Java ReentrantLock Reentrant Mutex Semantics

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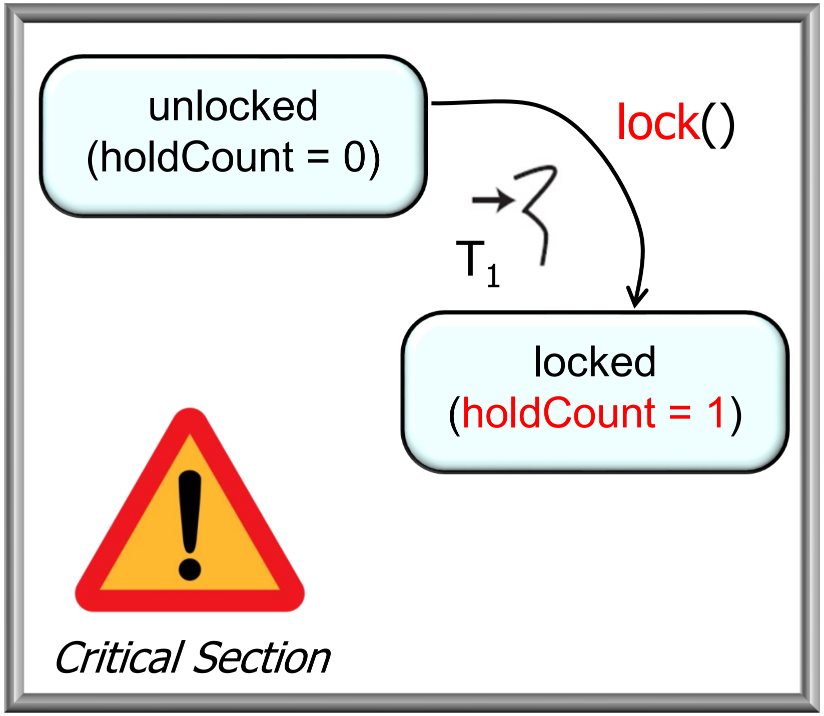
Learning Objectives in this Part of the Lesson

- Understand the concept of mutual exclusion in concurrent programs
- Note a human-known use of mutual exclusion
- Recognize the structure & functionality of Java ReentrantLock
- Be aware of reentrant mutex semantics



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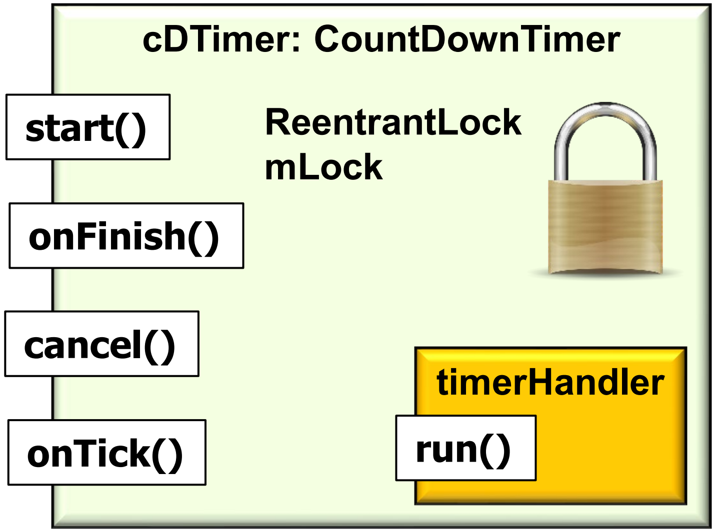
- Be aware of reentrant mutex semantics
  - In the context of Java ReentrantLock & the Android CountDownTimer framework



