Lecture-1

Object Oriented Programming

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programming language is a formal set of rules and instructions that allows humans to communicate with computers. It enables developers to write programs that perform specific tasks, manipulate data, and control the behavior of a computer system.

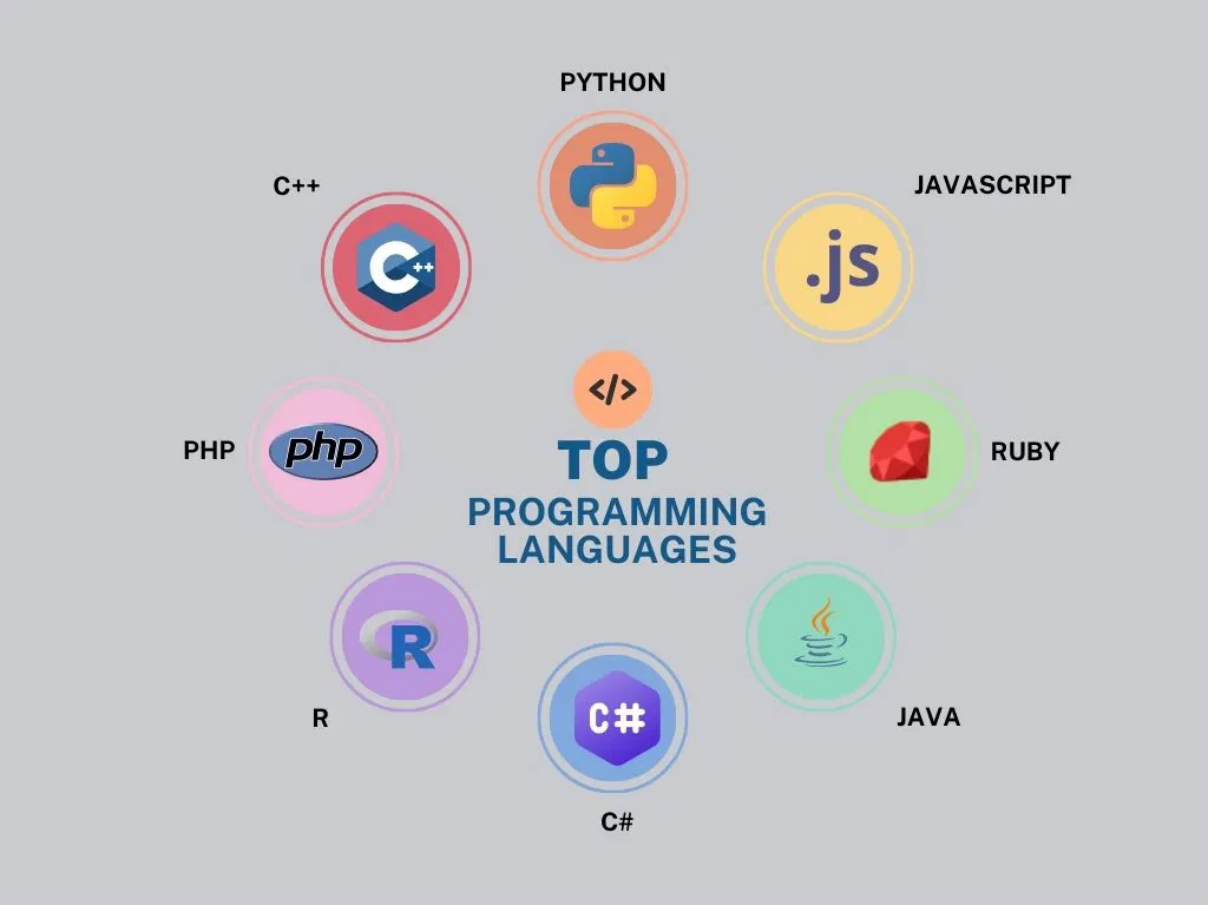

Figure 1: Examples of programming Languages

C++ is a high-level, general-purpose programming language that was developed by Bjarne Stroustrup starting in the late 1970s as an extension of the C programming language. It incorporates both high-level and low-level language features, making it suitable for a wide range of applications.

