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Computer Programming I

Lecturers:

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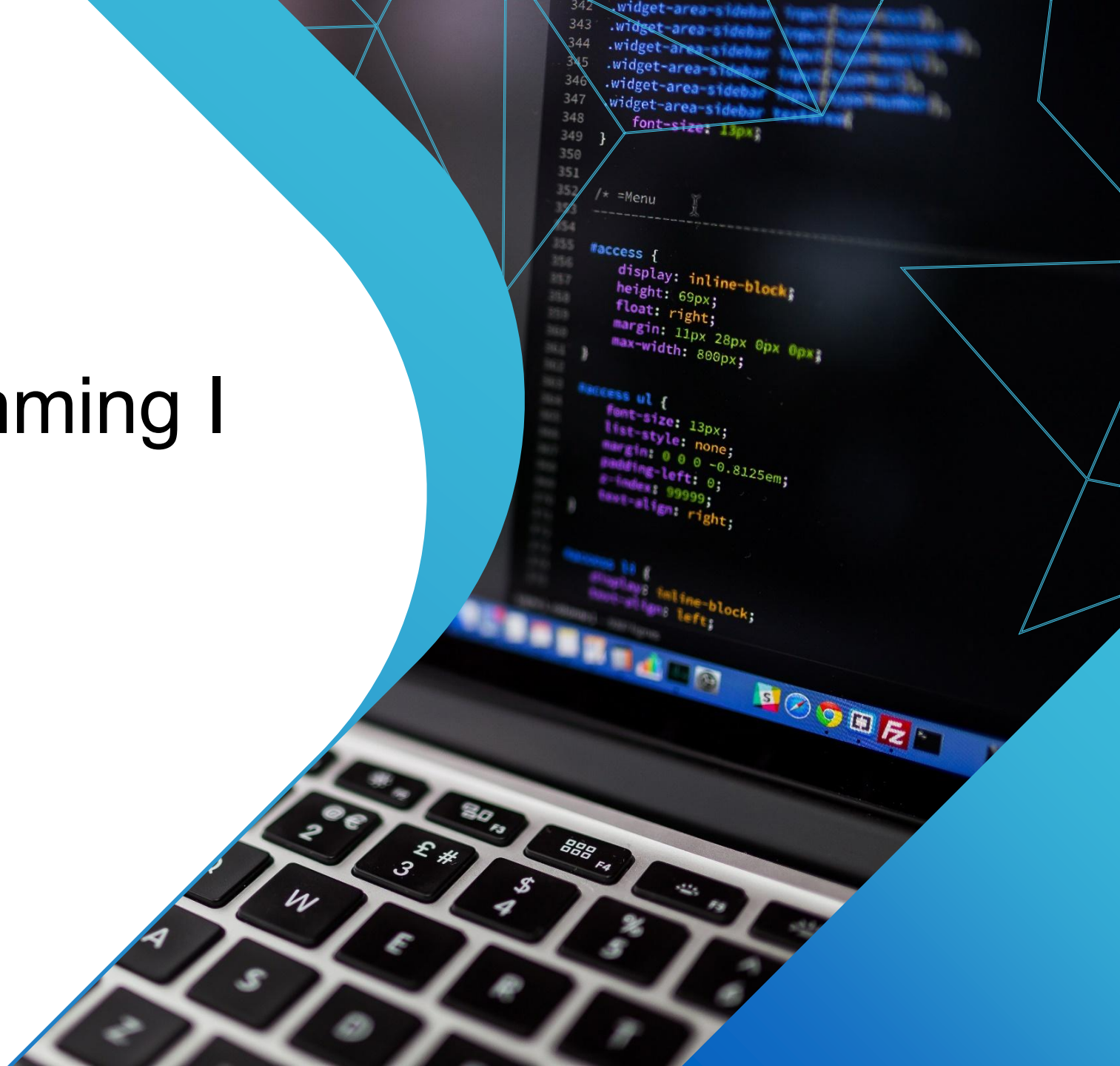
Fall 2025



