Programming Fundamentals with C++

Lecture 1 - Fundamentals

Dr. Muhammad Sajjad

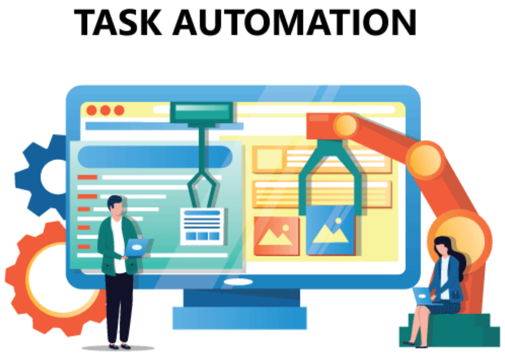
Overview

- **Introduction to Programming and Computers**
  - What is Programming?
  - Basic Computer Science Concepts
  - Why Learn Programming?
- **Introduction to C++ Programming Language**
  - History of C++
  - Why Use C++?
  - Structure of a C++ Program?
  - Setting up a Development Environment
- **Basic Syntax and First Program**
  - Hello, World Program
  - Explanation of Code Structure
  - Running and Compiling a Program
  - Understanding Errors

Introduction to Programming and Computers

What is Programming?

- **Definition**: Programming is the process of creating a set of instructions that a computer follows to perform specific tasks. It involves writing code in a programming language, which is a way to communicate with computers.
- **Why Program?**: Programming allows us to automate tasks, solve complex problems, and create applications or software that can be used in various fields—engineering, healthcare, finance, entertainment, and more.

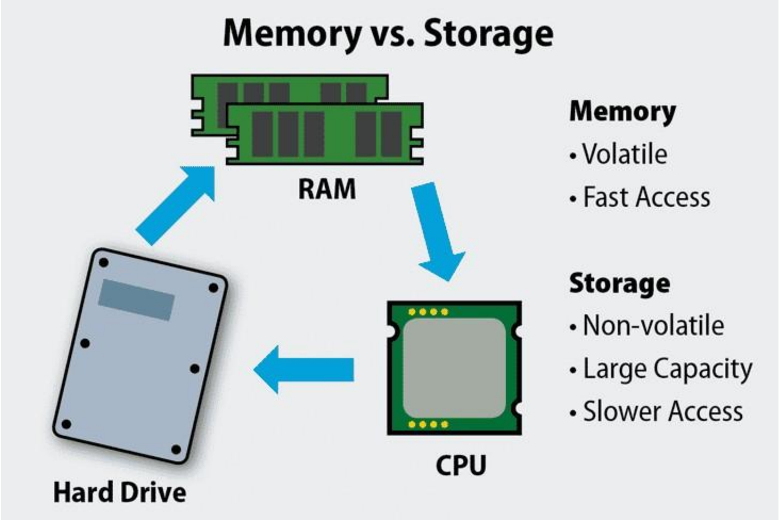


Introduction to Programming and Computers

Basic Computer Science Concepts

- **Hardware vs. Software**:
  - **Hardware** refers to the physical components of a computer (e.g., CPU, memory, keyboard).
  - **Software** includes programs and applications that run on the hardware, like Windows, games, and text editors.
- **CPU (Central Processing Unit)**:
  - Known as the "brain" of the computer, the CPU executes instructions from programs. It performs calculations and manages data.
- **Memory (RAM and Storage)**:
  - **RAM** (Random Access Memory): Temporary storage that holds data and instructions while a program is running. It's fast but erased when the computer is turned off.
  - **Storage** (e.g., hard drives, SSDs): Long-term storage for files and applications that persist even when the computer is powered off.

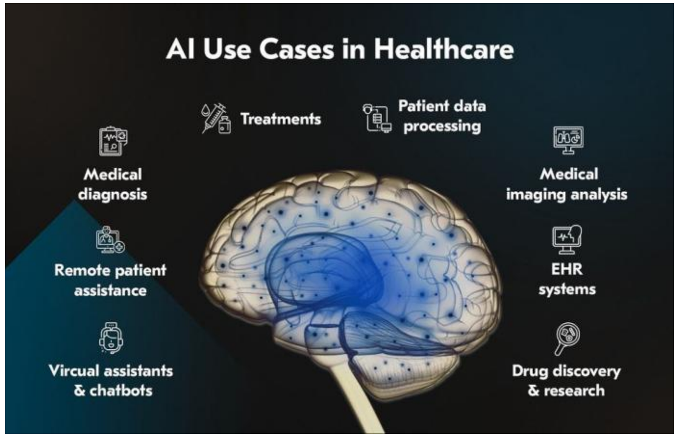
HARDWARE AND SOFTWARE
Java
GMail
Windows 7
McAfee
HARDWARE
SOFTWARE



Introduction to Programming and Computers

Why Learn Programming?

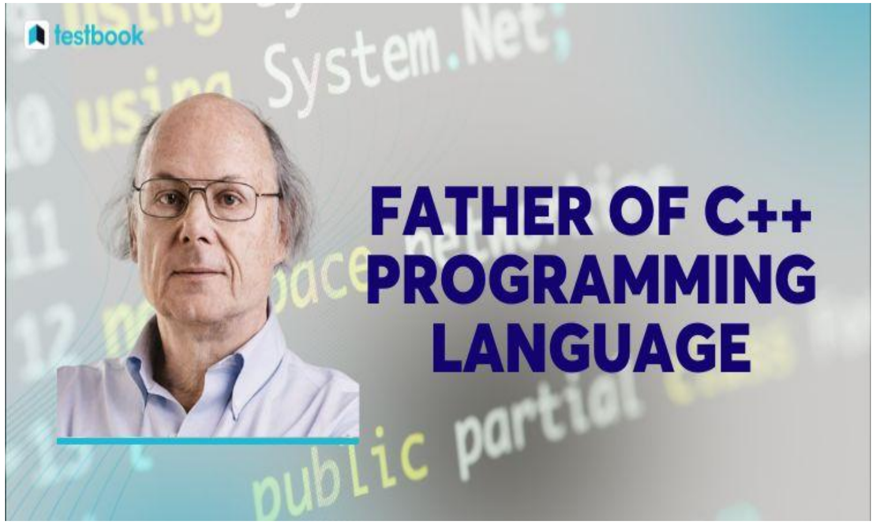
- **High Demand**: Many industries need programmers to develop software, manage data, and automate tasks.
- **Problem Solving**: Programming teaches problem-solving skills, as it involves breaking down complex tasks into smaller steps.
- **Creativity and Innovation**: Programming is a way to create new tools, applications, and solutions for real-world problems.
- **Applications Across Fields**:
  - **Medicine:** Automating diagnostics, analyzing medical data.
  - **Engineering:** Designing simulations, controlling hardware.
  - **Education:** Creating interactive learning platforms.