Remember: C++ is a case-sensitive programming language.
Note: In our C++ course, we will use Code::Blocks to execute the code

Use Cases

1- Systems Programming: Operating systems, drivers, and other system-level applications.
2- Game Development: Game engines and performance-critical gaming applications.
3- Application Software: Desktop applications, GUI applications, and databases.
4- Scientific Computing: Simulations and high-performance computing tasks.

C++ Program Structure

```cpp
#include <iostream>
using namespace std;
void main() {

}
```

Explanation

#include <iostream>:

This line includes the Input/Output stream library, which allows you to use features for input and output in C++. It contains functionality for handling standard input and output, like cout for outputting data to the console.

using namespace std:

This line tells the compiler to use the standard namespace. The standard library in C++ contains many useful functions and classes. By using this directive, you can use names like cout and cin without needing to prefix them with std.

void main():

This is intended to define the main function, where the execution of the program begins. However, the correct signature in C++ should be int main() instead of void main(). The int type indicates that the function returns an integer value, typically 0 to signify successful completion.

```cpp
#include <iostream>
using namespace std;
int main() {

return 0;
}
```

int main():

The entry point of the program. It should return an integer.

return 0;:

This indicates that the program finished successfully.

C++ Variables

Variables are containers for storing data values.

Remember: In C++, there are different types of variables (defined with different keywords)

Basic Data Types

Data Type	Description
int	Stores whole numbers, without decimals
float	Stores fractional numbers, containing one or more decimals. Sufficient for storing 7 decimal digits
boolean	Stores true or false values
char	Stores a single character/letter/number, or ASCII values
string	Stores text, such as "Hello World". String values are surrounded by double quotes

Declaring (Creating) Variables

Remember: Every statement in C++ ends with a semicolon;
Remember: Use single quotes for char type (single characters) and use double quotes for string type (multiple characters).

To create a variable, you must specify the type and assign it a value:
type variable = value;

Q/ Write a program in C++ to define five variables and assign the following values to them: (5, 5.99, 'D', "Hello", true)?

```
#include <iostream>
using namespace std;
void main() {

int myNum = 5;
float myFloatNum = 5.99;
char myLetter = 'D';
string myText = "Hello";
bool myBoolean = true;

}
```

Declare Many Variables

Remember: To declare more than one variable of the same type, use a comma separated list.

Q\ Write a program in C++ to define 3 variables in same line?

```
#include <iostream>
using namespace std;
void main() {

int x = 5, y = 6, z = 50;

}
```

C++ Identifiers

Remember: All C++ variables must be identified with unique names, these unique names are called identifiers.
Remember: Identifiers can be short names (like x and y) or more descriptive names (age, sum, totalVolume).

Note: It is recommended to use descriptive names in order to create understandable and maintainable code.

The general rules for constructing names for variables (unique identifiers):

1. Names can contain letters, digits and underscores
2. Names must begin with a letter or an underscore (_)
3. Names are case sensitive (myVar and myvar are different variables)
4. Names cannot contain whitespaces or special characters like !, #, %, etc.
5. Reserved words (like C++ keywords, such as int) cannot be used as names.

Constants

Remember: the const keyword in C++ is used to define constant values, meaning that once a variable is declared as const, its value cannot be modified. This helps prevent accidental changes and makes the code more understandable.

Q\ Write a program in C++ to define const variable pi?

```
#include <iostream>
using namespace std;
void main() {

const float PI = 3.14; }
```

C++ User Input

In C++, user input is typically handled using the cin object from the <iostream> library. cin reads data from the standard input (usually the keyboard) and stores it in variables.
cin is a predefined variable that reads data from the keyboard with the extraction operator (>>).

Q\ Write a program in C++ to define variable and input value from user ?

```
#include <iostream>
using namespace std;
void main() {

int var;
cin>>var;

}
```

C++ User Output

In C++, output is typically handled using the cout object from the <iostream>
cout is a predefined variable that print data on screen with the extraction operator (<<).

Q\ Write a program in C++ to print variable contain 10 ?

```
#include <iostream>
using namespace std;
void main() {

int var = 10;
cout<< var;

}
```

```
Output

10
```

C++ Operators

1. Arithmetic operators
2. Assignment operators
3. Comparison operators
4. Logical operators

Arithmetic Operators

Arithmetic operators are used to perform common mathematical operations.