Let’s start >>>>>

Your First C++ Program

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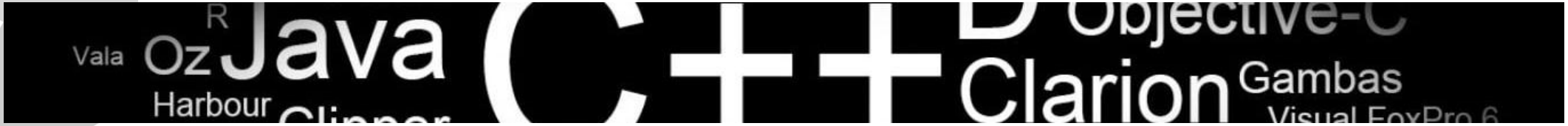
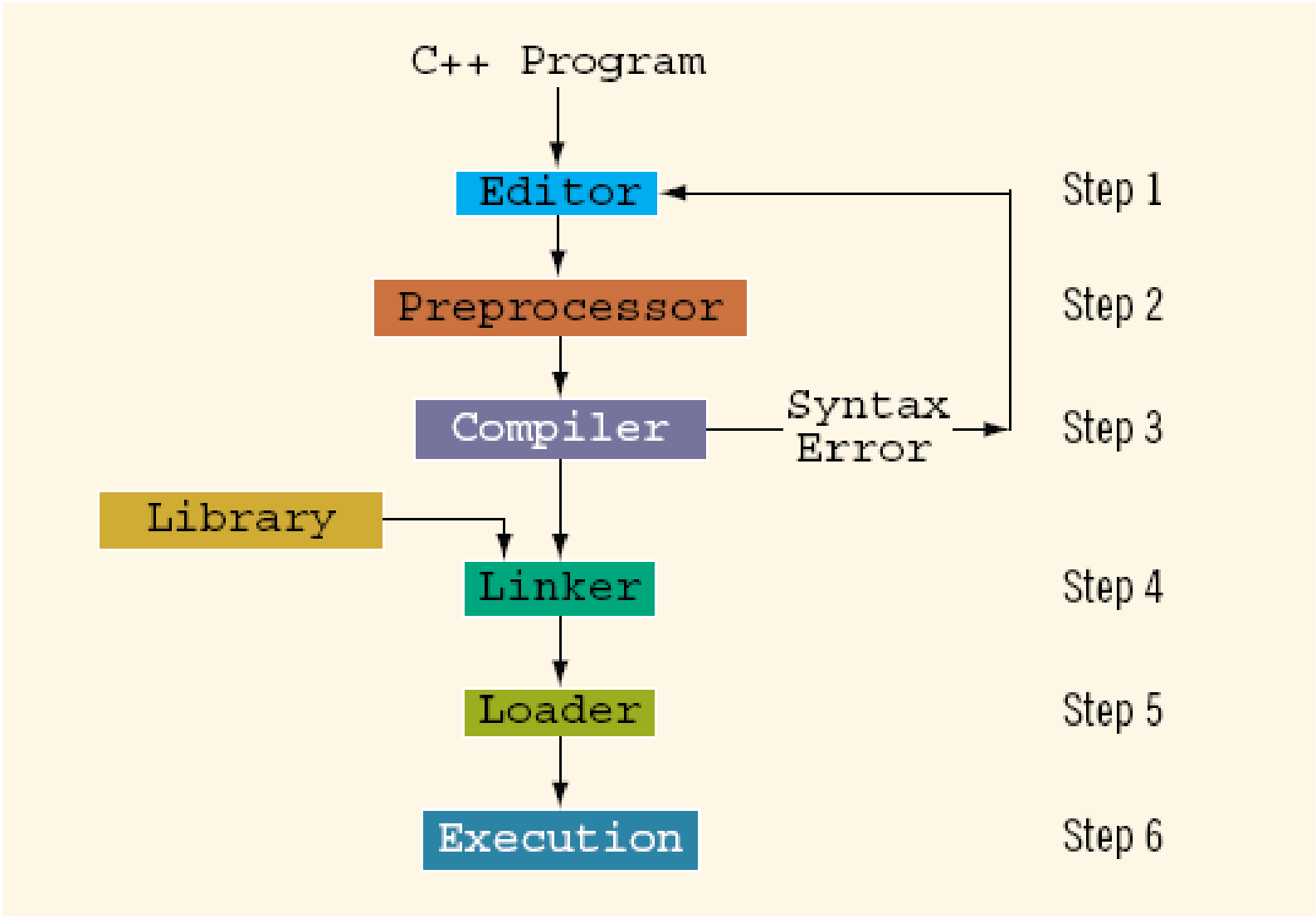
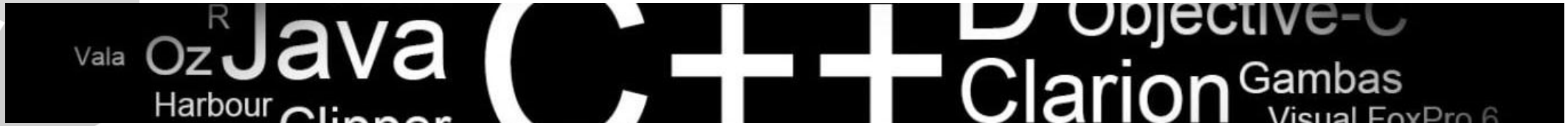
```
#include <iostream>
using namespace std;

int main()
{

    // This program is written by Dr. Amr
    Cout << “Welcome to the first C++ program.” << endl;
    Return 0;
}
```

OUTPUT:

Welcome to the first C++ program.







