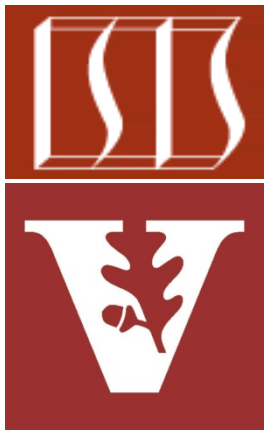
Coordinating Threads via Java Semaphore



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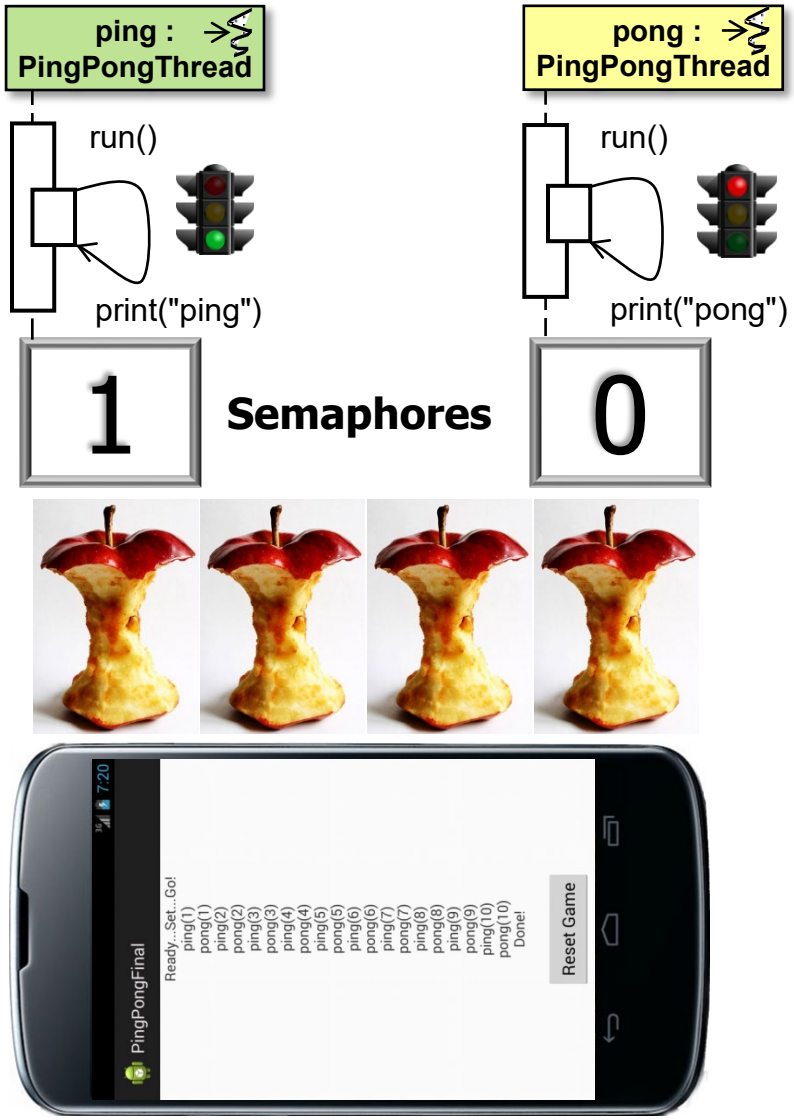
Learning Objectives in this Part of the Module

- Understand the concept of semaphores
- Be aware of the two types of semaphores
- Note a human known use of semaphores
- Recognize the structure & functionality of Java Semaphore
- Know the key methods defined by the Java Semaphore class
- Learn how Java semaphores enable multiple threads to
  - Mediate access to a limited # of shared resources
  - Coordinate the order in which operations occur



