# Parallel Processing: Takeaways



## Syntax

- Creating and starting new threads:

```
import threading
 counter = Counter()
 count_thread = threading.Thread(target=count_up_100000, args=[counter])
 count_thread.start()
```

- Joining a thread with the main thread:

```
thread.join()
```

- Using threading.Lock:

```
def conduct_trial():
     counter = Counter()
     lock = threading.Lock()
     count_thread = threading.Thread(target=count_up_100000, args=[counter, lock])
     count_thread.start()
     intermediate_value = counter.get_count()
     count_thread.join()
     return intermediate_value
```

## Concepts

- A multi-core central processing unit (CPU) has the ability to run multiple instructions simultaneously.

- Parallel processing is the technique of taking advantage of modern multi-core CPUs to run multiple programs at once.
- Immutable variables, such as integers, cannot be changed. Mutable variables, such as dictionaries and lists, are mutable. Mutable variables are especially useful in parallel processing because you often want to share and edit the same data between different processes.
- Multithreading refers to the technique of running multiple processes at once.
- A thread refers to any one path of execution in a program.
- Blocking refers to waiting for a condition to execute. For example, the main thread will wait until the other thread has finished executing.
- A program is deterministic if we can precisely predict its output for a particular input. On the other hand, a program is nondeterministic if we can't reliably predict the outcome of running a piece of code.
- By nature, multithreading is nondeterministic; however, we can use `threading.Lock` to combat this. A lock is a way of conditionally blocking the execution of some threads. At any given time, a lock is either available or acquired.
- Atomic operations finish executing before any operations can occur. On the other hand, nonatomic operations can run simultaneously while other operations are occurring.

## Resources

- Documentation for threading library
- Multithreading