Interacting With User: Displaying Messages on Screen

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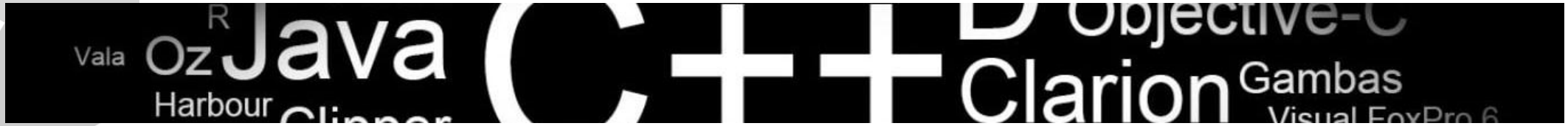
- In C++ , we use Cout << " Text To be Displayed on The screen "
- To use Cout << , we must use

  – **#include <iostream > ;** *notifies the preprocessor to include the contents of the* ***input/output stream header file < iostream> in the program***

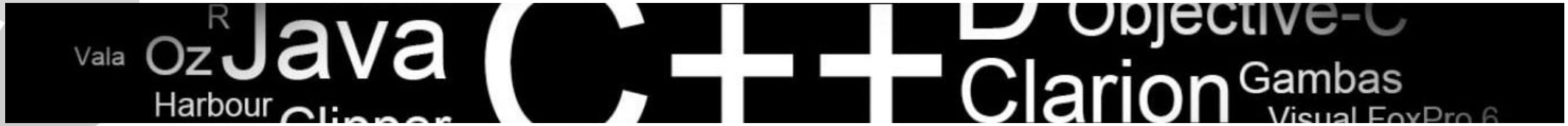
  – **using namespace std**; *using namespace std means that we can use names for objects and variables from the standard library.*

- **We can use the Escape Sequence to format the Displayed Text.**



Escape Sequence	Description
\n	Newline: Moves the cursor to the beginning of the next line.
\t	Horizontal Tab: Inserts a tab (typically 4 or 8 spaces).
\\	Backslash: Inserts a backslash (\) character.
\'	Single Quote: Inserts a single quote (') character.
\"	Double Quote: Inserts a double quote (") character.
\a	Alert (Bell): Produces an audible or visible alert (e.g., beep).
\r	Carriage Return: Moves the cursor to the beginning of the current line.

Escape Sequence	Description	Explanation
\n	Newline	Moves the cursor to the next line.
\t	Horizontal Tab	Inserts a horizontal tab (adds spacing).
\\	Backslash	Inserts a backslash (\) character.
\'	Single Quote	Inserts a single quote ('), useful in character literals.
\"	Double Quote	Inserts a double quote ("), useful in string literals.
\r	Carriage Return	Moves the cursor to the beginning of the current line without advancing down.
\b	Backspace	Moves the cursor one character back, erasing the last character on some systems.
\f	Form Feed	Advances the paper feed in printers (rarely used today).
\v	Vertical Tab	Moves the cursor down vertically without moving horizontally (rarely used).
\a	Alert (Bell)	Produces an alert sound or beep (if supported by the system).
\?	Question Mark	Inserts a literal question mark to avoid ambiguity in trigraphs.
\0	Null Character	Represents the null terminator in C-style strings, marking the end of a string.
\ooo	Octal Value	Represents a character using its octal ASCII code (e.g., \101 for 'A').
\xhh	Hexadecimal Value	Represents a character using its hexadecimal ASCII code (e.g., \x41 for 'A').



