " << b << endl << endl;

    // only x == 2 is tested
    b = ( x == 2 || y == 3 || z == 4 );
    cout << "b = ( x == 2 || y == 3 || z == 4 )" << endl
         << "b = " << b << endl << endl;

    // correct, since x != 0 in "y/x"
    b = ( x != 0 && y/x > 1 );
    cout << "b = ( x != 0 && y/x > 1 )" << endl
         << "b = " << b << endl << endl;

    return 0;
}
```

3 Day 3

3.1 aj_blocks_scope.cpp

```cpp
// program to illustrate blocks.
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    { // block 1
        int n1 = 1;
        double f1 = 0.0;
        cout << "Block 1 "    << endl;
        cout << "n1 = " << n1 << endl;
        cout << "f1 = " << f1 << endl;
    }

    { // block 2
        int n1 = 2;
        // n1 has value 2 in this block
        cout << "Block 2 "    << endl;
        cout << "n1 = " << n1 << endl;

        //int n1 = 5; // ERROR
    }

    return 0;
}
```

3.2 ak_scope.cpp

```cpp
// program to illustrate scope of variables
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    { // block 1
        int m, n1 = 1;
        { // block 1.1
            int n2 = 2;
            { // block 1.1.1
                m = n1 + n2;   // evaluates to m = 3
                cout << "Block 1.1.1: m = " << m << endl;
            }
        }

        { // block 1.2
            int n2 = 3;
            m = n1 + n2;       // evaluates to m = 4
            cout << "Block 1.2  : m = " << m << endl;
        }
    }

    return 0;
}
```

3.3 al_if_else.cpp

```cpp
// program to illustrate conditional structure
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int n = 1;

    if ( n > 0 )
    {
        n = n / n;
    }

    if ( n < 0 ) {
        n += 5; // NOTE: trivial block!
        cout << "hello " << n << endl;
    }
    else if ( n %2 == 0 ) {
        n += 1;
        cout << "hello " << n << endl;
    }
    else {
        n -= 6;
        cout << "hello " << n << endl;
    }

    cout << "n = " << n << endl;

    return 0;
}
```

3.4   am_for_loop.cpp

```cpp
// program to illustrate for loop
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int n = 1;

    for (int i=1; i<10; i++) {
        if (i>5) {
            n *= i;
            cout << "n = " << n << endl;
        }
    }

    return 0;
}
```

3.5 an_while_loop.cpp

```cpp
// program to illustrate while loop
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int n = 1;
    int i = 1;

    while (i < 10) {
        n *= i;
        i++;
        cout << "n = " << n << endl;
    }

    return 0;
}
```

3.6 ao_do_while_loop.cpp

```cpp
// program to illustrate do-while loop
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int n = 1;
    int i = 100;

    do {
        n *= i;
        i++;
        cout << "n = " << n << endl;
    } while (i < 10);

    return 0;
}
```

3.7 ap_break.cpp

```cpp
// program to illustrate use of break
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int n = 1;

    for ( int i = 1; i < 20; i++ ) {
        // avoid overflow
        if ( n > 21474836 )
            break;
        n *= i;
        cout << "n = " << n << endl;
    }

    return 0;
}
```

3.8   aq_break_nested_loop.cpp

```cpp
// program to illustrate behavior of break in nested loops
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    for ( int i = 1; i < 20; i++ ) {
        int n = 1;
        for ( int j = 1; j < i; j++ ) {
            if ( n > 21474836 )
                break;
            n *= j;
        }

        cout << "n = " << n << endl;
    }

    return 0;
}
```

3.9 ar_break_all_loops.cpp

```cpp
// program to illustrate breaking all nested loops
//
// Rajeev Singh
// 2013-03-29

#include <iostream>
using namespace std;

int main() {
    int flag = 0;
    for ( int i = 1; i < 20; i++ ) {
        int n = 1;
        for ( int j = 1; j < i; j++ ) {
            if ( n > 21474836 ) {
                flag = 1;
                break;
            }
            n *= j;
        }
        if (flag == 1)
            break;

        cout << "n = " << n << endl;
    }

    return 0;
}
```

4 Day 4

4.1 as_function_square.cpp

```cpp
// program to illustrate defining function
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

double
square (const double x) {
    return x*x;
}

int main() {
    double a = 2.5;

    cout << "a   = " << a << endl
         << "a^2 = " << square(a) << endl;

    return 0;
}
```

4.2   at_function_factorial.cpp

```cpp
// program to illustrate defining the factorial function
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

int
factorial (const int n) {
    int f = 1;
    for (int i = 1; i <= n; i++ )
        f *= i;

    return f;
}

int main() {
    int m = 10;

    cout << "m  = " << m << endl
         << "m! = " << factorial(m) << endl;

    return 0;
}
```

4.3 au_function_call_by_value.cpp

```cpp
// program to illustrate call by value feature
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

int
f (int n) {
    n = 10;
    return n;
}

int main() {
    int m = 5;

    cout << "m before calling = " << m    << endl;
    cout << "funtion output   = " << f(m) << endl;
    cout << "m after calling  = " << m    << endl;

    return 0;
}
```

4.4 av_function_call_by_reference.cpp

```cpp
// program to illustrate call by reference feature
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

int
f (int & n) {
    n = 10;
    return n;
}

int main() {
    int m = 5;

    cout << "m before calling = " << m    << endl;
    cout << "funtion output   = " << f(m) << endl;
    cout << "m after calling  = " << m    << endl;

    return 0;
}
```

4.5 aw_function_call_by_reference_using_pointers.cpp

```cpp
// program to illustrate call by reference feature using general
// pointers
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

int
f (int * n) {
    *n = 10;
    return *n;
}

int main() {
    int m = 5;

    cout << "m before calling = " << m     << endl;
    cout << "funtion output   = " << f(&m) << endl;
    cout << "m after calling  = " << m     << endl;

    return 0;
}
```

4.6 ax_function_multiple_return_values.cpp

```cpp
// program to illustrate funtions with multiple return values using
// call by reference
//
// Rajeev Singh
// 2013-03-31

#include <iostream>
using namespace std;

void
min_max ( const int n1, const int n2,
  int & min, int & max ) {
    if ( n1 < n2 ) {
        min = n1;
        max = n2;
    }
    else {
        min = n2;
        max = n1;
    }
}

int main() {
    int m1, m2, min, max;

    cout << "Enter two integers :";
    cin >> m1 >> m2;

    min_max(m1, m2, min, max);
    cout << "m1          = " << m1 << endl
         << "m2          = " << m2 << endl << endl
         << "min(m1,m2) = " << min << endl
         << "max(m1,m2) = " << max << endl;

    return 0;
}
```