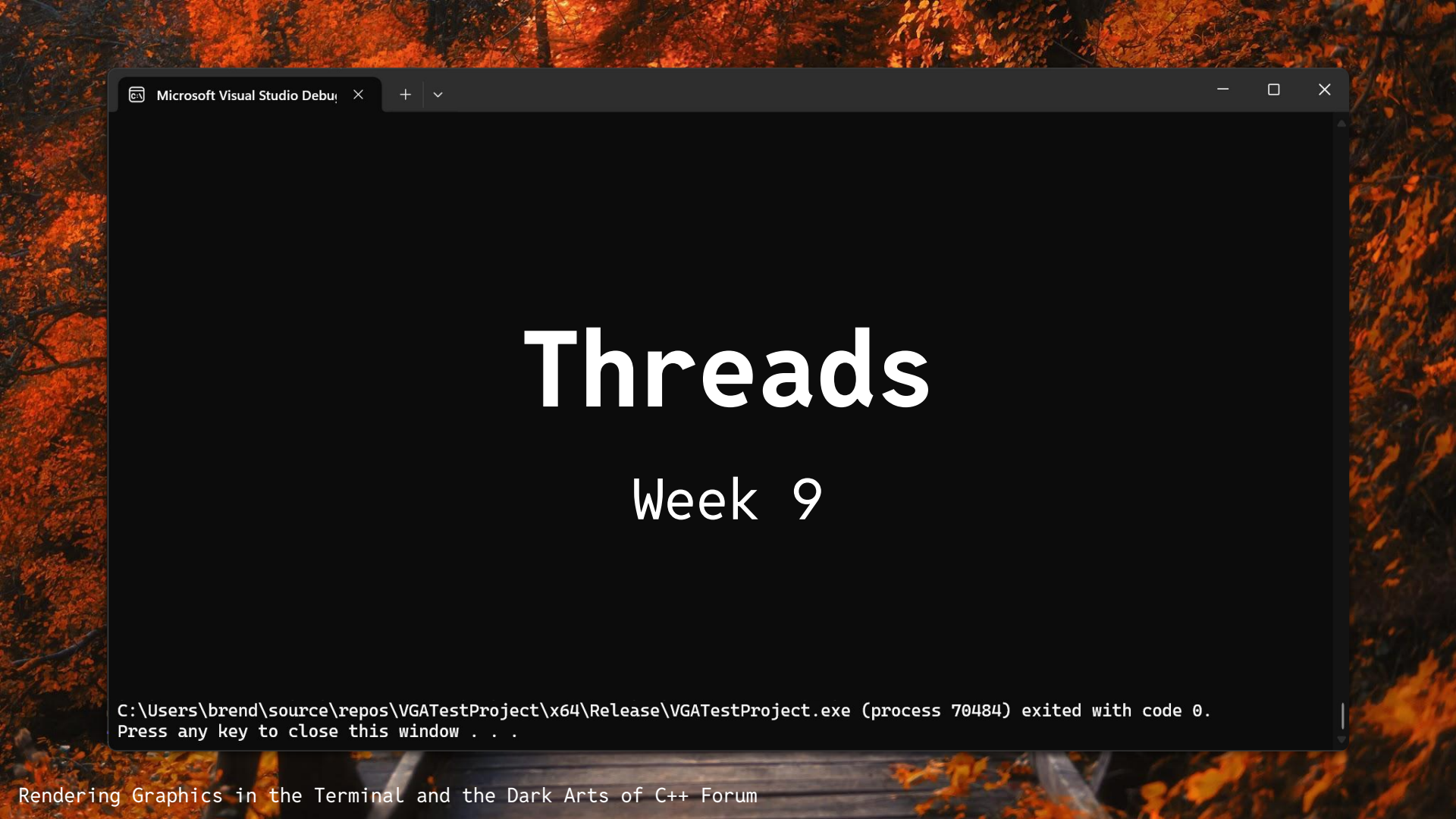
