Programming with C and C++

CSC-101 (Lecture 28)

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Sample CPP code

https://ideone.com/5hi8xD

```cpp
1   #include <iostream>
2
3   using namespace std;
4
5   int main() {
6       int num1, num2;
7       cout << "Enter the first number: "<<endl;
8       cin >> num1;
9       cout << "Enter the second number: "<<endl;
10      cin >> num2;
11
12      int sum = num1 + num2;
13      cout<<"Sum of "<<num1<<" and "<<num2<<" is: "<<sum<<endl;
14
15      return 0;
16  }
17
```

Success #stdin #stdout 0.01s 5424KB

Enter the first number:

Enter the second number:

Sum of 10 and 5 is: 15

Rating Ranges in Codeforces

Elo-MMR	Title	Division	Number	Percentile
3000+	**Legendary Grandmaster**	1	8	99.99
2700-2999	**International Grandmaster**	1	37	99.95
2400-2699	**Grandmaster**	1	255	99.7
2200-2399	**International Master**	1	560	99.1
2000-2199	**Master**	1	2089	97
1800-1999	**Candidate Master**	2	3968	93
1600-1799	**Expert**	2	7103	86
1400-1599	**Specialist**	3	11003	75
1200-1399	**Apprentice**	3	16909	58
1000-1199	**Pupil**	4	23977	34
Up to 999	Newbie	4	33923	0

Ratings in Codeforces

C and C++

- ► Some operators used only in C++ and not in C?
  - ▪ **this, new, ::, throw,** …
- ► switch-case and loops are same
- ► All the concepts till previous lecture (Arrays, functions, pointers and pass by value) are similar
- ► Till procedural oriented concepts both are similar
- ► Of course, the syntax is different

- ► Reference variable concept is found in C++ but not in C (will be covered in this lecture)

Sample cpp code

https://ideone.com/mPHqxf

```cpp
1    #include <iostream>
2    #include <cmath>
3
4    using namespace std;
5
6    bool isPrime(int num) {
7        if (num <= 1)
8            return false;
9        if (num == 2)
10            return true;
11
12        if (num % 2 == 0)
13            return false;
14
```

```cpp
15        int sqrtNum = sqrt(num);
16        for (int i = 2; i <= sqrtNum; i++) {
17            if (num % i == 0)
18                return false;
19        }
20
21        return true;
22    }
23
```

```cpp
23
24 ▼  int main() {
25        int num;
26        cout << "Enter a number: ";
27        cin >> num;
28
29        if (isPrime(num))
30            cout << num << " is a prime number." << endl;
31        else
32            cout << num << " is not a prime number." << endl;
33
34        return 0;
35  }
36
37
```

📥 stdin

43

⚙ stdout

Enter a number: 43 is a prime number.

Arrays

► Write a C++ program to generate the following series using Arrays

1,7,2,9,8,9,11,17,17,20, …

Arrays

https://ideone.com/xBW0Ur

```cpp
1   #include <iostream>
2
3   using namespace std;
4
5   void generateSeries(int n) {
6       int series[n];
7       series[0] = 1;
8       series[1] = 7;
9       series[2] = 2;
10      series[3] = 9;
11
12      for (int i = 4; i < n; i++) {
13
14              series[i] = series[i - 4] + series[i - 3];
15
16      }
17
```

Arrays

```cpp
18          // Print the generated series
19          for (int i = 0; i < n; i++) {
20              cout << series[i] << " ";
21          }
22      }
23
24  int main() {
25      int n;
26
27      cout << "Enter the number of terms in the series: ";
28      cin >> n;
29
30      generateSeries(n);
31
32      return 0;
33  }
34
```

Arrays

📥 stdin   📋 copy

20

⚙ stdout   📋 copy

Enter the number of terms in the series: 1 7 2 9 8 9 11 17 17 20 28 34 37 48 62 71 85
110 133 156