Interacting With User: Comments

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•We can put comment on our programs using

// to comment a single line

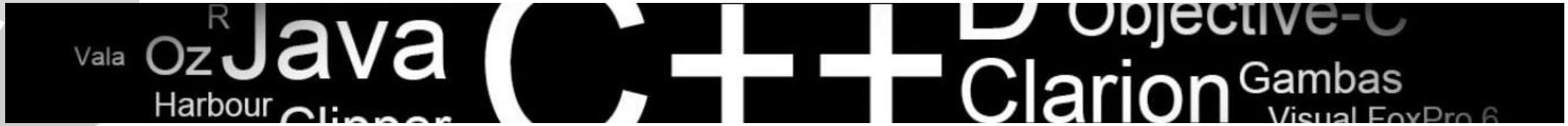
```
// this program is written by Amr Megahed
```

/*

Mulitple Lines

*/ to comment multiple lines

```
/*This program is written by Amr Megahed
On Monday 17/2/2025
*/
```



Interacting With User: Accept Input From User

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•In C++ , we use **Cin>> Variable**; To accept an input from the user.
•To use Cin>>, we must use **#include <iostream>** ;

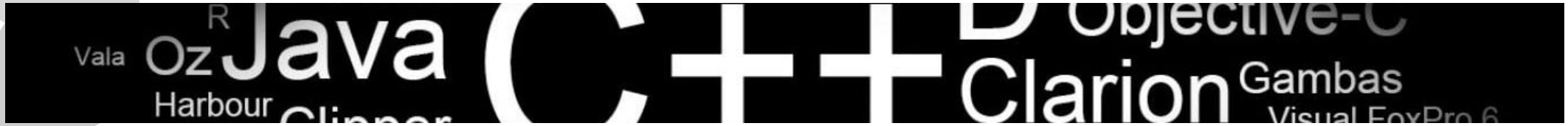
•`#include<iostream>`notifies the preprocessor to include in the program the contents of the input/output stream header file `<iostream>`.

• **A variable** is a location in the computer's memory where a value can be stored for use by a program.

• All variables must be **declared** with a **name** and a **data type** before they can be used in a program.

• **Declaration**

Datatype Identifier;
Int width ;
Float salary ;



C++ Data Types

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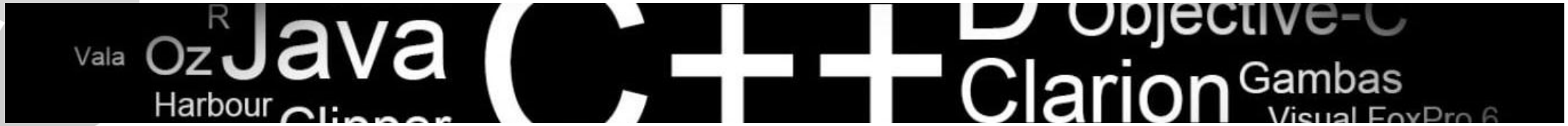
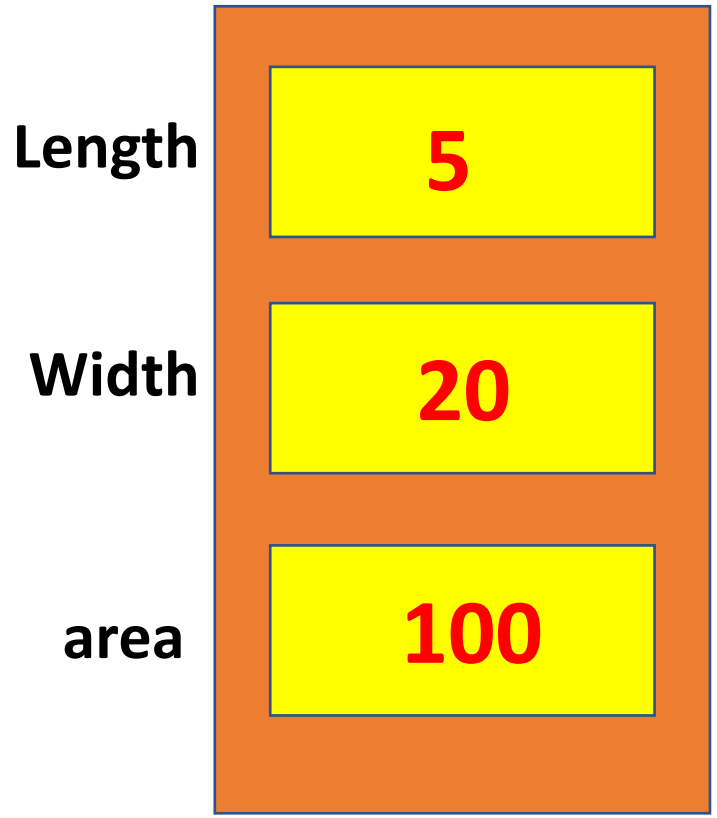
char	Character or small integer.	1byte	signed: -128 to 127 unsigned: 0 to 255
int	Integer.	4bytes	signed: -2147483648 to 2147483647 unsigned: 0 to 4294967295
short int (short)	Short Integer.	2bytes	signed: -32768 to 32767 unsigned: 0 to 65535
long int (long)	Long integer.	4bytes	signed: -2147483648 to 2147483647 unsigned: 0 to 4294967295
bool	Boolean value. It can take one of two values: true or false.	1byte	true or false
float	Floating point number.	4bytes	+/- 3.4e +/- 38 (~7 digits)
double	Double precision floating point number.	8bytes	+/- 1.7e +/- 308 (~15 digits)
long double	Long double precision floating point number.	8bytes	+/- 1.7e +/- 308 (~15 digits)