AI Use Cases in Healthcare
Treatments
Patient data processing
Medical diagnosis
Medical imaging analysis
Remote patient assistance
EHR systems
Vircual assistants & chatbots
Drug discovery & research

Introduction to C++ Programming Language

History of C++

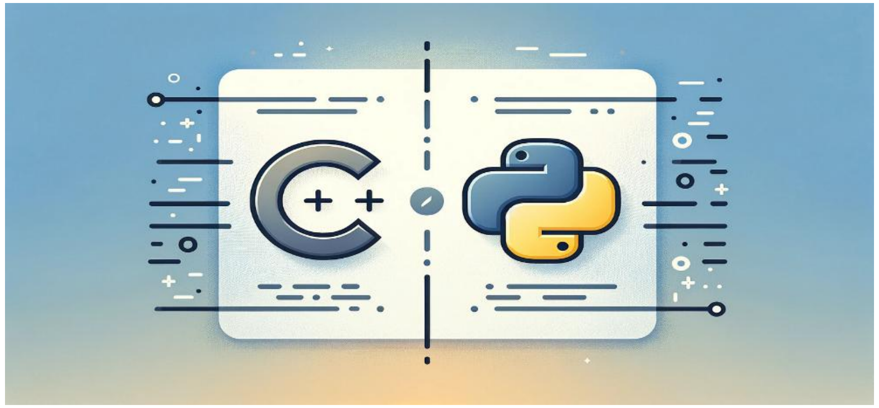
- **Origins**: C++ was developed by Bjarne Stroustrup in the early 1980s as an extension of the C programming language.
- **Purpose**: C++ was created to add object-oriented features to C, making it more versatile for large, complex programs.
- **Popularity**: It's widely used in applications that require performance and control, like system software, game development, real-time simulations, and embedded systems.



Introduction to C++ Programming Language

Why Use C++?

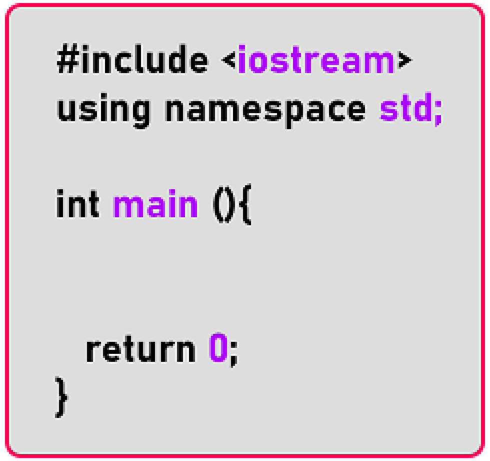
- **Performance**: C++ is a compiled language, meaning it's converted directly into machine code that the computer can execute. This makes it fast and efficient.
- **Flexibility**: C++ supports both high-level (object-oriented) and low-level (system programming) features.
- **Widely Used**: C++ is still one of the most popular languages for high-performance applications.
- **Transferable Skills**: Learning C++ provides a strong foundation for other languages, as many concepts (like variables, loops, and functions) are common across programming languages.



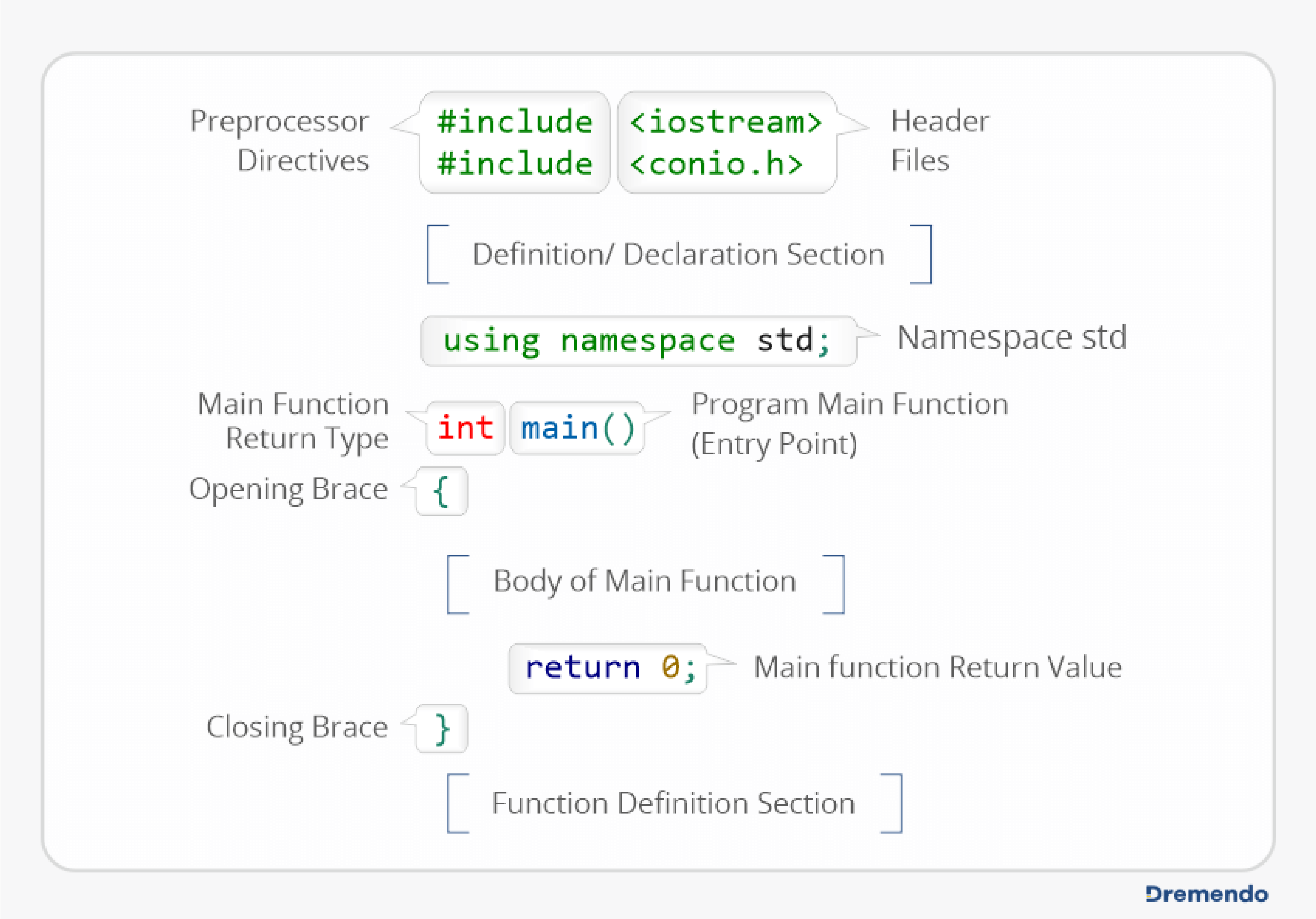
Introduction to C++ Programming Language