See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex24

Overview of Reentrant Mutex Semantics

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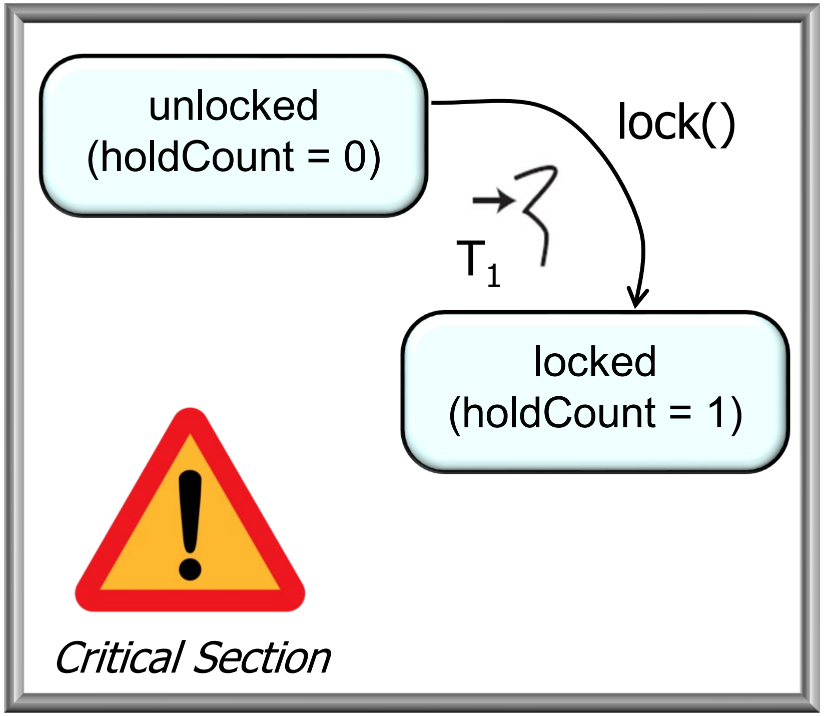
- A ReentrantLock supports "reentrant mutex" semantics



See en.wikipedia.org/wiki/Reentrant_mutex

Overview of Reentrant Mutex Semantics

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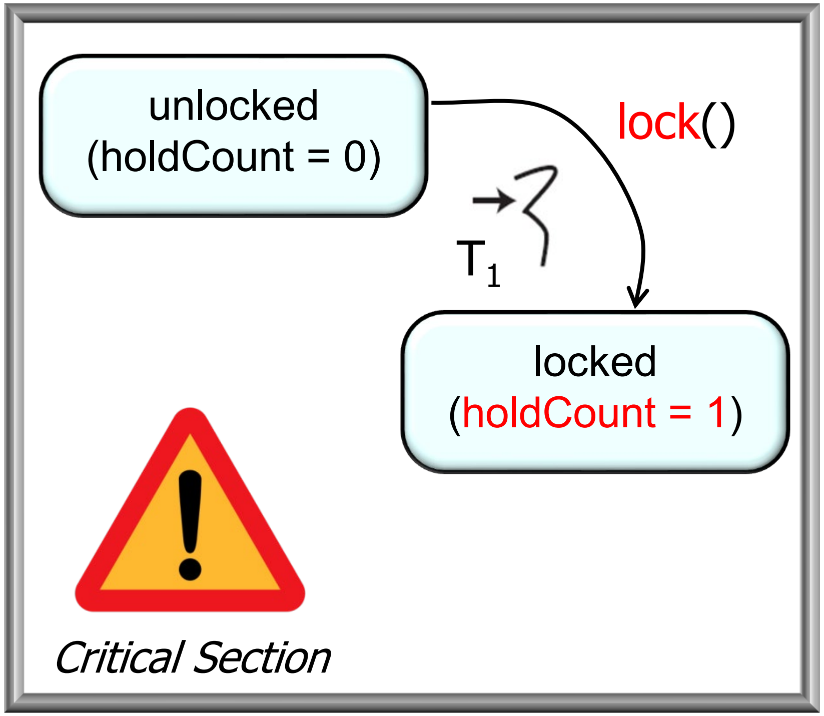
  - The thread holding the mutex can reacquire it without self-deadlock



