

Ordered Locking

CSE 334

Deadlock

- Happens when there's a set of threads where
 - each thread waits for a resource held by another thread.

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No-deadlock interleaving

// thread 1	// thread 2
a.lock();	
b.lock();	
drop(a);	
drop(b);	
	b.lock();
	a.lock();
	drop(a);
	drop(b);

Deadlock interleaving

// thread 1	// thread 2
a.lock();	
	b.lock();
b.lock();	
	a.lock();
drop(a);	
drop(b);	
	drop(a);
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                b.lock();
                a.lock();
                drop(a);
                drop(b);
```

Deadlock interleaving

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// thread 1      // thread 2
a.lock();
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                b.lock();
                a.lock();

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                drop(a);
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- Tricky to debug. What if it only deadlocks 1% of the time?

What code is deadlock-prone?

- Let's draw a graph, where each path represents a possible order of locking.

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```
// thread 1
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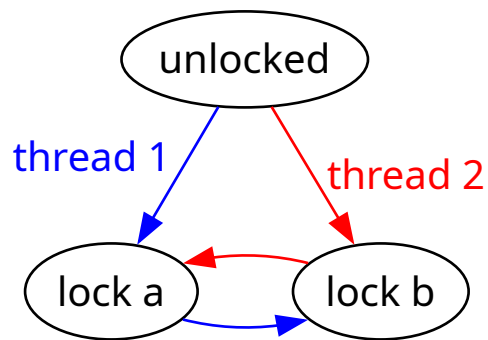
```
a.lock();
```

```
b.lock();
```

```
// thread 2
```

```
b.lock();
```

```
a.lock();
```



What code is deadlock-prone?

- Let's draw a graph, where each path represents a possible order of locking.

```
// thread 1
```

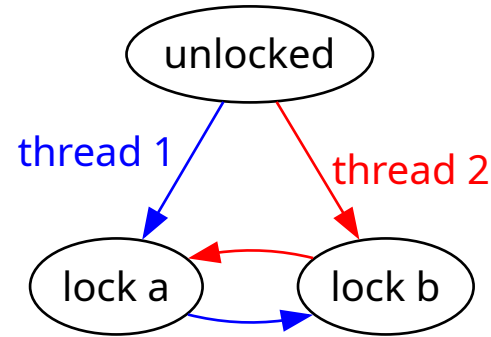
```
a.lock();
```

```
b.lock();
```

```
// thread 2
```

```
b.lock();
```

```
a.lock();
```



- What property of this graph tells us this can deadlock?
-
-

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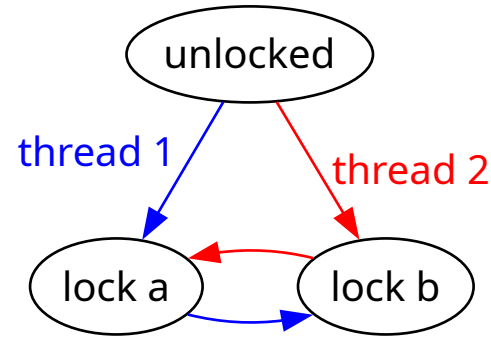
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- The cycle!
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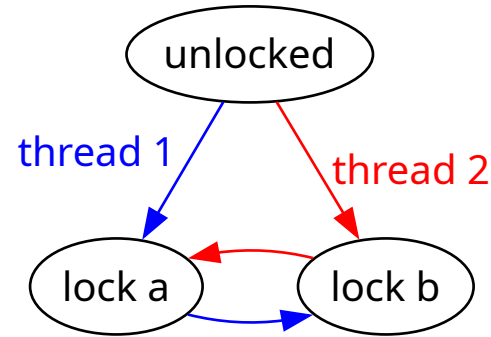
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a.lock();
```

```
b.lock();
```

```
// thread 2
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b.lock();
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a.lock();
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- What property of this graph tells us this can deadlock?
- The cycle!
- What rules can programmers follow to prevent cycles?

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// thread 1
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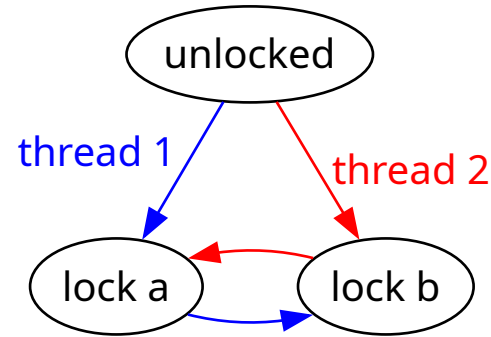
```
a.lock();
```

```
b.lock();
```

```
// thread 2
```

```
b.lock();
```

```
a.lock();
```



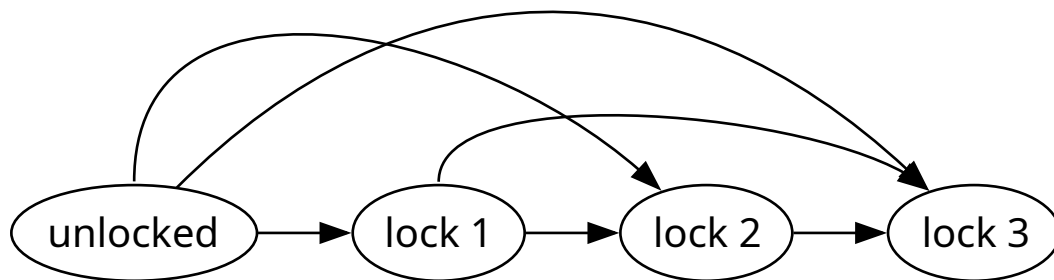
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Lock Ordering

- We can assign the locks an order.

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Hello

```
fn hi() {  
    println!("SUP");  
}
```