Applying Java Semaphores to Coordinate Threads

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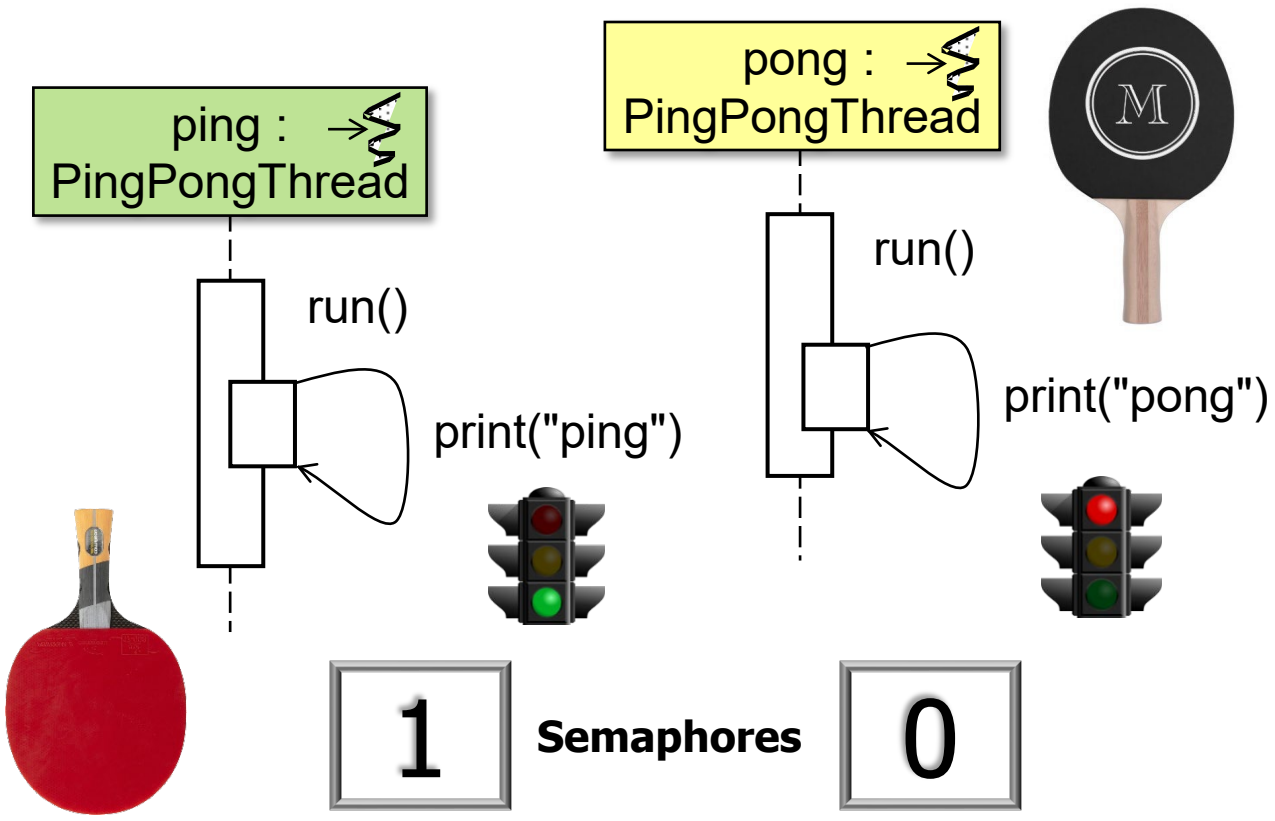
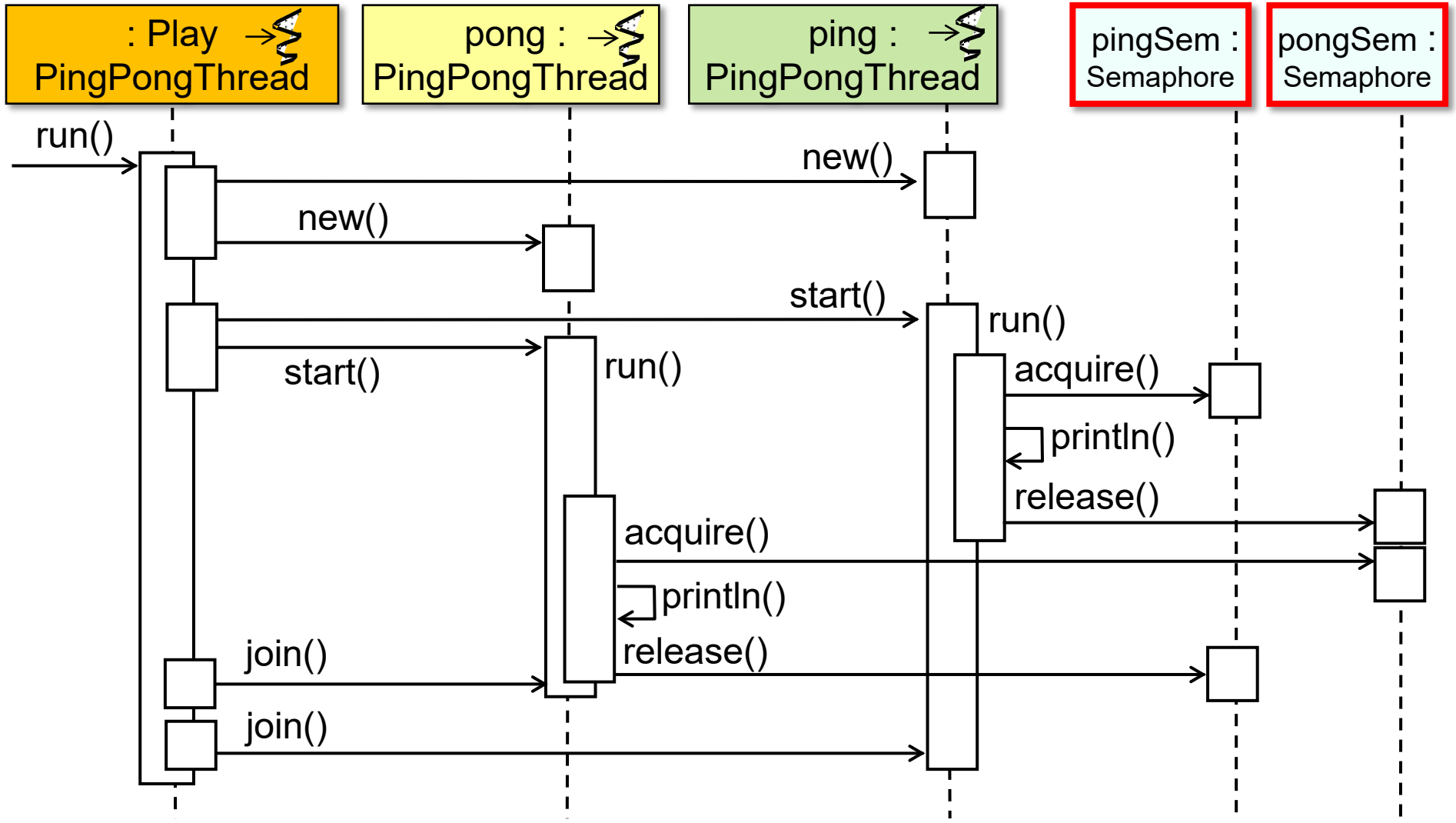
- The Android ping-pong app coordinates thread interactions via various Java synchronizers, including Java semaphores
  - i.e., these two threads alternate printing "ping" & "pong" on the display



