Basics

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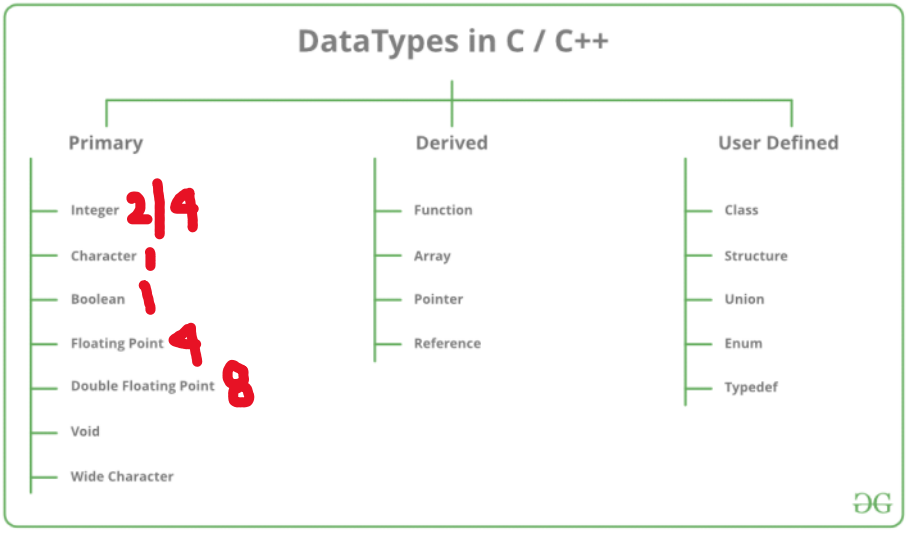
C++ was created by Bjarne Stroustrup in 1985 at AT&T Bell labs.
C++ is an Object Orientated and Compiled High level Language which is used for the development of OS, Compilers, Games, etc.

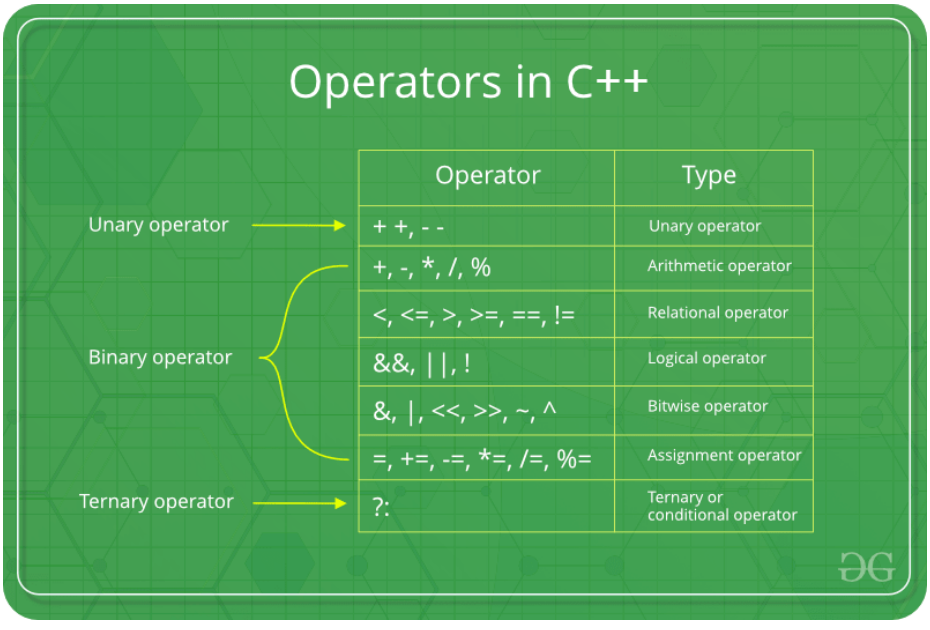
Data Types

A data types signifies 2 things that is

1. Representation of Data that is how a data can be represented in a program.
2. What are the operations are allowed to perform on that data.



Variables are the names given to the data. example **Int id = 21**; **char s = "s"**;



Order Precedence is the order in which an expression is evaluated. when there are multiple operators in a single line, then the part of expression having highest precedence get evaluated

first.

Operator	Name	Associativity
() [] -> .	Function call, Subscript, Member access	Left
++ —	Increment/Decrement	Right
! ~ – +	Logical/Bitwise NOT, Unary plus/minus	Right
* / %	Multiplication, Division, Modulus	Left
+ –	Addition, Subtraction	Left
<< >>	Bitwise shift	Left
< <= > >=	Relational operators	Left
== !=	Equality operators	Left
&	Bitwise AND	Left
^	Bitwise XOR	Left
|	Bitwise OR	Left
&&	Logical AND	Left
||	Logical OR	Left
?:	Ternary conditional	Right
= += -= *= /= %= &= ^= |= <<= >>=	Assignment and compound assignment	Right
,	Comma	Left

Practice Problems

Q1. Write a Program to take inputs from user and find the area of the triangle? Also, show difference in answer if wrong Order Precedence is followed in the Expression.