Structure of a C++ Program

- Headers and Libraries
- Main Function
- Statements
- Return Statement



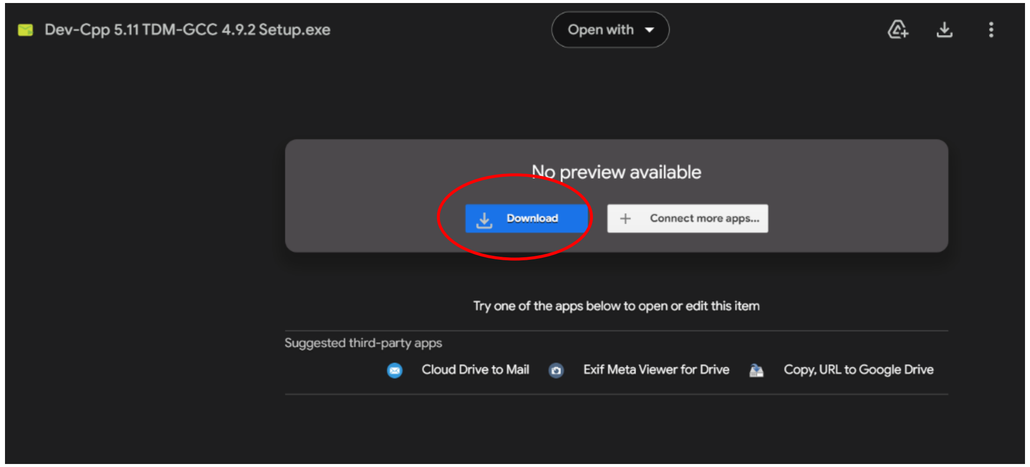
```
#include <iostream>
using namespace std;

int main (){


  return 0;
}
```



Introduction to C++ Programming Language

Setting up an Integrated Development Environment (Dev-C++)

- **Download Dev-C++ IDE**
  - Download Dev-C++ by copiyng the link provide below and paste in your favorite browser.
  - Link: https://drive.google.com/file/d/1f8vLWnmboKLUTJCfiIUCPSt30QV0GEei/view?usp=drive_link

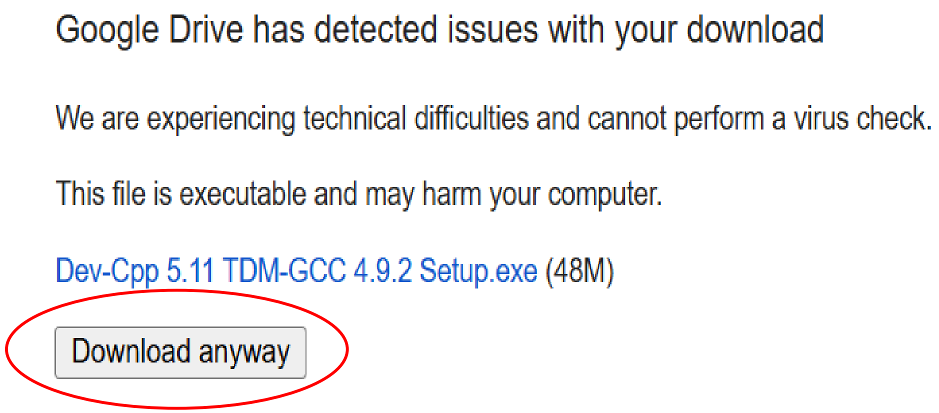


Dev-Cpp 5.11 TDM-GCC 4.9.2 Setup.exe

No preview available

Try one of the apps below to open or edit this item

Suggested third-party apps



Google Drive has detected issues with your download

We are experiencing technical difficulties and cannot perform a virus check.

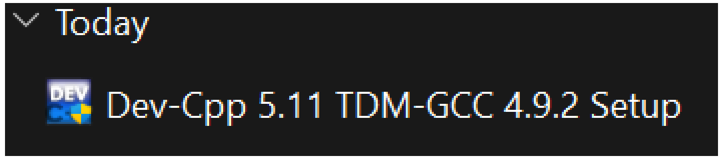
This file is executable and may harm your computer.

Dev-Cpp 5.11 TDM-GCC 4.9.2 Setup.exe (48M)

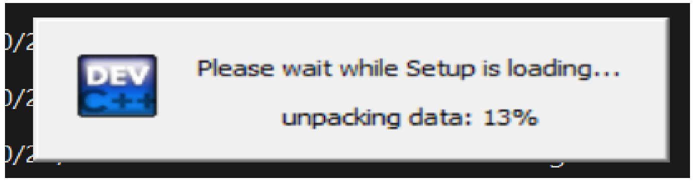
Introduction to C++ Programming Language

Setting up an Integrated Development Environment (Dev-C++)

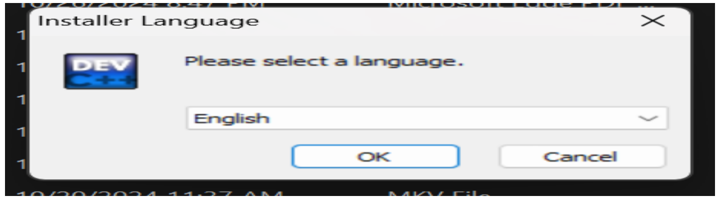
- **Install Dev-C++ IDE**
  - Open the folder where you have downloaded the IDE and double click to install it.



Dev-Cpp 5.11 TDM-GCC 4.9.2 Setup

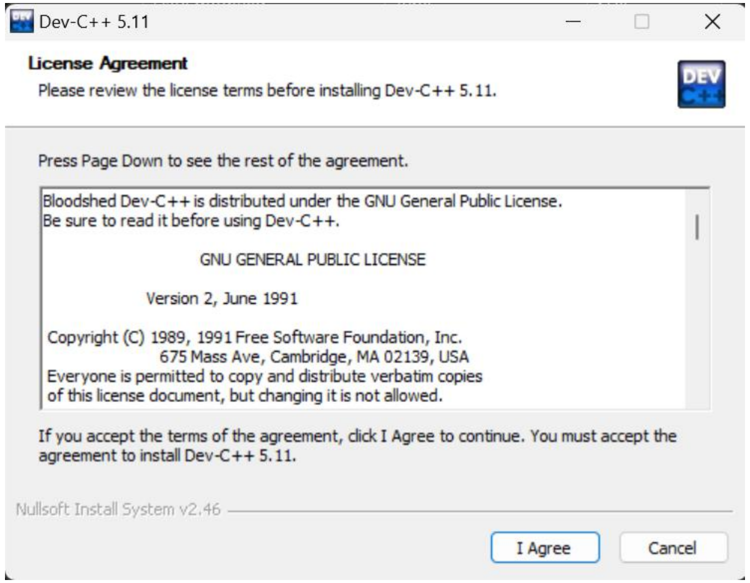

Please wait while Setup is loading...

unpacking data: 13%



Please select a language.