Operator	Description	Example	Result
+	Addition	a + b	Sum of a and b
-	Subtraction	a - b	substract of a and b
*	Multiplication	a * b	Multiplies of a and b
/	Division	a / b	devidea of a divided by b
%	Modulus (Remainder)	a % b	Remainder of a divided by b
++	Increment (adds 1)	++a or a++	Increases a by 1
--	Decrement (subtracts 1)	--a or a--	Decreases a by 1

Assignment Operators

Assignment operators are used to assign values to variables.

Operator	Example	Equivalent
=	x = 5	x = 5
+=	x += 3	x = x + 3
-=	x -= 3	x = x - 3
*=	x *= 3	x = x * 3
/=	x /= 3	x = x / 3
%=	x %= 3	x = x % 3
&=	x &= 3	x = x & 3
|=	x|=3	x = x | 3
^=	x ^= 3	x = x ^ 3
>>=	x >>= 3	x = x >> 3
<<=	x <<= 3	x = x << 3

Comparison Operators

Comparison operators are used to compare two values.

Remember: the return value of a comparison is either true (1) or false (0).

Operator	Name	Example
==	Equal to	x == y
!=	Not equal	x != y
>	Greater than	x > y
<	Less than	x < y
>=	Greater than or equal to	x >= y
<=	Less than or equal to	x <= y

Q\ Write a program in C++ to compare between 2 integer variables and print result of comparison ?

```
#include <iostream>
using namespace std;
void main() {

int var1 = 1;
int var2 = 2;

cout<<(var1 > var2)<<endl;
cout<<(var2 > var1)<<endl;

}
```

Output

```
0
1
```

Remember: endl in C++ use to print a newline and move the cursor to the next line.

Logical Operators

Logical operators are used to determine the logic between variables or values

Operator	Name	Description
&&	Logical AND	Returns true if both statements are true.
||	Logical OR	` Returns true if one of statements is true.
!	Logical NOT	Reverses the result, returns true if the result is false.

Q\ Write a program in C++ to print your name?

```cpp
#include <iostream>
using namespace std;
void main() {

cout<< "Ahmed" <<endl;

}
```

Output

```
Ahmed
```

Remember: In C++, you can print anything just put it in double quotation " Type here"
Remember: In C++, you can print character just put it in single quotation ' '

Q\ Write a program in C++ to print Letter R?

```cpp
#include <iostream>
using namespace std;
void main() {

cout<< 'R' <<endl;

}
```

Output

```
R
```

Comments

Comments are non-executable lines in code that are used to explain or annotate the code for better readability. They are ignored by the compiler, there are two types:
Single-line Comments: Begin with // and continue to the end of the line, it is useful for brief explanations.
Multi-line Comments: Begin with /* and end with */, it can span multiple lines.

Q\ Write a program in C++ to explain types of comments?

```
#include <iostream>
using namespace std;
void main() {
// This is a single-line comment
int x = 5; // Initializing x with 5

/* This is a multi-line comment
   It can cover multiple lines
*/  }
```

Q\ Write a C++ program that prompts the user to enter two integers, sums them, and displays the result?

```
#include <iostream>
using namespace std;
void main() {
    int num1, num2, sum;

    // Prompt the user for input
    cout << "Enter the first integer: ";
    cin >> num1;

    cout << "Enter the second integer: ";
    cin >> num2;

    // Calculate the sum
    sum = num1 + num2;

    // Display the result
    cout << "The sum of " << num1 << " and " << num2 << " is " << sum <<
"." << endl;
}
```

Q\ Write a program in C++ that prompts the user to enter two integers and then displays their difference and product?

```
#include <iostream>
using namespace std;
void main() {
    int num1, num2;
    int difference, product;

    // Prompt the user for input
    cout << "Enter the first integer: ";
    cin >> num1;
    cout << "Enter the second integer: ";
    cin >> num2;

    // Calculate the difference, product, and quotient
    difference = num1 - num2;
    product = num1 * num2;

    // Display the results
    cout << "Difference: " << difference << endl;
    cout << "Product: " << product << endl;
}
```