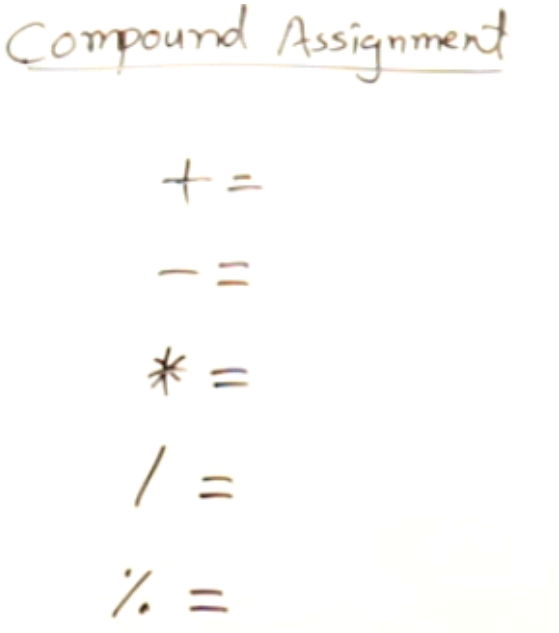
```cpp
#include <iostream>
int main() {
    float height, base;
    std::cout << "Enter the height of the Triangle: ";
    std::cin >> height;
    std::cout << "Enter the base of the Triangle: ";
    std::cin >> base;
    // Correct calculation
    float correct = (height * base) / 2;
    // Incorrect calculation (integer division causes the error)
    float incorrect = (1 / 2) * height * base;  // This will be zero
    std::cout << "Answer with correct precedence is: " << correct << std::endl;
    std::cout << "Answer with wrong precedence is: " << incorrect << std::endl;
    return 0;
}
```

Q2. Write a program to find the sum of N Natural number.

```cpp
#include<iostream>
using namespace std;
int main() {
    float n;
    cout<<"Enter n : ";
    cin>>n;
    float ans = n * ( n + 1) / 2;
    cout<<"Sum of First N natural Number is "<<ans;
    return 0;
}
```

Q3. Write a program to find the area of Circle.

```cpp
#include<iostream>
#define pi 3.14159f
using namespace std;
int main() {
    float radius;
    cout<<"Enter Radius : ";
    cin>>radius;
    float area = pi * radius * radius;
    float ar = (float) 22 / 7 * radius * radius;
    cout<<"way 1 : area of triangle is "<<area<<endl;
    cout<<"way 2 : area of triangle is "<<ar;
    return 0;
}
```



Increment and Decrement

Increment operator (++) as name suggest it increments/ increases the value by 1 whereas decrement operator (--) decreases the value by 1.

Types :

Increment

1. **Prefix increment (++value)** : first increments then assign the value if assigned to a variable.
2. **Post increment (value++)** : first assign the value if assigned to a variable than increments.

Decrement :

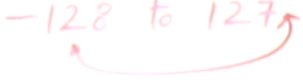
1. **Prefix decrement (--value)** : first decrements then assign the value if assigned to a variable.
2. **Post decrement (value--)** : first assign the value if assigned to a variable than decrements.

```cpp
#include<iostream>
using namespace std;
int main() {
    int i,j,k,l;
    i = 1;
    j = 1;
    k = 1;
    l = 1;
    cout<<"prefix increment of "<<i<<" is "<<++i<<endl; // 2
    cout<<"post increment of "<<j<<" is "<<j++<<endl; // 1
    cout<<"prefix decrement of "<<k<<" is "<<--k<<endl; // 0
    cout<<"post decrement of "<<l<<" is "<<l--<<endl; // 1
    return 0;
}
```

Note : In C++, integer are allocated with certain no. of bits that is a range. If an integer value, takes more bits than the allocated number of bits, then we may encounter an overflow or underflow.

- **Overflow** : if number is greater than the number it can be, then this causes integer Overflow.
- **Underflow** : if number is less than the number it can be, then it causes a underflow.

Example, let us assume a range of int data type is between -128 to 127. if we try to increment the value of variable beyond 127 it will cause Integer overflow where as if we try to decrement beyond the minimum value of -128 it will cause integer underflow and value will become 127.



Program :

```cpp
#include<iostream>
using namespace std;
int main() {
    // overfloe shows cyclic behaviour
    int min, max;
    min = -2147483648;
    max = 2147483647;
    cout<<"incrementing max : "<<++max<<endl; //-2147483648
    cout<<"decrementing min : "<<--min<<endl; //2147483647
    return 0;
}
```

Bitwise Operators

1. **Bitwise AND (&)**
2. **Bitwise OR (|)**
3. **Bitwise XOR (^)**
4. **Bitwise NOT (~)**

AND		
A	B	Result
0	0	0
0	1	0
1	0	0
1	1	1

OR		
A	B	Result
0	0	0
0	1	1
1	0	1
1	1	1

XOR		
A	B	Result
0	0	0
0	1	1
1	0	1
1	1	0

NOT	
A	Result
0	1
1	0

5. **Left Shift (<<) :** Shifts bits to left side.
6. **Right Shift (>>) :** shifts bits to right Side.

Program :

```
#include<iostream>
using namespace std;
int main() {
    int left, right;
    left = 2;
    right = 4;
    cout<<"Right shift : "<<(right >> 1)<<endl; // 2
    cout<<"left shift : "<<(left << 1)<<endl; // 4
    return 0;
}
```

Enum is a keyword used to define enumerated values. It is an user defined data type that can be assigned with some values. These values are defined at the time of declaration by the programmer.
A variable defined using the enum can only have a value which is declared inside enum otherwise compiler will give an error.

```
enum enumerated-type-name
{
    value1, value2, value3…..valueN
};
```

```
#include<iostream>
using namespace std;
enum week {Monday, tuesday, wednesday, thursday, friday, saturday, sunday};
int main() {
    week day;
    day = Monday;
    cout<<day<<endl; // 0 i.e. its index
    day = wednesday;
    cout<<day<<endl; // 2
    return 0;
}
```

A **typedef** declaration lets you define your own identifiers that can be used in place of type specifiers such as int , float , and double . A typedef declaration does not reserve storage.

```
typedef int marks;
typedef int rollno;

int main()
{
    marks m1,m2,m2;
    rollno r1,r2,r3;
```