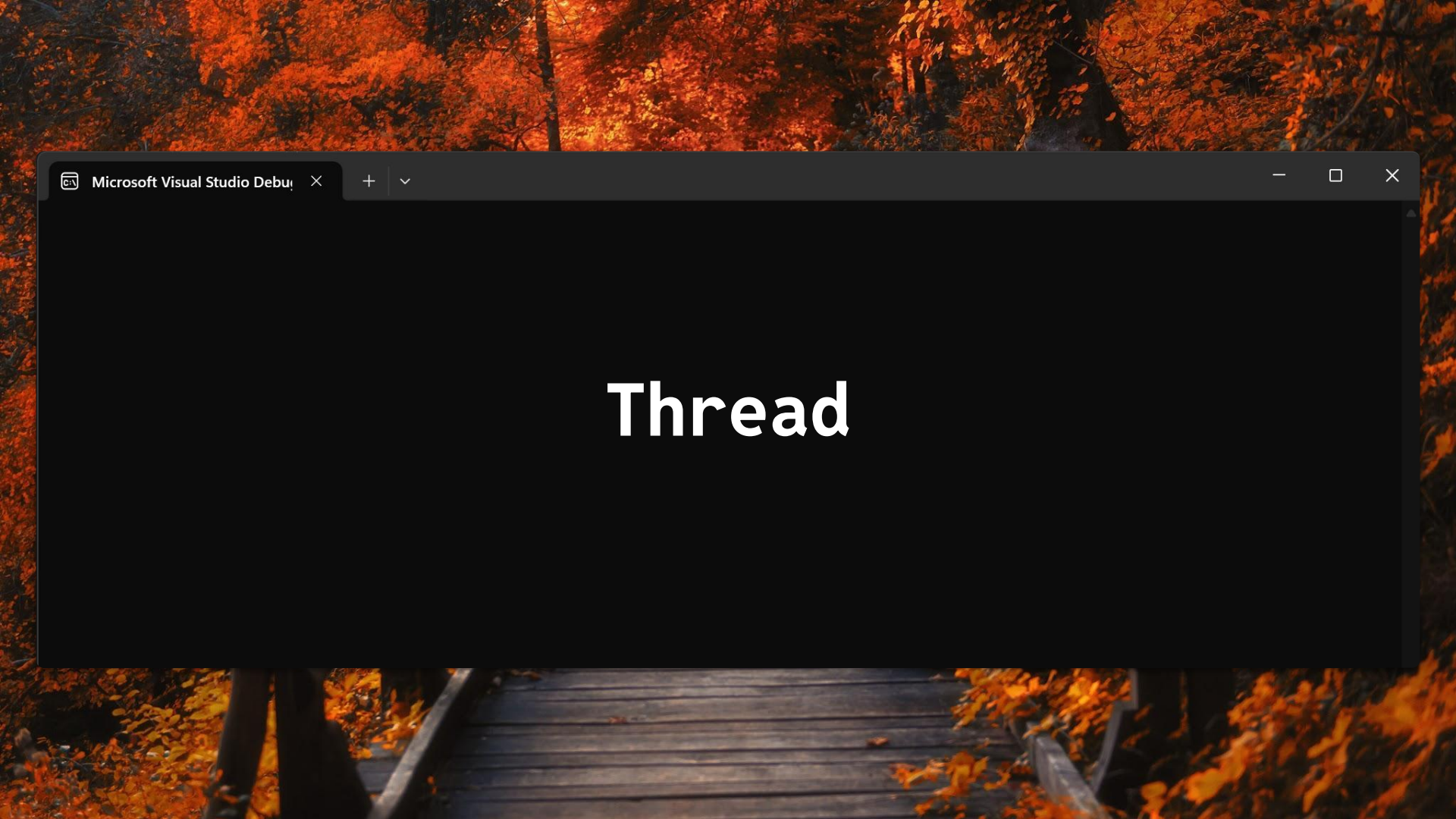