English



License Agreement

Please review the license terms before installing Dev-C++ 5.11.

Press Page Down to see the rest of the agreement.

Bloodshed Dev-C++ is distributed under the GNU General Public License.
Be sure to read it before using Dev-C++.

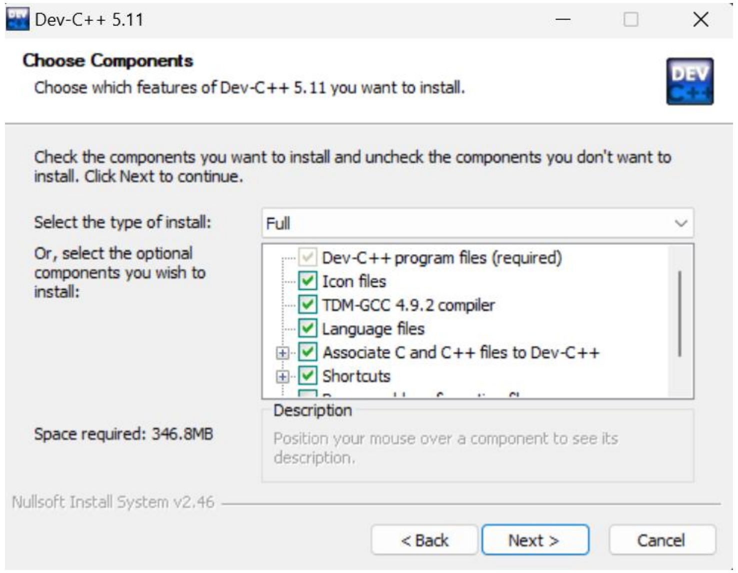
GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc.
675 Mass Ave, Cambridge, MA 02139, USA
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Dev-C++ 5.11.

Nullsoft Install System v2.46



Choose Components

Choose which features of Dev-C++ 5.11 you want to install.

Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.

Select the type of install: Full

Or, select the optional components you wish to install:

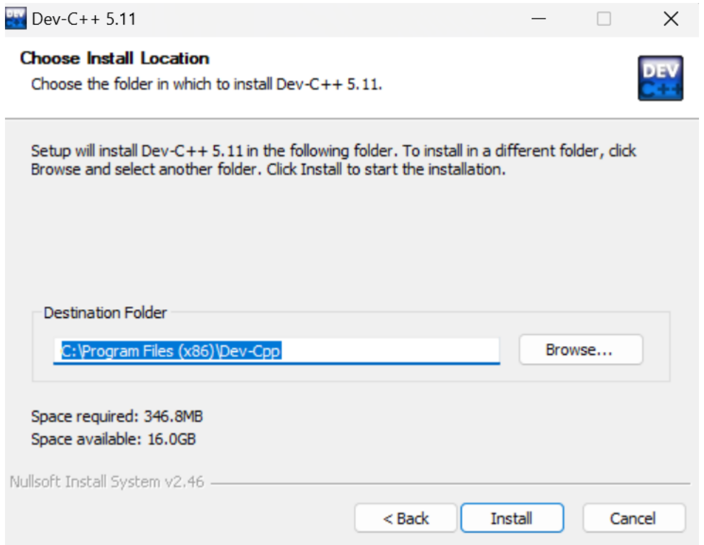
- ☑ Dev-C++ program files (required)
- ☑ Icon files
- ☑ TDM-GCC 4.9.2 compiler
- ☑ Language files
- ☑ Associate C and C++ files to Dev-C++
- ☑ Shortcuts

Space required: 346.8MB

Description

Position your mouse over a component to see its description.

Nullsoft Install System v2.46



Choose Install Location

Choose the folder in which to install Dev-C++ 5.11.

Setup will install Dev-C++ 5.11 in the following folder. To install in a different folder, click Browse and select another folder. Click Install to start the installation.

Destination Folder

C:\Program Files (x86)\Dev-Cpp

Space required: 346.8MB
Space available: 16.0GB

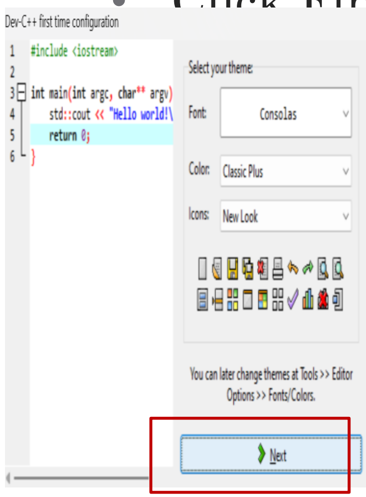
Nullsoft Install System v2.46

Press Enter to All

Introduction to C++ Programming Language

Setting up an Integrated Development Environment (Dev-C++)

- **Install Dev-C++ IDE**
    - Open the folder where you have downloaded the IDE and double click to install it.
    - You installation has been started now.
    - Click Finished when Installed



Dev-C++ first time configuration

```
#include <iostream>

int main(int argc, char** argv)
    std::cout << "Hello world!\
    return 0;
}
```

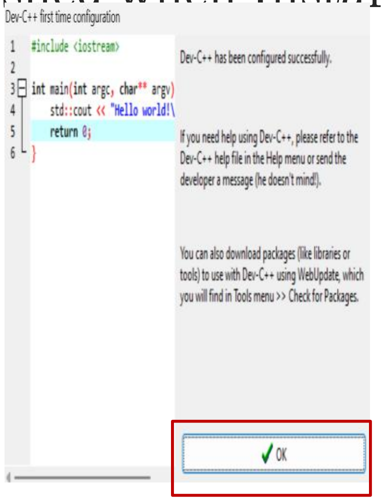
Select your theme:

Font: Consolas

Color: Classic Plus

Icons: New Look

You can later change themes at Tools >> Editor Options >> Fonts/Colors.



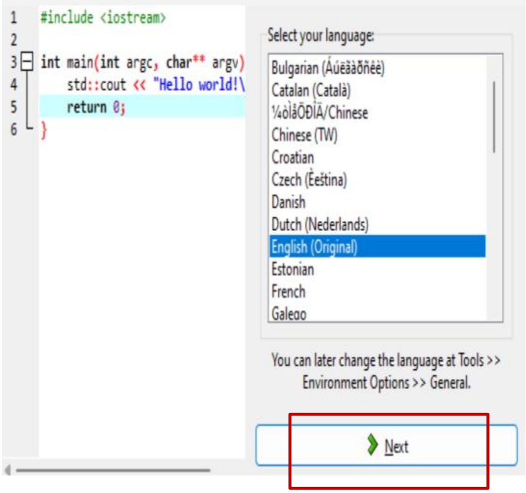
Dev-C++ first time configuration

```
#include <iostream>

int main(int argc, char** argv)
    std::cout << "Hello world!\
    return 0;
}
```

Dev-C++ has been configured successfully.