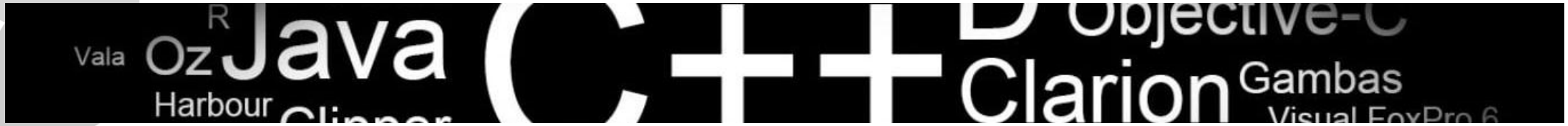


Working With Variable

```
Int length ;
Int width;
Int area;
```

```
Cin>>Length;
Cin>>width;
Area =  Length * width ;
```





Declaring & Initializing Variables

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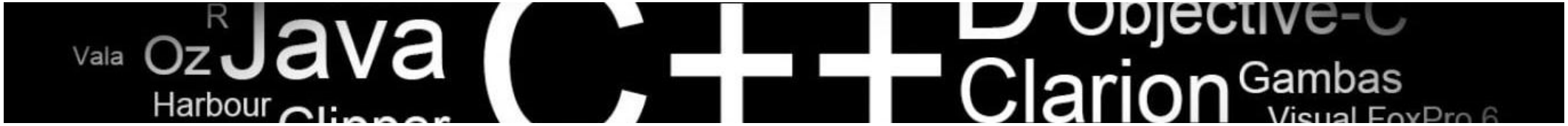
• Initialization means to give a variable an initial value.

• Variables can be initialized when declared:

```
Int first= 13 , second= 10;
Char ch = ‘ ’;
double x = 12.6;
```

• All variables must be initialized before they are used in an arithmetic operation

– But not necessarily during declaration



Rules on Variable Names

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- DO NOT use reserved words as variable names
  (e.g. if, else, int , float, case, for,….)

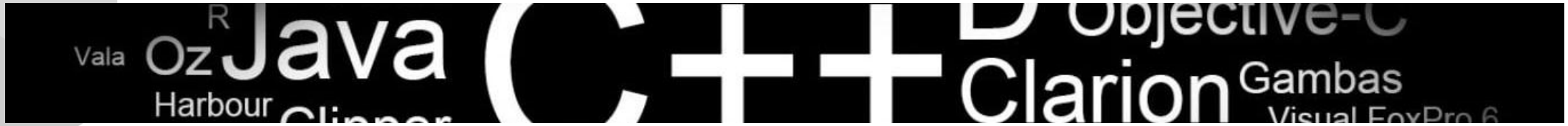
- The first character has to be a letter or underscore. It can not be a numeric digit.

- The second and the other characters of the name can be any letter, any number, or an underscore "__".

Examples

Some valid names: my_name , m1131 , salary, bluemoon , _at

Some invalid names: my name, my-name , 1stmonth , salary! , guns&roses ,



Frequently used data types

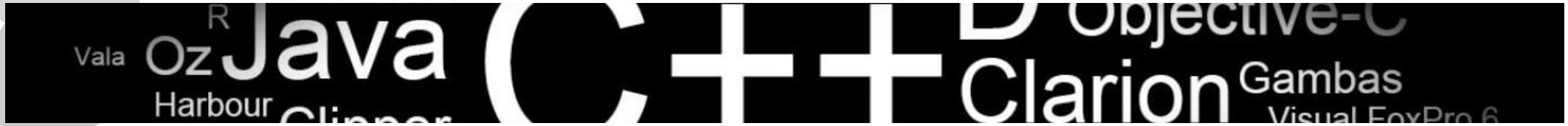
Data Types	Bytes Used
int	4 Bytes
short	2 Bytes
double	8 Bytes
unsigned	4 Bytes
Float	4 Bytes
Double	8 Bytes
Char	1 Byte

- The data type unsigned is used to represent positive integers.