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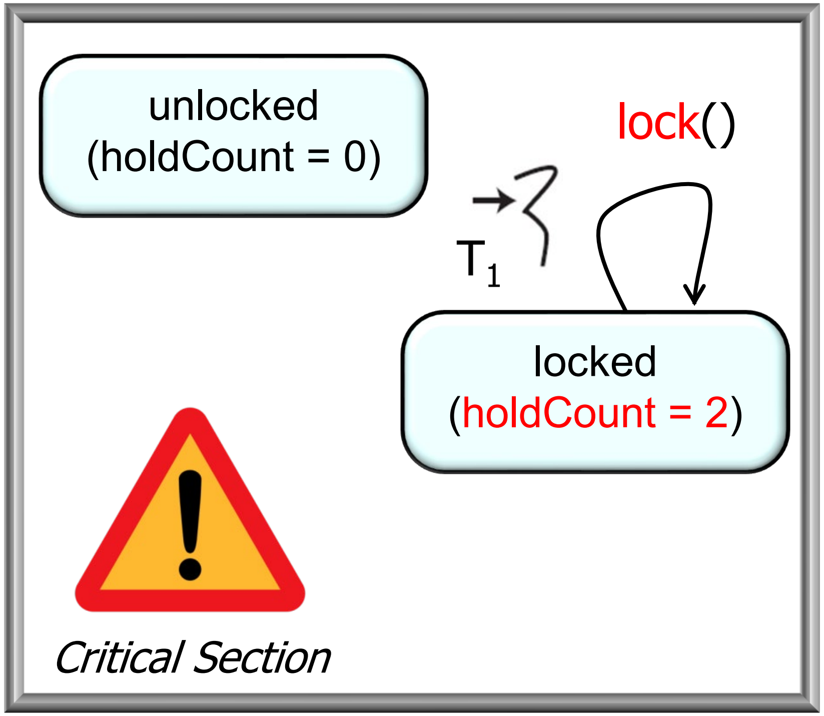

Overview of Reentrant Mutex Semantics

- Reentrant mutex semantics add a bit more overhead relative to non-recursive semantics due to extra software logic & synchronization

```
boolean nonfairTryAcquire
                    (int acquires) {
  Thread t =
    Thread.currentThread();
  int c = getState();
  if (c == 0) {
    if (compareAndSetState(0,
                         acquires)) {
      setExclusiveOwnerThread(t);
      return true;
    }
  } else if (t ==
      getExclusiveOwnerThread()) {
    int nextc = c + acquires;
    ...
    setState(nextc);
    return true;
  }
  return false;
}
```

See src/share/classes/java/util/concurrent/locks/ReentrantLock.java

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  }
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}
```

Record the calling thread identity

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Atomically read the current hold count

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```

Atomically acquire the lock if it's available

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    setState(nextc);
    return true;
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```

Simply increment lock count if the current thread is lock owner

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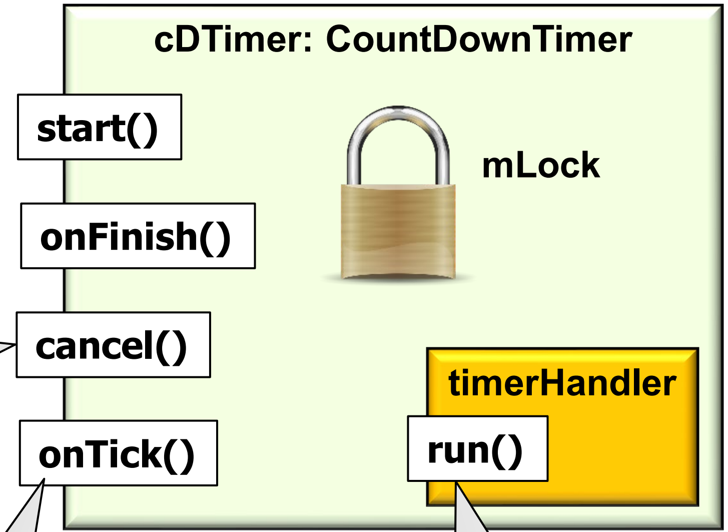
      getExclusiveOwnerThread()) {
    int nextc = c + acquires;
    ...
    setState(nextc);
    return true;
  }
  return false;
}
```