If you need help using Dev-C++, please refer to the Dev-C++ help file in the Help menu or send the developer a message (he doesn't mind).

You can also download packages (like libraries or tools) to use with Dev-C++ using WebUpdate, which you will find in Tools menu >> Check for Packages.



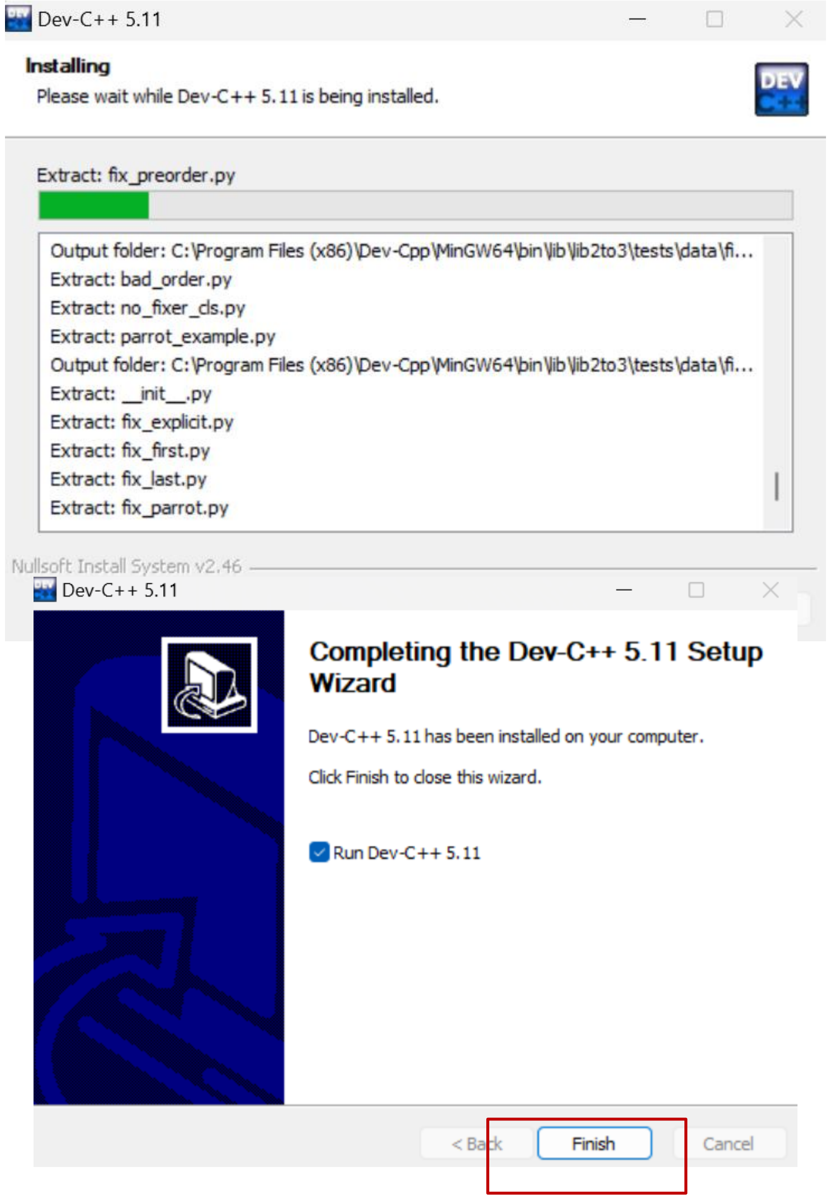
Dev-C++ first time configuration

```
#include <iostream>

int main(int argc, char** argv)
    std::cout << "Hello world!\
    return 0;
}
```

Select your language:

Bulgarian (Áúëãàðñêè)
Catalan (Català)
¼òÌåÖÐÎÄ/Chinese
Chinese (TW)
Croatian
Czech (Èeština)
Danish
Dutch (Nederlands)
English (Original)
Estonian
French
Galego

You can later change the language at Tools >> Environment Options >> General.



Dev-C++ 5.11

Installing

Please wait while Dev-C++ 5.11 is being installed.

Extract: fix_preorder.py

```
Output folder: C:\Program Files (x86)\Dev-Cpp\MinGW64\bin\lib\lib2to3\tests\data\fi...
Extract: bad_order.py
Extract: no_fixer_cls.py
Extract: parrot_example.py
Output folder: C:\Program Files (x86)\Dev-Cpp\MinGW64\bin\lib\lib2to3\tests\data\fi...
Extract: __init__.py
Extract: fix_explicit.py
Extract: fix_first.py
Extract: fix_last.py
Extract: fix_parrot.py
```

Nullsoft Install System v2.46

Dev-C++ 5.11

Completing the Dev-C++ 5.11 Setup Wizard

Dev-C++ 5.11 has been installed on your computer.

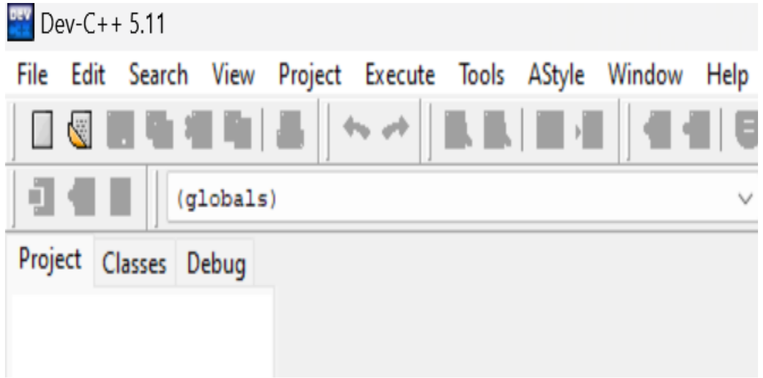
Click Finish to close this wizard.

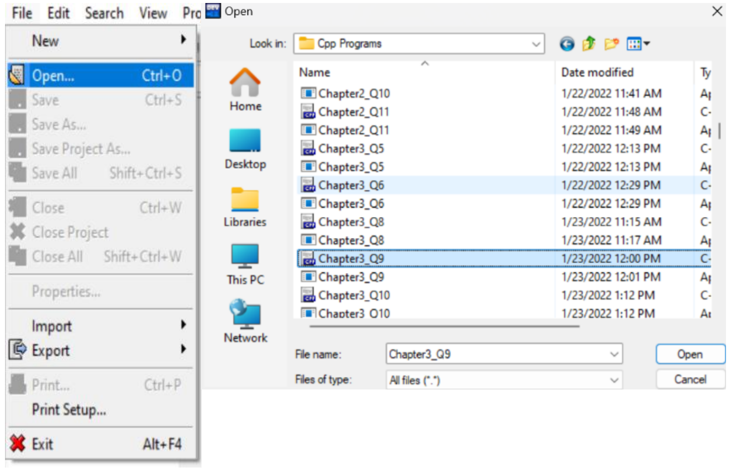
☑ Run Dev-C++ 5.11

Introduction to C++ Programming Language

Setting up an Integrated Development Environment (Dev-C++)

- **Open an Existing Folder**
  - If you have created a folder for your working you can open it by,
    - Click the file in the menu
    - Now click Open sub-menu
    - Go to the directory where you create the folder and open it.



