Setup a C++ Programming Environment on Windows

using Visual Studio Code, GCC C++ compiler (g++) and mingw-w64 GDB debugger

Sources:

- Using GCC with MinGW
- Basic C and C++ Windows Setup (MSYS2 + Git + VSCodium + CMake + Make + Library Install)

Click on each ▶ symbol below to see the steps. The %USERNAME% refers to your user name. All typed commands may be copy(highlight, then Ctrl+c)-pasted(Ctrl+v) into the needed location, instead of being typed there. Press the Enter key when you finish typing each typed command and are ready to execute it.

Don't be scared by the multitude of steps: many of them are optional, and quite a few are extremely simple, like a single key press. Focus on the "Do" column, and check the rest only when needed.

▼ Install MSYS2 software distribution/building platform for Windows

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	the Run dialog opens in the bottom left of the Windows desktop
the Open: field of the dialog	type cmd	open the console	the console window opens with the C:\Users\%USERNAME%> command prompt
the console	type winget install msys2.msys2	install the MSYS2	status bar appears on the console
same console, when prompted	type Y	accept all conditions	download and installation start and continue until the C:\Users\%USERNAME%> prompt appears when everything completes
(OPTIONAL) same console	type dir C:\msys64*msys2.exe /w/o/s/p	check the install	the directory C:\msys64 and the file msys2.exe appear in the output of this command
same console	keep it open	reuse it in the subsequent step	nothing new

▼ Install the MinGW-w64 compilation/debugging toolchain using MSYS2

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
The Open: field of the dialog	type C:\msys64\msys2.exe	open the MSYS shell	the MSYS shell window opens with the $ command prompt
The MSYS shell	type pacman -S --needed base-devel mingw-w64-ucrt-x86_64-toolchain	install the toolchain	a list of package appears appears on the shell, giving the default for selecting all of them
pacman command Enter a selection (default=all): prompt	press key Enter	select all the packages in the toolchain	download and installation start and continue until the $ command prompt appears when everything is done
pacman command :: Proceed with installation? [Y/n] prompt	type Y	install everytihng	download and installation start and continue until the $ command prompt appears when everything is done
(OPTIONAL) go back to the console (or reopen it as described earlier if you accidentally closed it)	type dir C:\msys64\ucrt64\bin* /w/o/s/p	check that the main tools are there	the files g++.exe, gcc.exe, and gdb.exe appear (among many others listed)

(OPTIONAL) same console	type (one line at a time): C:\msys64\ucrt64\bin\g++.exe --version C:\msys64\ucrt64\bin\gcc.exe --version C:\msys64\ucrt64\bin\gdb.exe --version	check that these tools actually work	each command shows the version of each tool installed
Console and MSYS shell	this time, close both of these windows	start fresh after the next step	empty Windows desktop

▼ Add the installed toolchain location to the PATH environment variable

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
The Open: field of the dialog	type rundll32 sysdm.cpl,EditEnvironmentVariables	open the Environment Variables dialog	the Environment Variables dialog appears
the User variables for %USERNAME% window on the top of the dialog	double-click the Path	edit the %PATH% variable	the Edit environment variable dialog appears
the Edit environment variable dialog	press the New button on the right and type C:\msys64\ucrt64\bin in the field that appears	add the location of the toolchain to the path	the Edit environment variable dialog appears
the Edit environment variable dialog	press the OK button on the bottom	accept the change	the Edit environment variable dialog closes
the User variables for %USERNAME% dialog	press the OK button on the bottom	accept the change	the User variables for %USERNAME% dialog closes
(OPTIONAL) Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
(OPTIONAL) The Open: field of the dialog	type cmd	open the console	the console window opens with the C:\Users\%USERNAME%> command prompt
(OPTIONAL) same console	type (one line at a time): g++ --version gcc --version gdb --version	check that the console can find these tools	each command shows the version of each tool installed

▼ Write, compile and run C++ code directly, without an IDE

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
The Open: field of the dialog	type cmd	open the console	the console window opens with the C:\Users\%USERNAME%> command prompt
The console	type mkdir C:\Users\%USERNAME%\Desktop\projects (note that we use an absolute path in the above command)	create the projects folder	new folder projects appears on the desktop
Same console	type cd C:\Users\%USERNAME%\Desktop\projects (absolute path again)	get into the projects folder	the command prompt of the console turns into C:\Users\%USERNAME%\Desktop\projects>
Same console	type mkdir hello (note that we use a path relative to the current location of the console, meaning that we are creating a sub-folder C:\Users\%USERNAME%\Desktop\projects\hello inside of the C:\Users\%USERNAME%	create the hello subfolder	new subfolder hello appears inside the projects

