C++

LAUNCHPAD

CODING BLOCKS

Lecture-2

FUNDAMENTALS - I

- Programming Fundamentals in C++

Utkarsh Nath

Brain Teasers?

BT – 4: Criminal Cupbearers

An evil king has 1000 bottles of wine. A neighboring queen plots to kill the bad king, and sends a servant to poison the wine. The king's guards catch the servant after he has only poisoned one bottle. The guards don't know which bottle was poisoned, but they do know that the poison is so potent that even if it was diluted 1,000,000 times, it would still be fatal. Furthermore, the effects of the poison take one month to surface. The king decides he will get some of his prisoners in his vast dungeons to drink the wine. **Rather than using 1000 prisoners each assigned to a particular bottle, this king knows that he needs to murder no more than 10 prisoners to figure out what bottle is poisoned, and will still be able to drink the rest of the wine in 5 weeks time. How does he pull this off?**

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Time to write our first program!

Program to print “Hello World”

```
#include <iostream>
using namespace std;
int main() {
        cout << “Hello world!”;
        return 0;
}
```

Fahrenheit to Celsius

Write a program which takes initial value, final value and a step value and prints a table for Fahrenheit to Celsius using formula - C = (5/9)(F – 32)

E.g: For initial 0, final 300 and step 20 output is

```
0     -17
20    -6
40    4
60    15
80    26
100   37
120   48
140   60
160   71
180   82
200   93
220   104
240   115
260   126
280   137
300   148
```

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Identifiers

- A C++ identifier is a name used to identify a variable, function, class, module, or any other user-defined item
- An identifier starts with a letter A to Z or a to z or an underscore (_) followed by zero or more letters, underscores, and digits (0 to 9)

Keywords

- Some reserve words which cannot be used as identifiers
- These are basically part of the grammar representing the language
- E.g: if, while, return, namespace, etc.

Data types

- As we know we need variables to store information.
- We might want to store information of various types in a variable like character, whole numbers, integers, floating point, boolean etc.
- Based on the data type of a variable, the operating system **allocates memory** and **interprets the combination of 0s and 1s in that memory**

Primitive Data Types

- Boolean - bool
- Character - char
- Integer – int
- Floating Point – float
- Double Floating Point – double

Data type modifiers

Several of the basic types can be modified using one or more of these type modifiers

- signed
- unsigned
- short
- long

Data types – size and range!

Type	Typical Bit Width	Typical Range
char	1byte	-127 to 127 or 0 to 255
unsigned char	1byte	0 to 255
signed char	1byte	-127 to 127
int	4bytes	-2147483648 to 2147483647
unsigned int	4bytes	0 to 4294967295
signed int	4bytes	-2147483648 to 2147483647
short int	2bytes	-32768 to 32767
unsigned short int	Range	0 to 65,535
signed short int	Range	-32768 to 32767
long int	4bytes	-2,147,483,647 to 2,147,483,647
signed long int	4bytes	same as long int
unsigned long int	4bytes	0 to 4,294,967,295
float	4bytes	+/- 3.4e +/- 38 (~7 digits)
double	8bytes	+/- 1.7e +/- 308 (~15 digits)
long double	8bytes	+/- 1.7e +/- 308 (~15 digits)

Variables

- C++ is strongly typed language, so every variable must be defined before using it.
- type variablelist; // type is the type (eg. int), varName is the name of the variable
- e.g:
  i. int sum;
  ii. char ch;
  iii. float a, b;
- Variables when just declared have garbage value until they are assigned a value for the first time
- We can assign a specific value from the moment variable is declared, called as initialization of variable.[float b = 0.0;]

Basic Operators in a Expression

- Unary [+, -]
- Arithmetic [+, -, /, *, %]
- Brackets [()]
- Assignment [=]
- Relational [==, !=, >, <, >=, <=]
- Logical Operators [&&, | |, !]

PS - 1: Relational Operators and Logical Operators always Evaluate to 0 or 1

PS – 2: For logical evaluation any non-zero value is true.

Lets convert some pseudocodes!

- Check if a number is prime or not

- Write a program to print the following pattern

  1

  2 3

  4 5 6

  7 8 9 10

Recap

- Program Always starts with main()
- { } are used to enclose a block (function, if, while etc.).
- C++ Compiler Ignores whitespace (space, carriage returns, linefeeds, tabs, vertical tabs, etc.)
- Output using cout
- Input using cin
- Header Files
- Comments (// & /*… */)

If Block

- Single If

```
if (a > 10) {
    cout << "Hello!";
}
```

- If Else

```
If (a>10) {
    cout << "Hello!";
} else {
    cout << "World.";
}
```

- If .. Else If .. Else

```
If (a>10 && a <20) {
    cout << "Hello!";
} else if (a >20 && a <30) {
    cout << "Hello World!";
} else {
    cout << "Welcome to Coding Blocks";
}
```

While block

```
while( condition is true ) {
        //do some stuff
}
```

Time to try?

- Given a list of N integers, find mean, maximum and minimum value. You would be given first N, and then N integers of the list.
- Print all prime numbers between 2 to N
- Read N and print the below pattern

```
    1
   232
  34543
 4567654
567898765
```

Binary Number System!

How is data stored?

- Whole Numbers / Positive Integers – Binary Equivalent. E.g: 23 → 10111
- Characters – Binary Equivalent of their ASCII Values. E.g: 'A' → 65 → 1000001
- Negative Numbers – 2's complement of their counter part
- Floating Values – Binary Equivalent of 2 integers [Significant and Exponent]. E.g: 1.23 can be respresented as 123 * 10^-2. So we now have two integers 123 and -2.

Time for Brain Teasers!

BT – 5: Circular Jail Cell

There is a circular jail with 100 cells numbered 1-100. Each cell has an inmate and the door is locked. One night the jailor gets drunk and starts running around the jail in circles. In his first round he opens each door. In his second round he visits every 2nd door (2,4,6---) and shuts the door. In the 3rd round he visits every 3rd door (3,6,9---) and if the door is shut he opens it, if it is open he shuts it. This continues for 100 rounds (i.e. 4,8,12 ---; 5,10,15 ---; ---; 49,98 etc.) and exhausted the jailor falls down.

How many prisoners found their doors open after 100 rounds?

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Thank You !

Utkarsh Nath