- float and double data types for storing real numbers.
  The float data type has a precision of seven digits

  - This means after the decimal point you can have seven digits
  - **Example**: 5.13159 874.324364 0.1234567

- The double data type has a precision of fifteen digits
  - **Example** :- 3738.7878787878, 3.141592653589790, 0.123456789123456



Frequently used data types

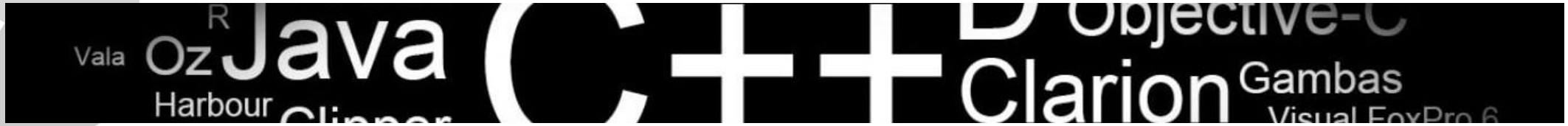
- We can use *Scientific Notation* to represent real numbers that are very large or very small in value.

- The letters e or E is used to represent times 10 to the power.

Example:

- 1.23×10^5 is represented **as** 1.23e5 or 1.23e +5 or 1.23E5

- 1×10^{-9} is represented **as** 1e-9



Arithmetic Operations

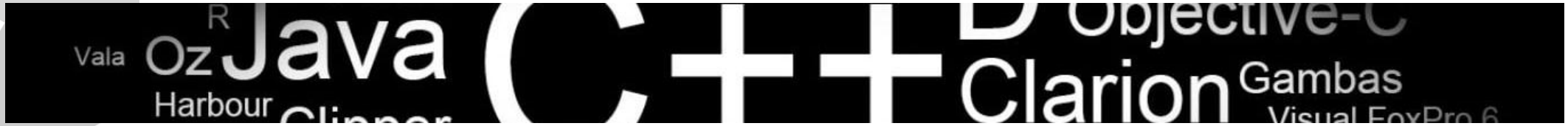
C++ operation	C++ arithmetic operator	C++ expression
Addition	+	f + 7
Subtraction	-	p - c
Multiplication	*	b * m
Division	/	x / y
Modulus	%	r % s

Arithmetic operators.

- Parentheses are used in C++ expressions in the same manner as in algebraic expressions.
- For example, to multiply **a** times the quantity **b** + **c** we write

$$a * (b + c)$$

- There is no arithmetic operator for exponentiation in C++, so x^2 is represented as $x * x$



Precedence of arithmetic operations

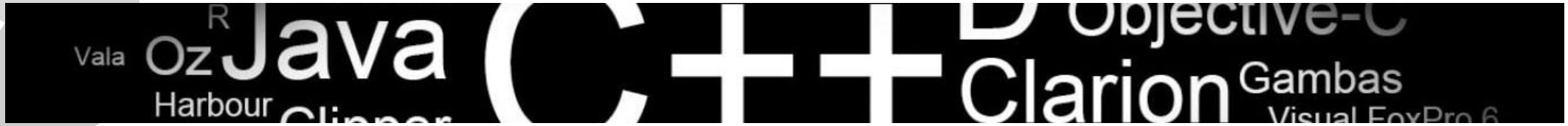
Operator(s)	Operation(s)	Order of evaluation (precedence)
( )	Parentheses	Evaluated first. If the parentheses are nested, the expression in the innermost pair is evaluated first. [*Caution:* If you have an expression such as `(a + b) * (c - d)` in which two sets of parentheses are not nested, but appear "on the same level," the C++ Standard does *not* specify the order in which these parenthesized subexpressions will be evaluated.]
*, /, %	Multiplication, Division, Modulus	Evaluated second. If there are several, they're evaluated left to right.
+ -	Addition Subtraction	Evaluated last. If there are several, they're evaluated left to right.

Precedence of arithmetic operators.