Return false if the calling thread doesn't own the lock

Overview of Reentrant Mutex Semantics

- Reentrant mutex semantics are useful for frameworks that hold locks during callbacks to user code

```
mLock.lock();
try {
  mCancelled = true;
  mSchedExeSvc
       .shutdownNow();
} finally {
  mLock.unlock();
}
```




```
if (...)
  cancel();
```

```
mLock.lock();
try {
  ...
  onTick(millisLeft);
  ...
} finally {
  mLock.unlock();
}
```

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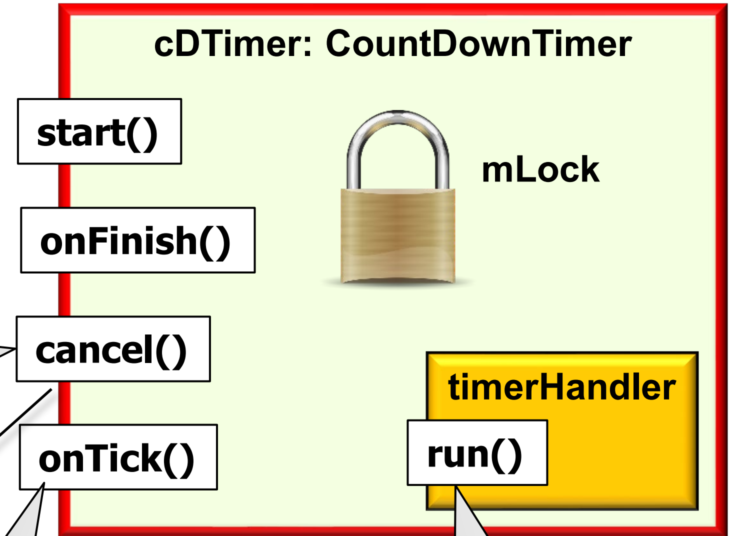


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Schedule a countdown until a time in the future, with regular notifications on intervals along the way via the onTick() hook method

See developer.android.com/reference/android/os/CountDownTimer

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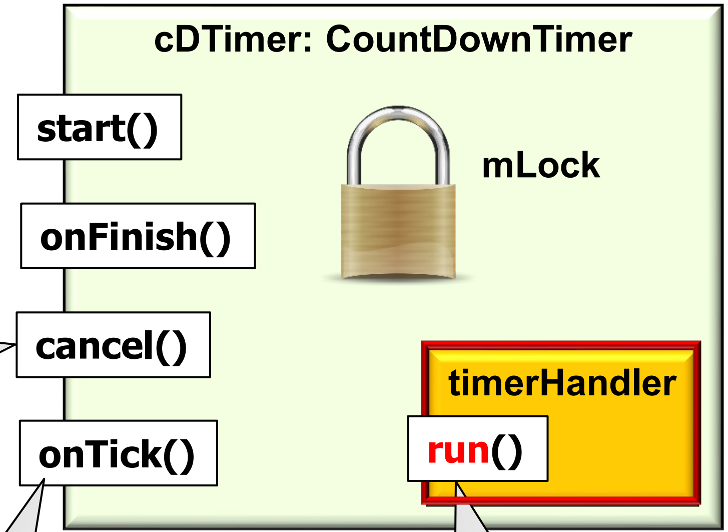


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Framework calls onTick() hook method in a background thread with the mLock held

