



The Deadlock Empire



Slay dragons, master concurrency!

Welcome to **The Deadlock Empire**, commander!

The skills you need are your intelligence, cunning, perseverance and the will to test yourself against the intricacies of multi-threaded programming in the divine language of C#. Each *challenge* below is a computer program of two or more threads. You take the role of the Scheduler - and a cunning one! Your objective is to exploit flaws in the programs to make them crash or otherwise malfunction.

For example, you might cause a deadlock (<http://en.wikipedia.org/wiki/Deadlock>) to occur or you might schedule context switches in such a way that two threads enter the same critical section (http://en.wikipedia.org/wiki/Critical_section) at the same time. Any action that disrupts the program this way counts as a victory for you.

You are the **Scheduler** - you only have one tool at your disposal: the ability to switch contexts at any time, as the total master of time and interruptions. Let's hope it is enough... it has to be, because the Parallel Wizard's armies are upon us and only you can lead the Sequentialist armies into victory!

Tutorial

Learn to fight.



Tutorial 1: Interface

Click here to begin the tutorial.



Tutorial 2: Non-Atomic Instructions

In the second tutorial, you will learn to expand statements.

Unsynchronized Code

The war has begun. *The Deadlock Empire* attacks!



Boolean Flags Are Enough For Everyone

Or so thinks the Deadlock Empire.



Simple Counter

Is the Deadlock Empire stupid?



Confused Counter

Could it be that some instructions are hidden from sight?

Locks

...because in the end, you're going to simply lock everything, anyway.



Insufficient Lock

Locks don't solve everything.



Deadlock

Stop the Empire army in its tracks!



A More Complex Thread

Three locks, two threads, one flag.

High-Level Synchronization Primitives

Microsoft has deemed even locks too complicated. Rightly so.



Manual Reset Event

Introduces the `ManualResetEventSlim` class, a no-fuss simple primitive.



Countdown Event

Introduces the `CountdownEvent` class, a more powerful barrier but also trickier.



Countdown Event Revisited

I fixed the bug. What are you going to do about it, huh?



The Barrier

The Deadlock Empire rolls out a new defensive weapon.

Semaphores

Sabotage the Deadlock Empire's factories!



Semaphores

A semaphore is a simple synchronization primitive.



Producer-Consumer

A new victory condition awaits you!



Producer-Consumer (variant)

The victory conditions just keep coming!

Condition Variables

We had to get to them eventually...



Condition Variables

Don't worry. It's not *that* hard.

The Final Stretch

Defeat the Parallel Wizard using everything you have learned so far!



Dragonfire

Withstand the onslaught of the Parallel Wizard's legions!



Triple Danger


You face not only a two-headed dragon, but a sorcerer as well!



Boss Fight

This is it. The final duel between the Master Scheduler and the Parallel Wizard.

 Submit feedback

 Clear progress

Share 1.9K

Got any ideas or feedback? Both are much appreciated at this form
(<http://goo.gl/forms/i05ukNUMmB>).

GitHub: [deadlockempire/deadlockempire.github.io](https://github.com/deadlockempire/deadlockempire.github.io)
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