For example,

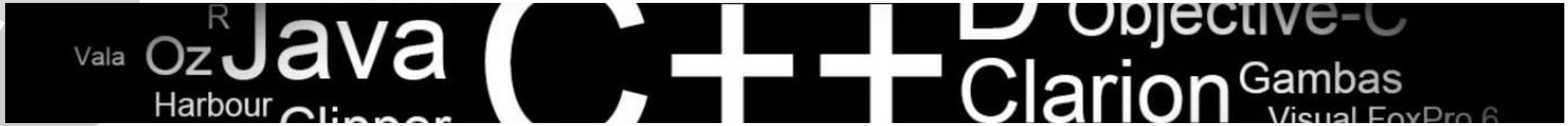
$$2 + 3 * 5 \; and \; (2 + 3) * 5$$

both have different meanings



Example

```
Step 1.   y = 2 * 5 * 5 + 3 * 5 + 7;      (Leftmost multiplication)
              2 * 5 is 10
Step 2.   y = 10 * 5 + 3 * 5 + 7;         (Leftmost multiplication)
              10 * 5 is 50
Step 3.   y = 50 + 3 * 5 + 7;             (Multiplication before addition)
                  3 * 5 is 15
Step 4.   y = 50 + 15 + 7;                (Leftmost addition)
              50 + 15 is 65
Step 5.   y = 65 + 7;                     (Last addition)
              65 + 7 is 72
Step 6.   y = 72                          (Last operation—place 72 in y)
```

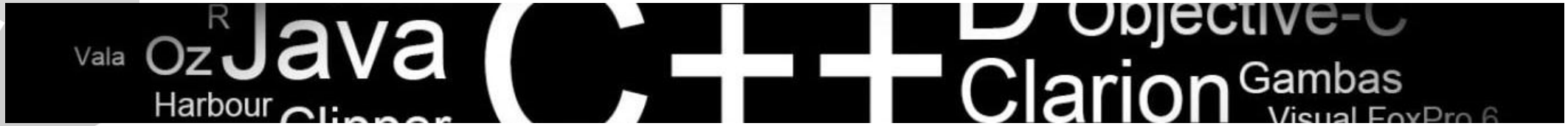


Data Type of an Arithmetic Expression

- Data type of an expression depends on the type of its operands
  - Data type conversion is done by the compiler

- If operators **are *, /, +, or -** , then the type of the result will

  - **integer**, if all operands are integer.
    - **» Int A , B;**
    - **» A+ B ➔ Integer.**
  - **float**, If at least one operand is float and there is no double
    - **» Int A ; Float B;**
    - **» A + B ➔ Float.**
  - **double**, if at least one operand is double
    - **» Int A ; Float B ; Double C;**
    - **» A + B + C ➔ double.**



Data Type of an Arithmetic Expression

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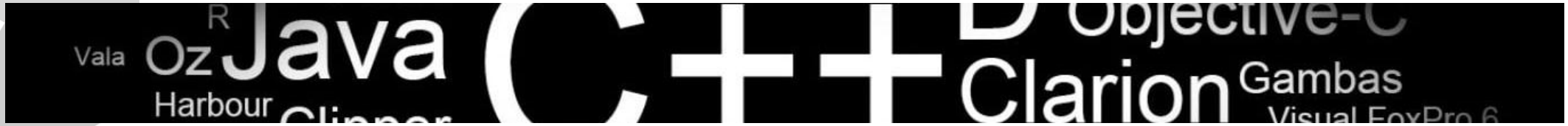
Example

Int * int ; → **Result Int**

Int + float; → **Result float**

Int + double / float; → **Result double**

Int - double; → **Result double**



Data Type of an Arithmetic Expression

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- The data type of the target variable is also important

- If the result is a real number and the target variable is declared as integer , only the integer part of the result will be kept, and decimal part will be lost

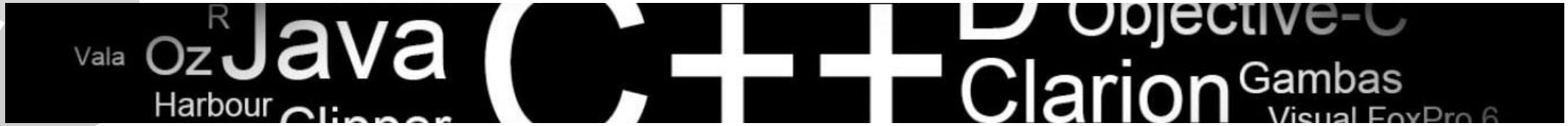
Example

```
int avg;
float sum= 100.0 , cnt = 6.0
avg = sum / cnt;
```