	\Desktop\projects folder		
Same console	type cd hello (relative path again)	get into the hello folder	the command prompt of the console turns into C:\Users\%USERNAME%\Desktop\projects>
Same console	type notepad main.cpp	create and edit the main.cpp file inside of the hello folder	Notepad window opens and a prompt says: Cannot find the C:\Users\%USERNAME%\Desktop\projects\hello\main.cpp file. Do you want to create a new one?
Notepad dialog	press the Yes button	open the file main.cpp for editing	Notepad dialog closes, leaving an empty main.cpp Notepad window

main.cpp Notepad window	type
	#include <iostream>
	using namespace std;
	
	int main(){
	cout << "Hello world!" << endl;
	return 0;
	}
	then save the file and close the Notepad window.
		create the main.cpp file	Notepad the Notepad window closes, but the file main.cpp now contains the code pasted there

Same console	type g++ main.cpp	compile the main.cpp source file	the prompt returns with no messages displayed
Same console	type dir	check that the executable file a.exe was created	a new executable file a.exe appears in the file list
Same console	type a	run the a.exe executable file	Hello world! appears on the console

▼ Install the Visual Studio Code IDE from Microsoft

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
The Open: field of the dialog	type cmd	open the console	the console window opens with the C:\Users\%USERNAME%> command prompt
The console	type winget install VSCode	install the Visual Studio Code from Microsoft	status bar appears on the console and the program installs
(OPTIONAL) same console	type dir "C:\Users\%USERNAME%\AppData\Local\Programs\Microsoft VS Code\bin"	check the install	the directory C:\Users\user\AppData\Local\Programs\Microsoft VS Code\bin should contain the file code
Same console	close the console window	start fresh after the VSCode Install (which updates the Path variable for any console open subsequent to the install)	empty Windows desktop

▼ Load Visual Studio Code C++ extensions and link it to the compiler/debugger installed earlier

Starting with	Do	In order to	What should happen
Windows desktop	press keys Windows+R	open the Run dialog	The Run dialog opens in the bottom left of the Windows desktop
The Open: field of the dialog	type cmd	open the console	the console window opens with the C:\Users\%USERNAME%> command prompt
The console	type cd C:\Users\%USERNAME%\Desktop\projects\hello	get inside of the hello folder	the console command prompt should turn into cd C:\Users\%USERNAME%

			\Desktop\projects\hello>
same console	type code .	open the current directory, namely C:\Users\ %USERNAME% \Desktop\projects\hello in Visual Studio Code	Visual Studio Code window opens with the dialog Do you trust the authors of the files in this folder?
Visual Studio Code dialog	select Yes, I trust the authors	allow Visual Studio to run code in the opened folder	the dialog disappears
Visual Studio Code window	press keys Ctrl+Shift+X	open the EXTENSIONS view	the EXTENSIONS view opens in a new pane on the left of the Visual Studio Code window
Search Extensions in Marketplace search box on the top of the EXTENSIONS view	type C++	find the **C/C++** C/C++ IntelliSense, debugging, and code browsing. Microsoft extension	the extensions relevant for C++ appear in the EXTENSIONS view, with the one we are looking for on the top
the EXTENSIONS view	press the Install button under the C/C++ IntelliSense, debugging, and code browsing. extension	add the extension to Visual Studio Code	the details for the extension appear in the main pane and the extension is installed
the Visual Studio Code window	press keys Ctrl+Shift+E	open the File EXPLORER view	the EXPLORER view opens in the left pane of the Visual Studio Code window
the EXPLORER view	click on the file main.cpp	open the for editing	the dialog Do you want to install the recommended 'C/C++ Extension Pack' extension from Microsoft for the C++ language? opens on the bottom of the main pane
the install confirmation dialog	press the Install button	install the recommended extension	the installation ends with the details of C/C++ Extension Pack displayed in the main pane
the Visual Studio Code window	press (again) keys Ctrl+Shift+E	open the File EXPLORER view	the EXPLORER view opens in the left pane of the Visual Studio Code window
the EXPLORER view	click (again) on the file main.cpp	open the for editing	the main.cpp file opens in the main pane
the top right corner of Visual Studio Code window	press the play button (which looks like the ▷ symbol with little bug on the bottom)	configure the run and debug options for C++ code	the dropdown list of detected compilers appears with a Select a debug configuration field on the top
the dropdown of detected compilers	click the C/C++: g++.exe build and debug active file preLaunchTask: C/C++: g++.exe build active file Detected Taks	set the default compiler for the current project in .vscode\tasks.json file	the build process starts and completes
the tabs below the main pane	click the TERMINAL tab	verify program compilation and execution	Hello world! appears in the TERMINAL tab under the main pane
the RUN AND DEBUG pane on the left of the window	press the Run and Debug button	configure the debugger	Select debugger dropdown menu appears on the top of the window
the Select debugger dropdown	click C++ (GDB/LLDB)	select the installed debugger	setup completes