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Launchpad

Lecture - 2

Programming Fundamentals - 1

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Any doubts?

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Brain Teasers?

Warm up!

I. Write a pseudo code to print the following pattern

```
1
01
101
0101
10101
```

Time to write our first program!

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Program to print "Hello World"

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

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Identifiers

I. A C++ identifier is a name used to identify a variable, function, class, module, or any other user-defined item

II. 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)

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Keywords

I.   Some reserve words which cannot be used as identifiers

II. These are basically part of the grammar representing the language

III. E.g: if, while, return, namespace, etc.

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Data types

I.   As we know we need variables to store information.

II.   We might want to store information of various types in a variable like character, whole numbers, integers, floating point, boolean etc.

III. Based on the data type of a variable, the operating system **allocates memory** and **interprets the combination of 0s and 1s in that memory**

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Primitive Data Types

I. Boolean - bool

II. Character - char

III. Integer – int

IV. Floating Point – float

V. Double Floating Point – double

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Data type modifiers

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

I.   signed

II. unsigned

III. short

IV. 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)

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Variables

I. C++ is strongly typed language, so every variable must be defined before using it.

II. type variablelist; // type is the type (eg. int), varName is the name of the variable

III. e.g:
   i. int sum;
   ii. char ch;
   iii. float a, b;

IV. Variables when just declared have garbage value until they are assigned a value for the first time

V. We can assign a specific value from the moment variable is declared, called as initialization of variable.[float b = 0.0;]

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Constants

C++ has two types of constants

I.   Literals

    i.   Integer [212, 215u,0x4b,077, 30ul, 75L)

    ii.   Floating [3.14, 31459E-5]

    iii.   Boolean [true, false]

    iv.   Character ['a', '\n', '\t', '\\', '\'']

    v.   String ["Coding Blocks"]

II.   Symbolic Constants

    i.   #define preprocessor

    ii.   const keyword

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Statements & Expressions

I.   A statement in C++ is the smallest independent unit in the language

II. Statements in C++ are terminated by a semicolon

III. An expression is a mathematical entity that evaluates to a value

IV. Expressions are often used inside of statements.

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Type conversion!

I.   Implicit
II. Explicit

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If statement

I.   Single If
```
if (a > 10) {
    cout << "Hello!";
}
```
II. If Else
```
If (a>10) {
    cout << "Hello!";
} else {
    cout << "World.";
}
```
III. 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";
}
```

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While statement

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

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Lets convert some pseudocodes!

I.   Read P,R,T and calculate SI
II. Find largest of 3 numbers
III. Check if a number is prime or not
IV. Write a program to print the following pattern

1
2 3
4 5 6
7 8 9 10

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Time to try?

I. 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.

II. Print all prime numbers between 2 to N

III. Read N and print the below pattern