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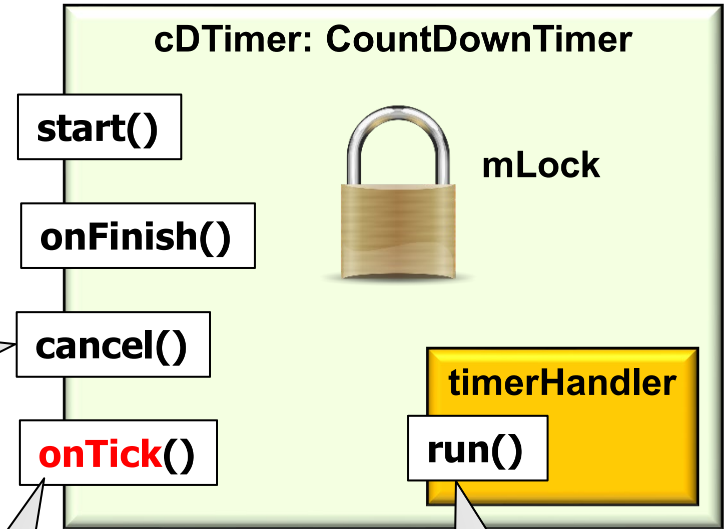


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The app can override the onTick() hook method to conditionally call cancel()

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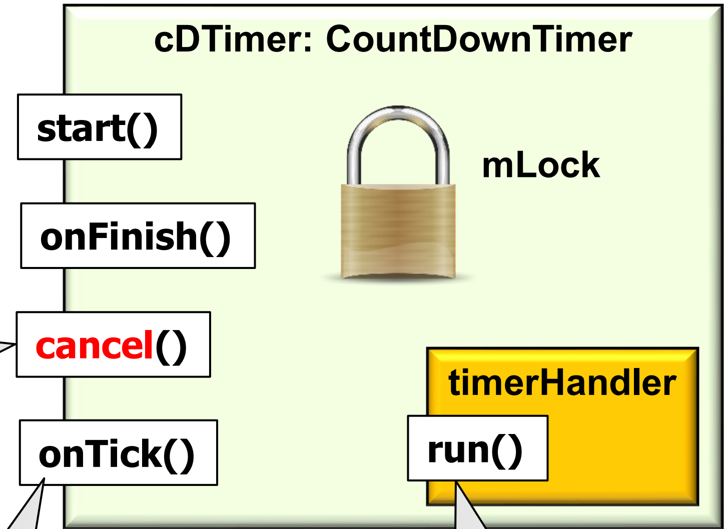


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mLock.lock();
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```

cancel() also acquires mLock, which must be recursive or self-deadlock will occur

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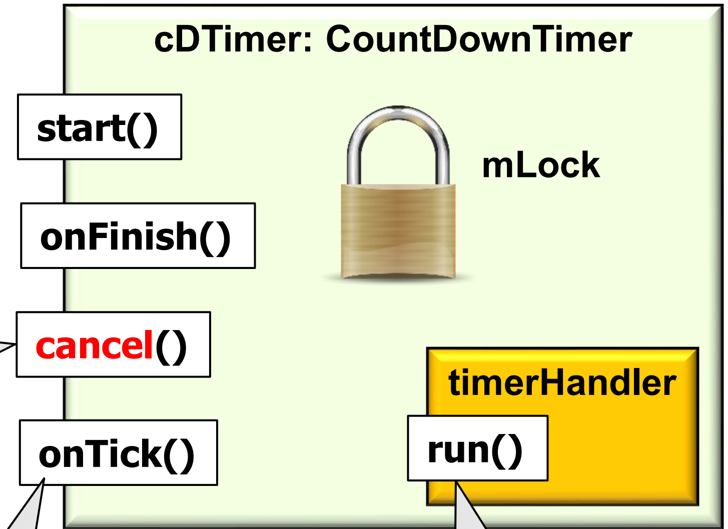


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unlock() will be called multiple times to unwind the reentrant lock