Microsoft Visual Studio Debu
Threads
Week 9
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .


Microsoft Visual Studio Debu
Thread

Microsoft Visual Studio Debu

Needle and Thread?

Computers run on a clock.

Every “tick” each the computer executes a simple instruction then moves on.

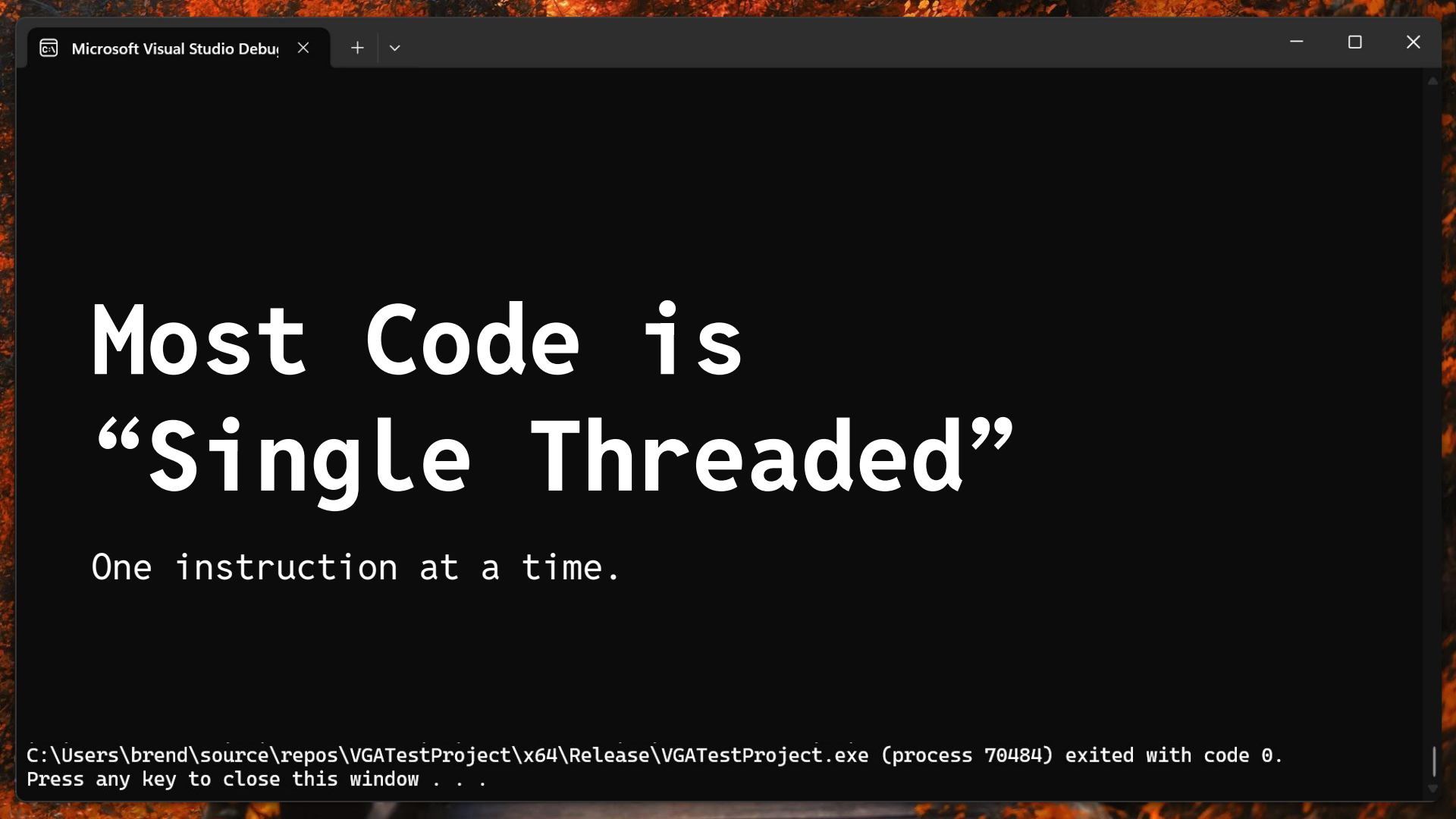
Each thread lets the CPU do an instruction per tick, so long as it is affecting different registers than the other threads.

**This is a massive oversimplification*

Thus, each thread runs a simultaneous process

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```


Microsoft Visual Studio Debu
Threading


Microsoft Visual Studio Debu
Most Code is
“Single Threaded”
One instruction at a time.
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .

Microsoft Visual Studio Debu

Multithreading

Running code across multiple threads to speed up processing

- These threads will break off the main thread and eventually must return to the main thread.
- Different CPUs have different thread counts
- If you need data from a thread, you must await it to grab the data or wait until the thread is done
- Having many threads accessing a pointer creates data races

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```

Microsoft Visual Studio Debu

This isn’t Parallel Processing

Parallel processing uses the GPU, which is designed to have tons of threads that perform the same operation at once.

The CPU runs one instruction iteratively or a sequence of instructions, even when **multithreading**.