```
    1
   232
  34543
 4567654
567898765
```

Recap

I. Program Always starts with main()

II. { } are used to enclose a block (function, if, while etc.).

III. C++ Compiler Ignores whitespace (space, carriage returns, linefeeds, tabs, vertical tabs, etc.)

IV. Output using cout

V. Input using cin

VI. Header Files

VII. Comments (// & /*… */)

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Operators

I.   Arithmetic

II. Relational

III. Logical

IV. Bitwise

V.   Assignment

VI. Misc

Precedence & Associativity

TABLE 2-1. PRECEDENCE AND ASSOCIATIVITY OF OPERATORS

OPERATORS	ASSOCIATIVITY
( ) [ ] -> .	left to right
! ~ ++ -- + - * & (*type*) sizeof	right to left
* / %	left to right
+ -	left to right
<< >>	left to right
< <= > >=	left to right
== !=	left to right
&	left to right
^	left to right
¦	left to right
&&	left to right
¦¦	left to right
?:	right to left
= += -= *= /= %= &= ^= ¦= <<= >>=	right to left
,	left to right

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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?

BT – 6: Greedy Pirates

A pirate ship captures a treasure of 1000 golden coins. The treasure has to be split among the 5 pirates: 1, 2, 3, 4, and 5 in order of rank. The pirates have the following important characteristics: infinitely smart, bloodthirsty, greedy. Starting with pirate 5 they can make a proposal how to split up the treasure. This proposal can either be accepted or the pirate is thrown overboard. A proposal is accepted if and only if a majority of the pirates agrees on it. **What proposal should pirate 5 make?**

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BT – 7: Infinite Quarter Sequence

You are wearing a blindfold and thick gloves. An infinite number of quarters are laid out before you on a table of infinite area. Someone tells you that 20 of these quarters are tails and the rest are heads. He says that if you can split the quarters into 2 piles where the number of tails quarters is the same in both piles, then you win all of the quarters. You are allowed to move the quarters and to flip them over, but you can never tell what state a quarter is currently in (the blindfold prevents you from seeing, and the gloves prevent you from feeling which side is heads or tails). **How do you partition the quarters so that you can win them all?**

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BT – 8: Daughters' Ages

Local Berkeley professors Dr. X and Dr. Y bump into each after a long time.

X   hey! how have you been?

Y   great! i got married and i have three daughters now

X   really? how old are they?

Y   well, the product of their ages is 72, and the sum of their ages is the same as the number on that building over there

Y   right, ok ... oh wait ... hmm, i still don't know

X   oh sorry, the oldest one just started to play the piano
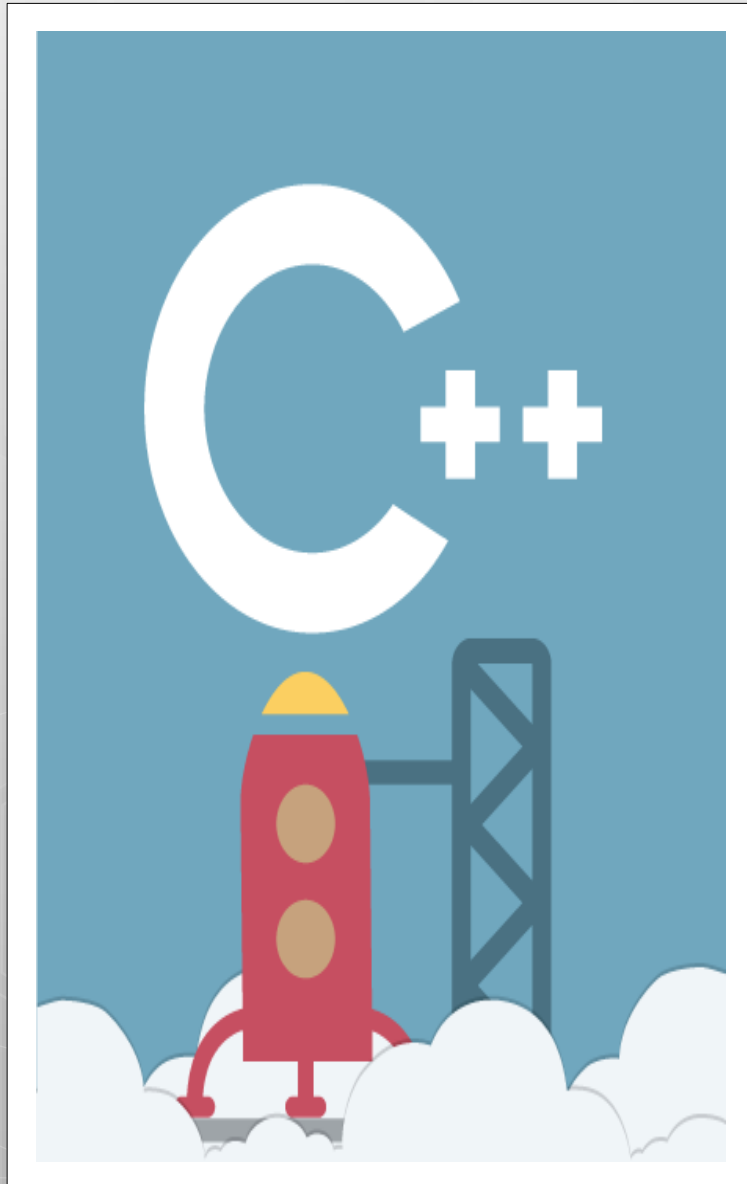
Y   wonderful! my oldest is the same age!

How old are the daughters?

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What is next class about?

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Programming Fundamentals - 1

I. Operators/loops
II. Continue, break;
III. Arrays

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Thank You!

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