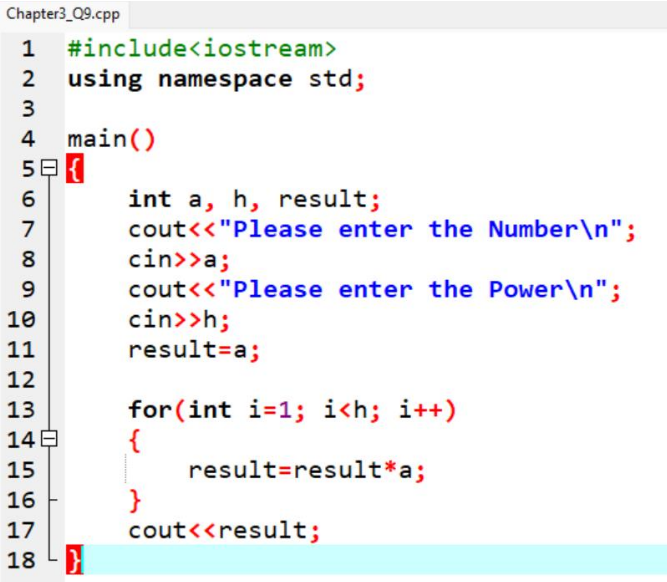


Look in: Cpp Programs

Name	Date modified	Ty
Chapter2_Q10	1/22/2022 11:41 AM	A
Chapter2_Q11	1/22/2022 11:48 AM	C-
Chapter2_Q11	1/22/2022 11:49 AM	A
Chapter3_Q5	1/22/2022 12:13 PM	C-
Chapter3_Q5	1/22/2022 12:13 PM	A
Chapter3_Q6	1/22/2022 12:29 PM	C-
Chapter3_Q6	1/22/2022 12:29 PM	A
Chapter3_Q8	1/23/2022 11:15 AM	C-
Chapter3_Q8	1/23/2022 11:17 AM	A
Chapter3_Q9	1/23/2022 12:00 PM	C-
Chapter3_Q9	1/23/2022 12:01 PM	A
Chapter3_Q10	1/23/2022 1:12 PM	C-
Chapter3_Q10	1/23/2022 1:12 PM	A

File name: Chapter3_Q9

Files of type: All files (*.*)



Chapter3_Q9.cpp

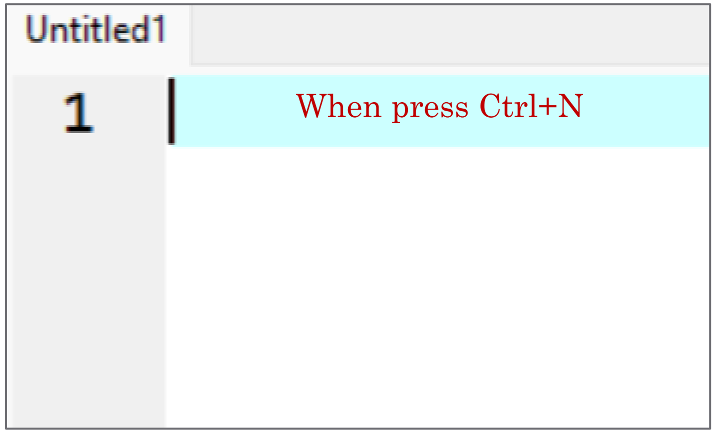
```
#include<iostream>
using namespace std;

main()
{
    int a, h, result;
    cout<<"Please enter the Number\n";
    cin>>a;
    cout<<"Please enter the Power\n";
    cin>>h;
    result=a;

    for(int i=1; i<h; i++)
    {
        result=result*a;
    }
    cout<<result;
}
```

Introduction to C++ Programming Language

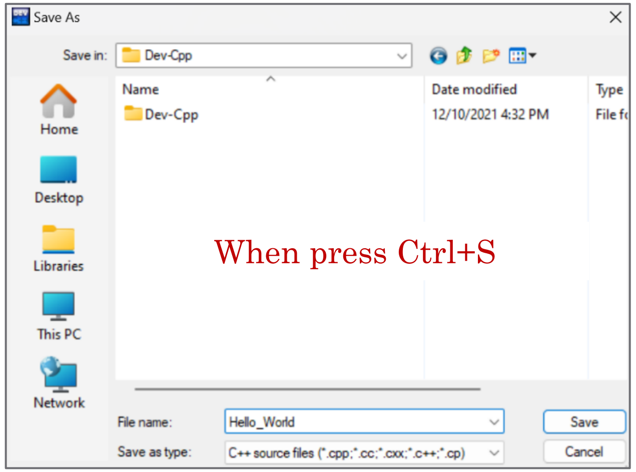
Setting up an Integrated Development Environment (Dev-C++)

- **Create New From Start**
  - If you have not created any Folder yet you can start as
  - Open Dev-C++ application
  - Press Ctrl+N, it will create a new file with untitled name
  - Press Ctrl+S and save the file in you desire directory.
  - Now Compile the file and then Run it.

Empty Page



When press Ctrl+N



Save As

Save in: Dev-Cpp

Name	Date modified	Type
Dev-Cpp	12/10/2021 4:32 PM	File fo

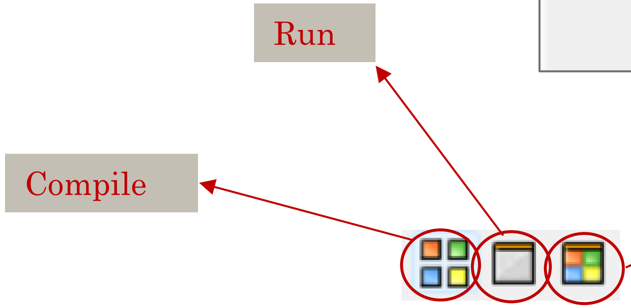
File name: Hello_World

Save as type: C++ source files (*.cpp;*.cc;*.cxx;*.c++;*.cp)