Reference Operator (&) in C++

https://ideone.com/vTUskQ

```cpp
1  #include <iostream>
2  using namespace std;
3
4  int main() {
5      int num1, num2;
6      cout << "Enter the first number: "<<endl;
7      cin >> num1;
8      cout << "Enter the second number: "<<endl;
9      cin >> num2;
10     int sum = num1 + num2;
11     cout<<"Sum of "<<num1<<" and "<<num2<<" is: "<<sum<<endl;
12     cout<<"Address of num1 is "<<&num1<<endl;
13     cout<<"Address of num2 is "<<&num2<<endl;
14     cout<<"Address of sum is "<<&sum<<endl;
15
16     return 0;
17 }
18
```

Reference Operator (&) in C++

Success #stdin #stdout 0.01s 5448KB

Enter the first number:

Enter the second number:

Sum of 50 and 100 is: 150

Address of num1 is 0x7fff95f4cebc

Address of num2 is 0x7fff95f4cec0

Address of sum is 0x7fff95f4cec4

Reference Operator in C++

```
1    #include <iostream>
2    using namespace std;
3
4    int main() {
5        // your code goes here
6        int n=44;
7        int rn;
8        rn=n;
9        cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
10       n--;
11       cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
12       rn*=2;
13       cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
14
15       return 0;
16   }
17
```

https://ideone.com/RV4ud1

```
n=44 rn=44

n=43 rn=44

n=43 rn=88
```

Reference Operator in C++

```
1   #include <iostream>
2   using namespace std;
3
4   int main() {
5       // your code goes here
6       int n=44;
7       int& rn=n;
8       cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
9       n--;
10      cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
11      rn*=2;
12      cout<<"n="<<n<<" "<<"rn="<<rn<<endl;
13
14      return 0;
15  }
16
17
```

n=44 rn=44

n=43 rn=43

n=86 rn=86

In C

```c
1    #include <stdio.h>
2
3    int main(void) {
4        // your code goes here
5        int n=44;
6        int& rn=n;
7        printf("%d",n);
8        return 0;
9    }
10
11
```

In C

Compilation error #stdin compilation error #stdout 0s 0KB

stdin

Standard input is empty

compilation info

```
prog.c: In function 'main':
prog.c:6:5: error: expected identifier or '(' before '&' token
   int& rn=n;
     ^
```

Dereference Operator (*) in C++

A pointer is a variable that points to an address of an another variable.

```
void main()
 {
int u=30;
int v;
int *pu, *pv;
pu=&u;
v=*pu;
pv=&v;
cout<<u<<&u<<pu<<*pu;
cout<<v<<&v<<pv<<*pv;
}
```