The result is calculated as 16.66667

But avg will be 16

- **Only the integer part of the result will be considered if two operands are integer Even when the target variable is float**



Type Casting

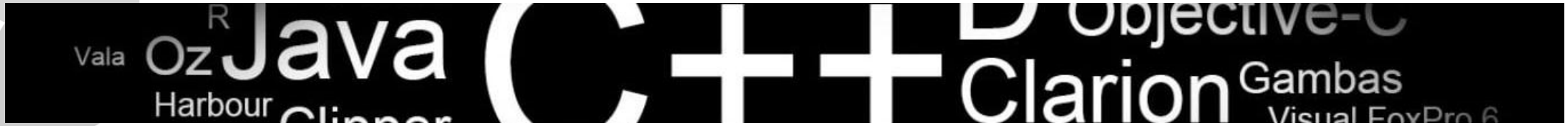
```
Int main()
{
Int i = 5 , j = 3;
float div;
div= i /j;
cout<<div;
}
```

The **div** will be **1** and this is not write

```
Int main()
{
Int i = 5 , j = 3;
float div;
div= (float) i /j;
cout<<div;
}
```

Type cast : tells the compiler to treat **i** as a float

After type casting , The **div** will be 1.66667



Increment and Decrement Operators

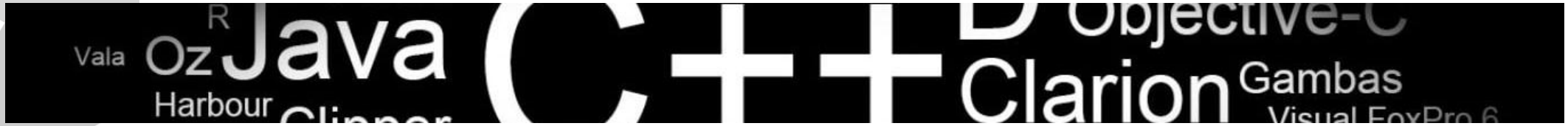
- **Increment operator: increment variable by 1**
  - Pre increment: ++variable
  - Post increment: variable++

- **Decrement operator: decrement variable by 1**
  - Pre decrement: variable
  - Post decrement: variable

- **Examples :**

++K , K++ » k= K+ 1

-- K , K » K= K+ 1



Increment and Decrement Operators

- If the value produced by ++ or is not used in an expression , it does not matter whether it is a pre or a post increment (or decrement).

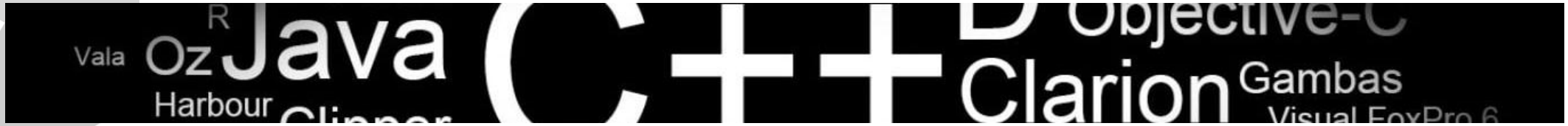
- When ++ (or --) is used before the variable name, the computer first increments (or decrements) the value of the variable and then uses its new value to evaluate the expression.

- When ++ (or --) is used after the variable name, the computer uses the current value of the variable to evaluate the expression, and then it increments (or decrements) the value of the variable.

- There is a difference between the following

```
x = 5;
Cout << ++x;
```

```
x = 5;
Cout << x++;
```



special assignment statements

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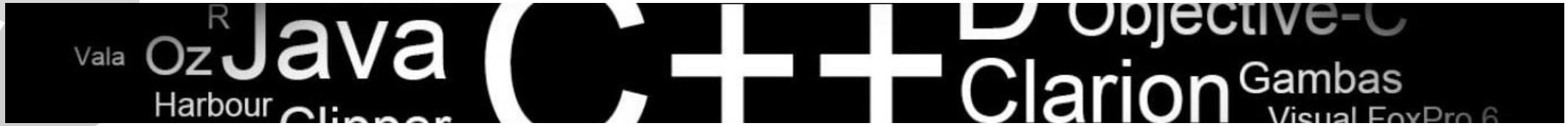
- C++ has special assignment statements called compound Assignments

$$+= , -= , *= , \neq , \% =$$

- **Example:**

X += 5 ;	**means**	**x = x + 5;**
x *=y;	**means**	**x = x * y;**
x /=y;	**means**	**x = x / y;**



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Thank You