Save

Cancel

When press Ctrl+S



Run

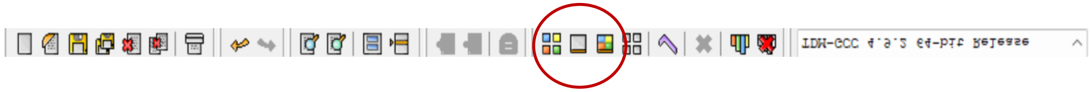
Compile

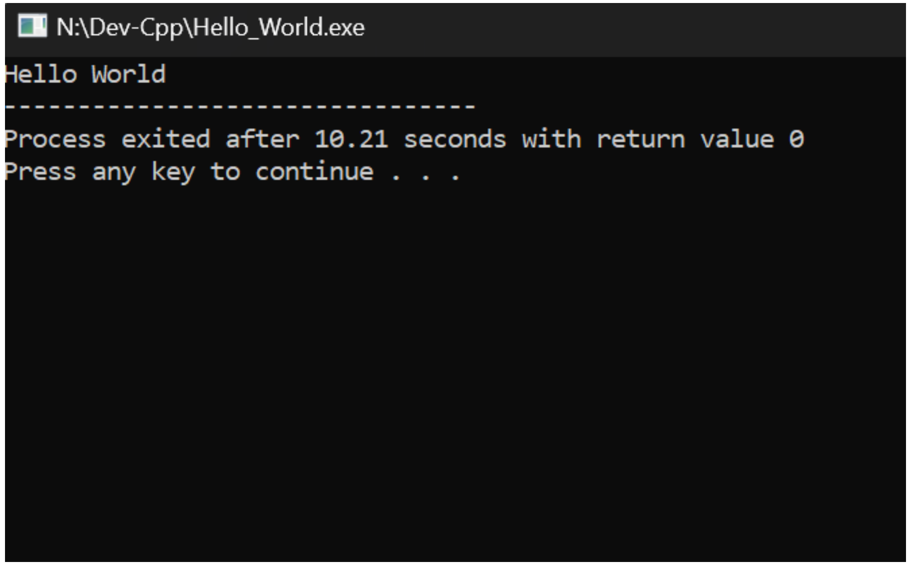
Compile and Run

Introduction to C++ Programming Language

Setting up an Integrated Development Environment (Dev-C++)

- **Compile, Run and Output**
  - If you want to run your file you have to compile it first as follows
    - Look at the menu for the icons seen on previous slide.
    - One is for compilation of the code
    - Second one is for running
    - And the third one is for both compilation and running.
  - When you compile and run the code, you can see your program output on the black screen which is .exe file of your code.




N:\Dev-Cpp\Hello_World.exe

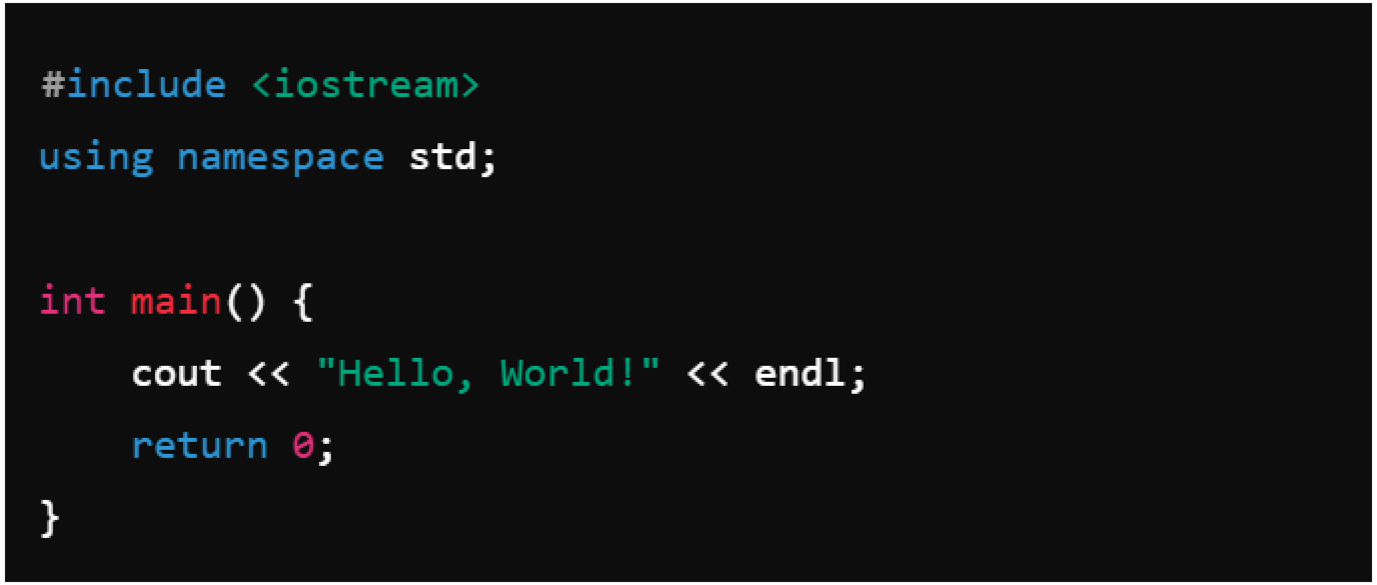
```
Hello World
--------------------------------
Process exited after 10.21 seconds with return value 0
Press any key to continue . . .
```

Basic Syntax and First Program

Hello, World Program

- The "Hello, World!" program is a classic first program that displays "Hello, World!" on the screen. It helps introduce basic C++ syntax and structure.

Example Code

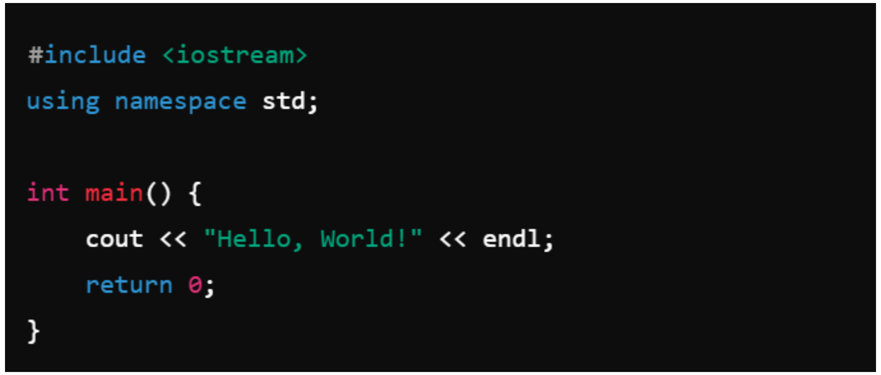


```
#include <iostream>
using namespace std;

int main() {
    cout << "Hello, World!" << endl;
    return 0;
}
```

Basic Syntax and First Program

Explanation of Code Structure

- #include <iostream>: Includes the iostream library, which contains functions for input and output.
- using namespace std; : Allows the use of standard library functions without prefixing them with std:: (e.g., cout instead of std::cout)
- int main() { ... } : Defines the main function, where the program starts execution.
- cout << "Hello, World!" << endl; : Outputs "Hello, World!" to the screen.
  - cout is used for output.
  - << is the stream insertion operator that sends data to the output.
  - endl adds a newline at the end of the output.
- return 0; : Signals successful program completion to the operating system.