Essentially:

Parallel Processing – Thousands of the Same Instruction

Multithreading – Multiple CPUs Processes

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```

Microsoft Visual Studio Debu

Le Code

```
#include <thread>

auto function = [](params) {

    Statements;

}; // This is a lambda, but could be a normal function


std::thread threadObject (function, param); // Runs When Created

threadObject.join();
```

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```

Microsoft Visual Studio Debu

When threads finish

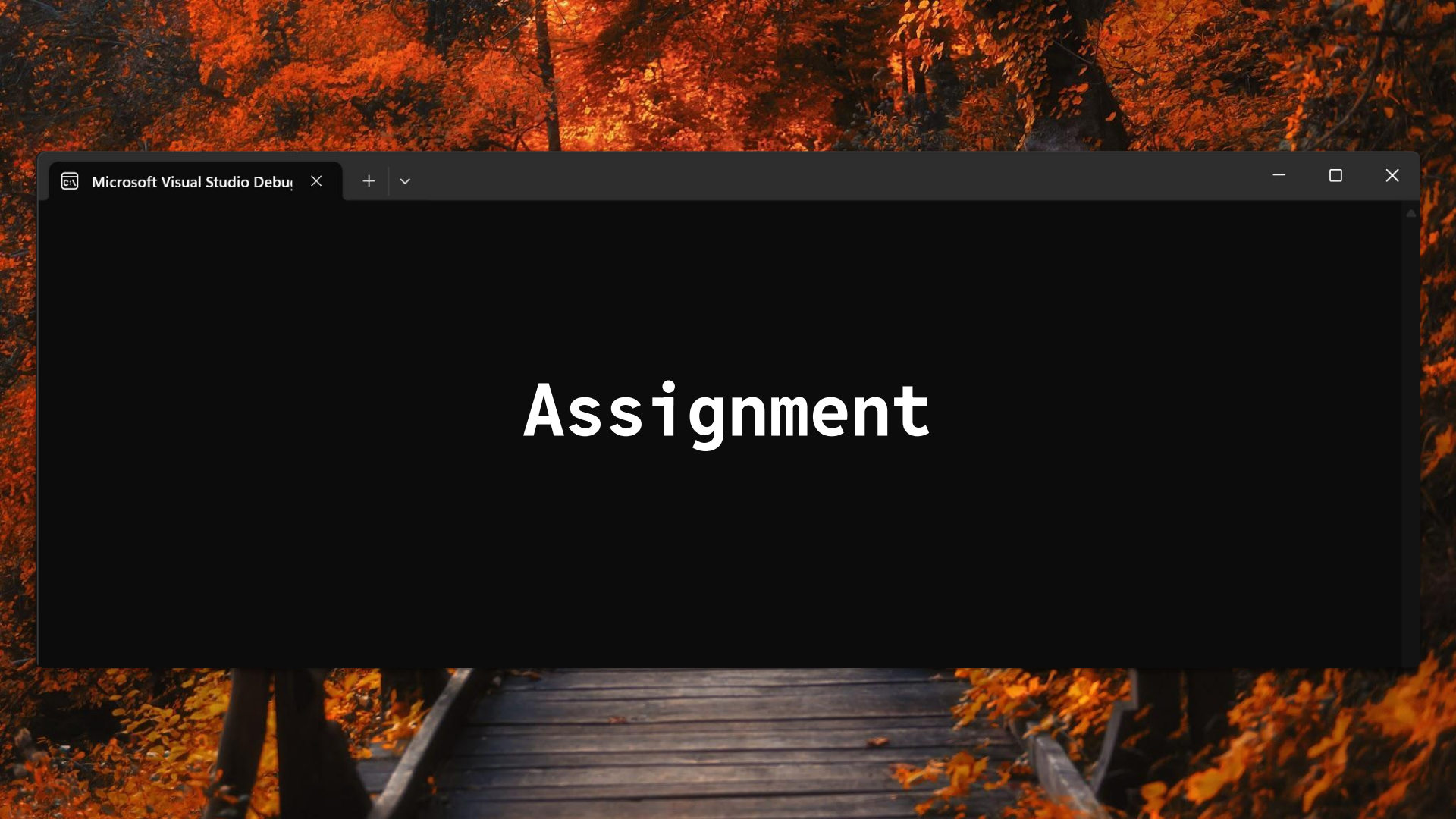
```
threadObject.join() // Wait for thread to finish

threadObject.detach() // Separates the thread's execution from
its variable.
```

You can only delete a thread safely after one of these has been called.

You can only access data in use by a thread if .join() is used

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```


Microsoft Visual Studio Debu
Assignment

Microsoft Visual Studio Debu

Multithread your “Rendering”

Fill the a second video buffer while rendering your current one to the console.

I will walk you through this process in class!

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.
Press any key to close this window . . .
```