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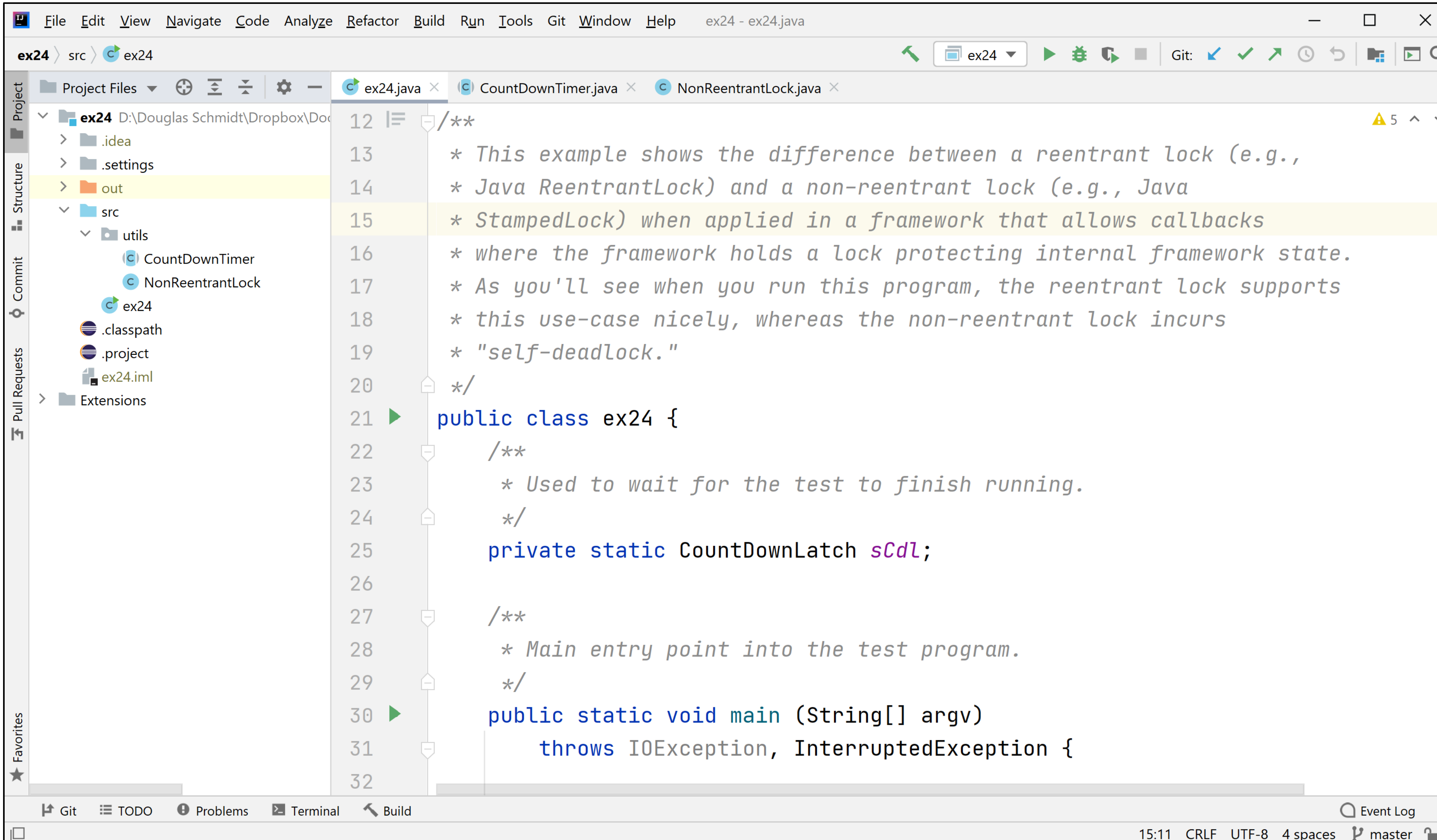

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End of Java ReentrantLock Reentrant Mutex Semantics