Q\ Write a program in C++ that prompts the user to enter the length and width of a rectangle, then calculates and displays the area?

```
#include <iostream>
using namespace std;
void main() {
    double length, width, area;
    // Prompt the user for input
    cout << "Enter the length of the rectangle: ";
    cin >> length;
    cout << "Enter the width of the rectangle: ";
    cin >> width;
    // Calculate the area
    area = length * width;

    // Display the result
    cout << "The area of the rectangle is: " << area << endl;
}
```

Q\ Write a program in C++ that calculates the perimeter of a rectangle given its length and width?

```
#include <iostream>
using namespace std;
void main() {
    double length, width, perimeter;

    // Prompt the user for input
    cout << "Enter the length of the rectangle: ";
    cin >> length;

    cout << "Enter the width of the rectangle: ";
    cin >> width;

    // Calculate the perimeter
    perimeter = 2 * (length + width);

    // Display the result
    cout << "The perimeter of the rectangle is: " << perimeter << endl;
}
```

Q\ Write a program in C++ that takes the side length of a square as input and calculates its area and perimeter?

```
#include <iostream>
using namespace std;
void main() {
    float sideLength, area, perimeter;

    // Prompt the user for input
    cout << "Enter the side length of the square: ";
    cin >> sideLength;

    // Calculate the area and perimeter
    area = sideLength * sideLength;
    perimeter = 4 * sideLength;
    // Display the results
    cout << "The area of the square is: " << area << endl;
    cout << "The perimeter of the square is: " << perimeter << endl;
}
```

Q\ Write a program in C++ that print your full name, your name in first line, second name in second line and third name in third line?

```
#include <iostream>
using namespace std;
void main() {
    cout << "Ahmed" << endl;
    cout << "Abed" << endl;
    cout << "Mohammed" << endl;
}
```

Q\ Write program in C++ that asks for the user's favorite color and then outputs it?

```
#include <iostream>
using namespace std;
void main() {
    string color;

    cout << "Enter your favorite color: ";
    cin >> color; // Read input
    cout << "Your favorite color is " << color << "!" << endl;
}
```

Q\ Write program in C++ that asks for a number and outputs its square?

```
#include <iostream>
using namespace std;
void main() {
    int number;
    cout << "Enter a number: ";
    cin >> number; // Read input
    cout << "The square of " << number << " is " << (number * number) <<
"." << endl;
}
```

Q\ Write program in C++ that asks the user for their age and outputs a message based on the input?

```cpp
#include <iostream>
using namespace std;
void main() {
    int age;
    cout << "Enter your age: ";
    cin >> age; // Read input
    cout << "You are " << age << " years old." << endl; // Output age
}
```

H.W

Q1\ write a program in C++ that calculates the area of a circle using a constant for π (pi)?

Q2\ What is output of below code?

```
#include <iostream>
using namespace std;
void main() {
    // Initialize variables
    int a = 10;
    int b = 5;

    // Display initial values
    cout << "Initial values:" << endl;
    cout << "a = " << a << ", b = " << b << endl;

    // Using the basic assignment operator
    int c = a; // c is assigned the value of a
    cout << "c (after assignment) = " << c << endl;

    // Using the addition assignment operator
    a += b; // a = a + b
    cout << "a (after a += b) = " << a << endl;

    // Using the subtraction assignment operator
    b -= 3; // b = b - 3
    cout << "b (after b -= 3) = " << b << endl;

    // Using the multiplication assignment operator
    a *= 2; // a = a * 2
    cout << "a (after a *= 2) = " << a << endl;
    // Using the division assignment operator
    a /= 5; // a = a / 5
    cout << "a (after a /= 5) = " << a << endl;
    // Using the modulus assignment operator
    b %= 2; // b = b % 2
    cout << "b (after b %= 2) = " << b << endl;
}
```

Q3\ Write a program in c++ prompts the user to enter their name and age, then outputs a greeting?

Q4\ Write a program in c++ that converts a temperature from Celsius to Fahrenheit?

Q5\ Write program in C++ that prompts the user for their favorite food and then displays it.

Q6\ Write program in C++ that converts hours entered by the user into minutes?

Q7\ Write program in C++ that calculates the area of a circle given its radius?

Q8\ Write program in C++ that calculates the area of a triangle given its base and height?