Dereference Operator (*) in C++

https://ideone.com/hrfFzp

```cpp
1   #include <iostream>
2   using namespace std;
3
4   int main() {
5       // your code goes here
6       int u=30;
7       int v;
8       int *pu, *pv;
9       pu=&u;
10      v=*pu;
11      pv=&v;
12      cout<<"u="<<u<<" &u="<<&u<<" pu="<<pu<<" *pu="<<*pu<<endl;
13      cout<<"v="<<v<<" &v="<<&v<<" pv="<<pv<<" *pv="<<*pv<<endl;
14
15      return 0;
16  }
```
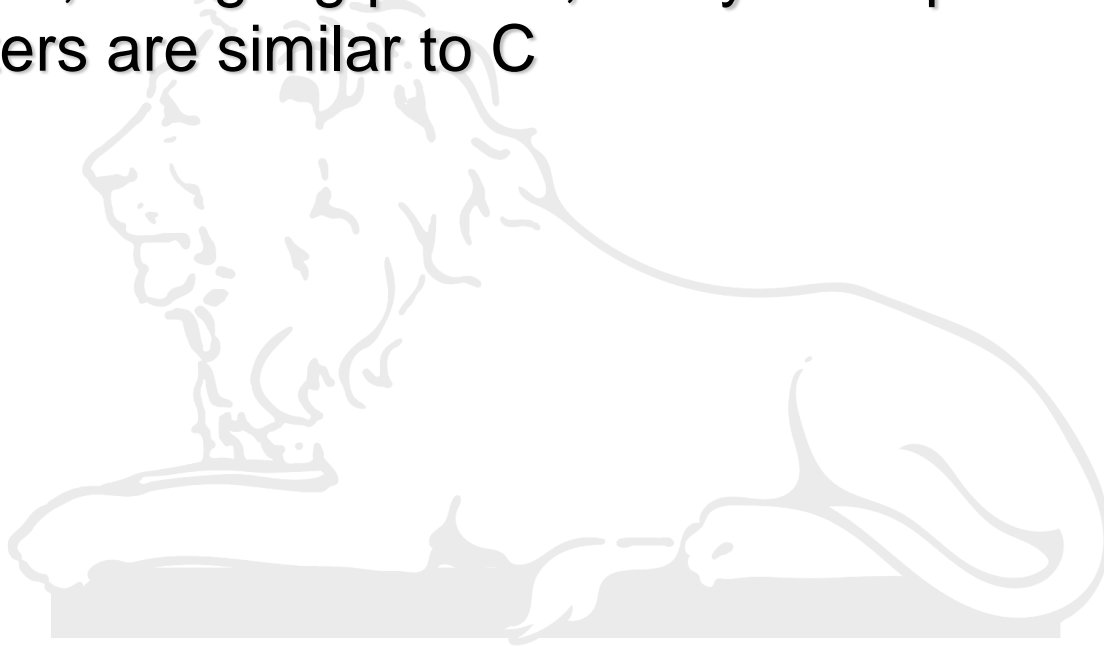
Success #stdin #stdout 0.01s 5544KB
u=30 &u=0x7ffcd1dcd3e0 pu=0x7ffcd1dcd3e0 *pu=30
v=30 &v=0x7ffcd1dcd3e4 pv=0x7ffcd1dcd3e4 *pv=30

I I T ROORKEE

In C++

► All pointer concepts are similar to C

► Null pointer, Dangling pointer, Arrays and pointers, functions and pointers are similar to C

Pointers in C++

https://ideone.com/qxbaM2

```cpp
1  #include <iostream>
2  using namespace std;
3
4  int main() {
5      // your code goes here
6      int u=50;
7      int v;
8      int *pu, *pv;
9      pu=&u; //stores the address of number variable
10     v=*pu;
11     pv=&v;
12     cout<<"u="<<u<<" &u="<<&u<<" pu="<<pu<<" *pu="<<*pu<<endl;
13     cout<<"v="<<v<<" &v="<<&v<<" pv="<<pv<<" *pv="<<*pv<<endl;
14
15     return 0;
16  }
17
```

Success #stdin #stdout 0.01s 5536KB

u=50 &u=0x7ffc2765a7f0 pu=0x7ffc2765a7f0 *pu=50

v=50 &v=0x7ffc2765a7f4 pv=0x7ffc2765a7f4 *pv=50

I I T ROORKEE

Pointers in C++

```cpp
1   #include <iostream>
2   using namespace std;
3
4   int main() {
5       int v=5;
6       int *pv;
7       pv=&v; //stores the address of number variable
8       cout<<*pv<<" "<<v<<endl;
9       *pv=500;
10      cout<<*pv<<" "<<v<<endl;
11      return 0;
12  }
13
```

⚙ stdout
___

5 5

500 500

Null Pointer

https://ideone.com/P9rHcO

```cpp
1   #include <iostream>
2   using namespace std;
3
4   int main() {
5       // your code goes here
6       int u=50;
7       int* pu;
8       pu=NULL; //stores the address of number variable
9       cout<<*pu;
10
11      return 0;
12  }
13
```