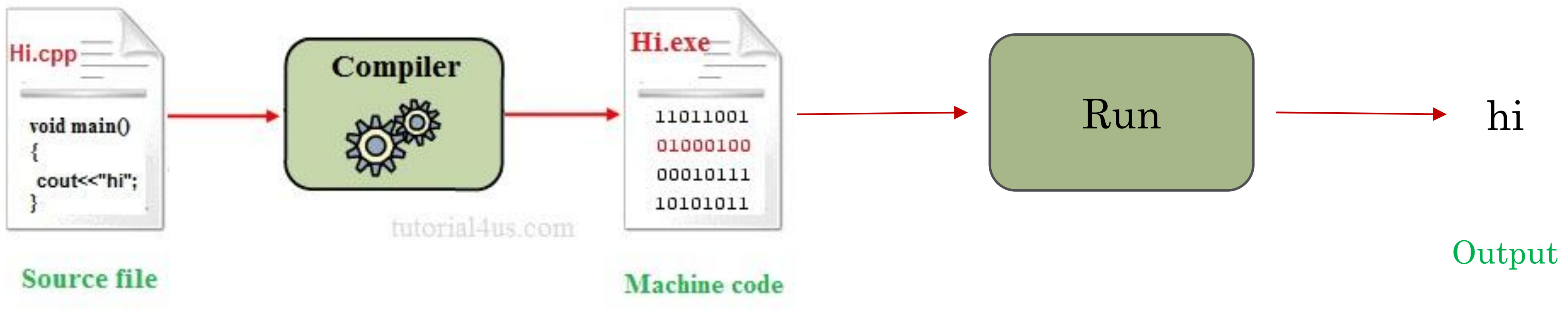


```
#include <iostream>
using namespace std;

int main() {
    cout << "Hello, World!" << endl;
    return 0;
}
```

Basic Syntax and First Program

Running and Compiling a Program

- **Compile**: Use the IDE's "Build" or "Compile" option to check for syntax errors and convert the code to machine language.
- **Run**: After successful compilation, use "Run" to execute the program and see the output.

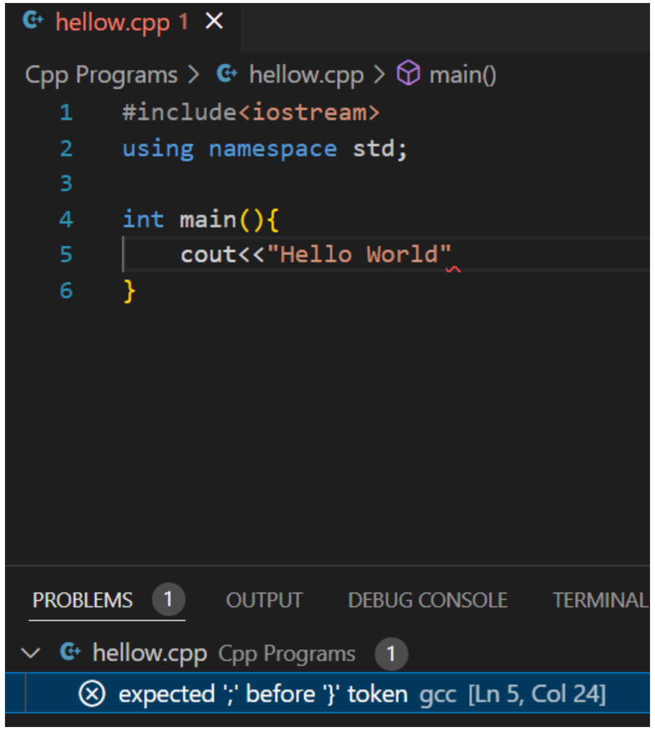


```
void main()
{
 cout<<"hi";
}
```

Basic Syntax and First Program

Understanding Errors

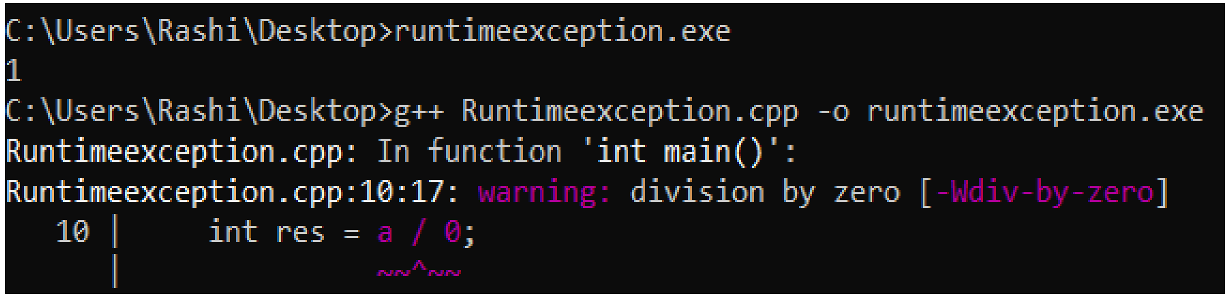
- **Syntax Errors:** Mistakes in code structure, like missing “ **;** “ or mismatched brackets { }.
- **Runtime Errors**: Errors that occur when the program is running, like dividing by zero.
- **Logical Errors**: The program runs but does not produce the expected output due to incorrect logic.



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

int main(){
    cout<<"Hello World"
}
```

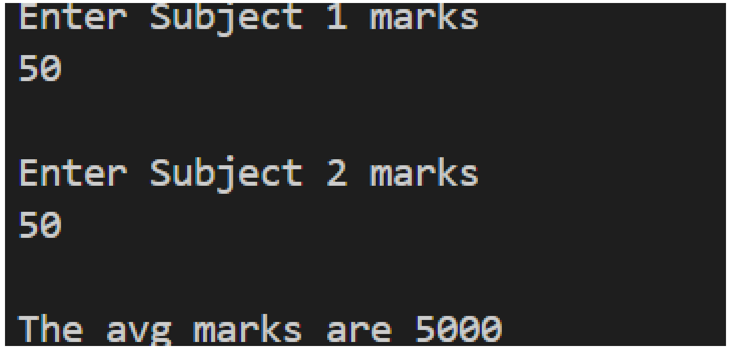
```
expected ';' before '}' token gcc [Ln 5, Col 24]
```

Syntax Error



```
C:\Users\Rashi\Desktop>runtimeexception.exe
1
C:\Users\Rashi\Desktop>g++ Runtimeexception.cpp -o runtimeexception.exe
Runtimeexception.cpp: In function 'int main()':
Runtimeexception.cpp:10:17: warning: division by zero [-Wdiv-by-zero]
   10 |     int res = a / 0;
      |               ~~^~~
```

Runtime Error



```
Enter Subject 1 marks
50

Enter Subject 2 marks
50

The avg marks are 5000
```

Logical Error

Thank You