Runtime error #stdin #stdout 0.01s 5476KB

Dangling Pointer

```cpp
1   #include <iostream>
2   using namespace std;
3
4   int main() {
5       int u1,u2;
6       int v=20;
7       int *pv;
8       u1=2*(v+5);
9       u2=2*(*pv+5);
10      cout<<u1<<" "<<u2<<endl;
11      return 0;
12  }
13
```

https://ideone.com/ZThZ2p

Runtime error

Arrays and Pointers

```cpp
1   #include <iostream>
2   using namespace std;
3
4   int main()
5       { int a[3];
6       for (int i=0; i<3; i++)
7           {cin>>a[i];
8           cout<<a[i]<<endl;
9           cout<<a+i<<endl;
10          cout<<*(a+i)<<endl;
11          cout<<i[a]<<endl<<endl;
12          }
13      return 0;
14  }
15
```

https://ideone.com/arqZ4m

```
10                          30
0x7ffe1893683c              0x7ffe18936844
10                          30
10                          30


20
0x7ffe18936840
20
20
```
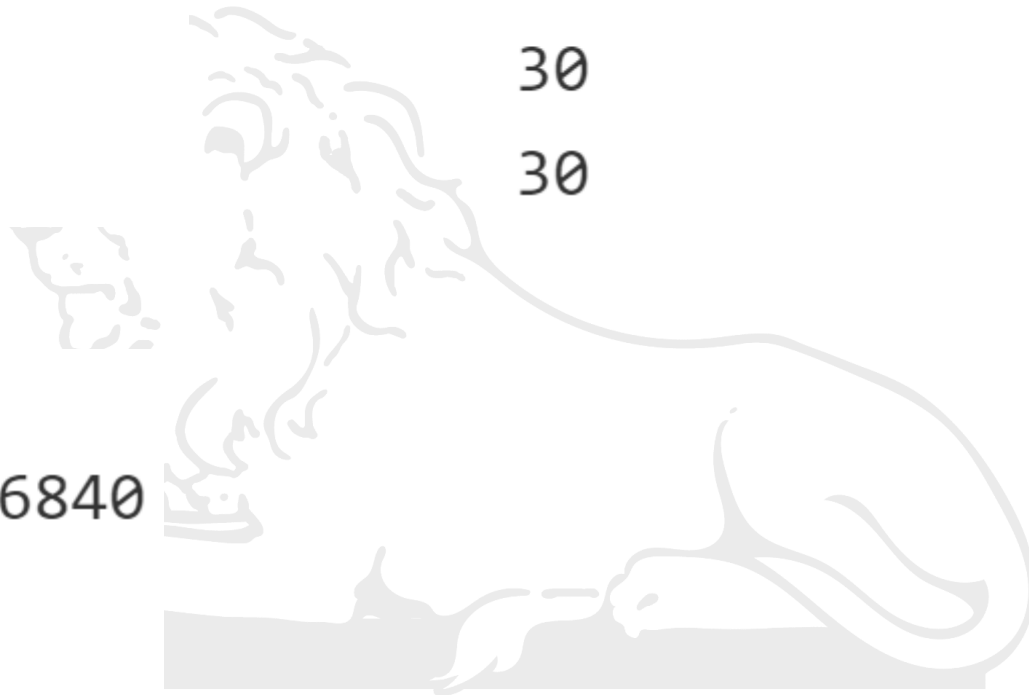
Call by Value

```cpp
1   #include <iostream>
2   using namespace std;
3
4   void swapVariables(float var1, float var2)
5       { float temp;
6           temp = var1;
7           var1 = var2;
8           var2 = temp;
9           cout<<var1<<" "<<var2<<endl;
10      }
11
12  int main( )
13      { float float1 = 3.5, float2 = 5.6;
14          swapVariables(float1, float2);
15          cout<<float1<<" "<<float2<<endl;
16          return 0;
17      }
18
```

⚙️ stdout

5.6 3.5

3.5 5.6

Call by Reference

https://ideone.com/h9gXrt

```cpp
1    #include <iostream>
2    using namespace std;
3
4    void swapVariables(float& var1, float& var2)
5        { float temp;
6            temp = var1;
7            var1 = var2;
8            var2 = temp;
9            cout<<var1<<" "<<var2<<endl;
10       }
11
12   int main( )
13       { float float1 = 3.5, float2 = 5.6;
14           swapVariables(float1, float2);
15           cout<<float1<<" "<<float2<<endl;
16           return 0;
17       }
18
```

⚙ stdout

5.6 3.5

5.6 3.5

Thank You!