See github.com/douglascraigschmidt/POSA/tree/master/ex/M3/PingPong

Applying Java Semaphores to Coordinate Threads

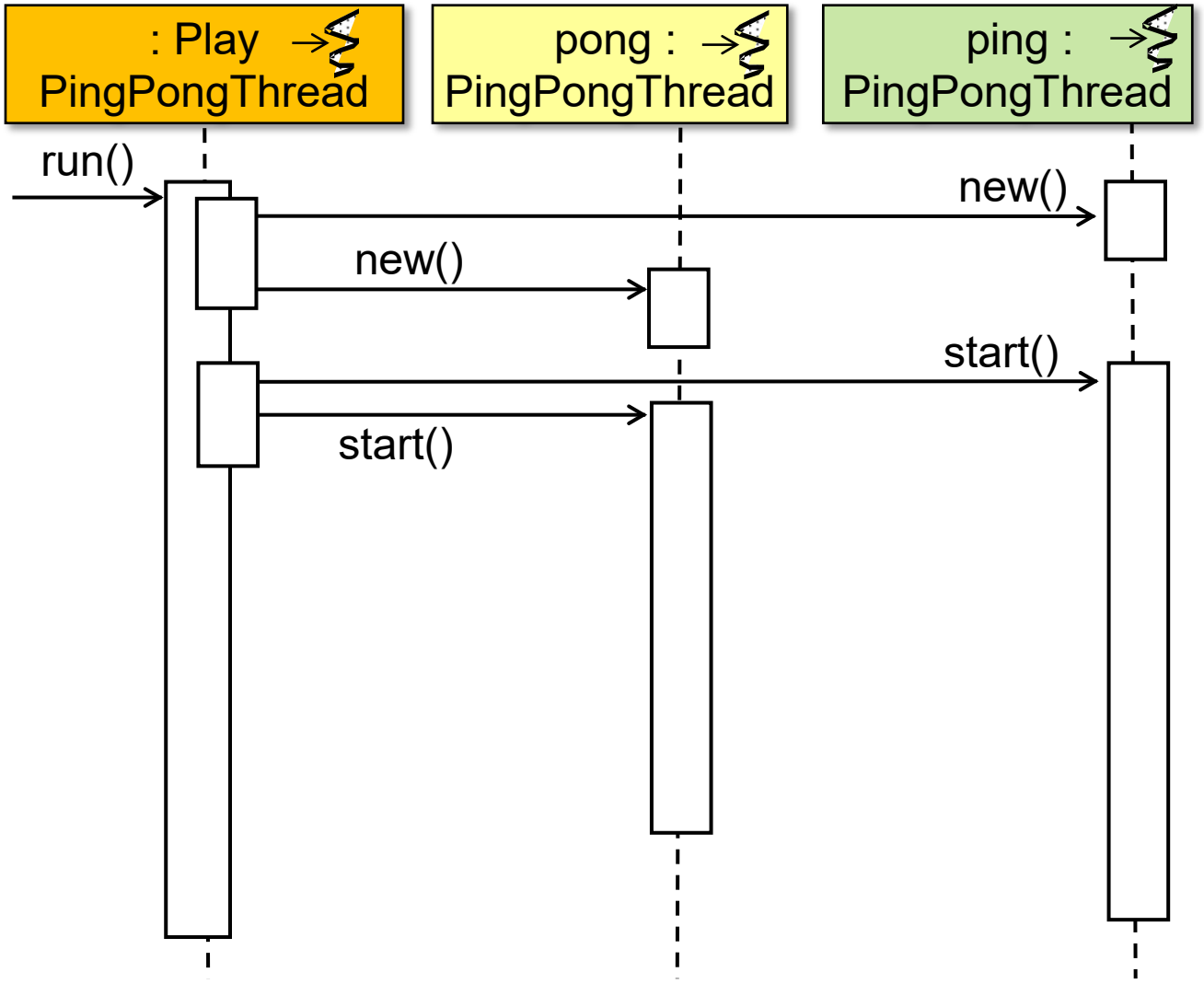
- UML sequence diagram for the ping-pong app



This app can be configured to use a pair of semaphores that coordinate the order in which the "ping" & "pong" threads are called to play ping-pong

Applying Java Semaphores to Coordinate Threads

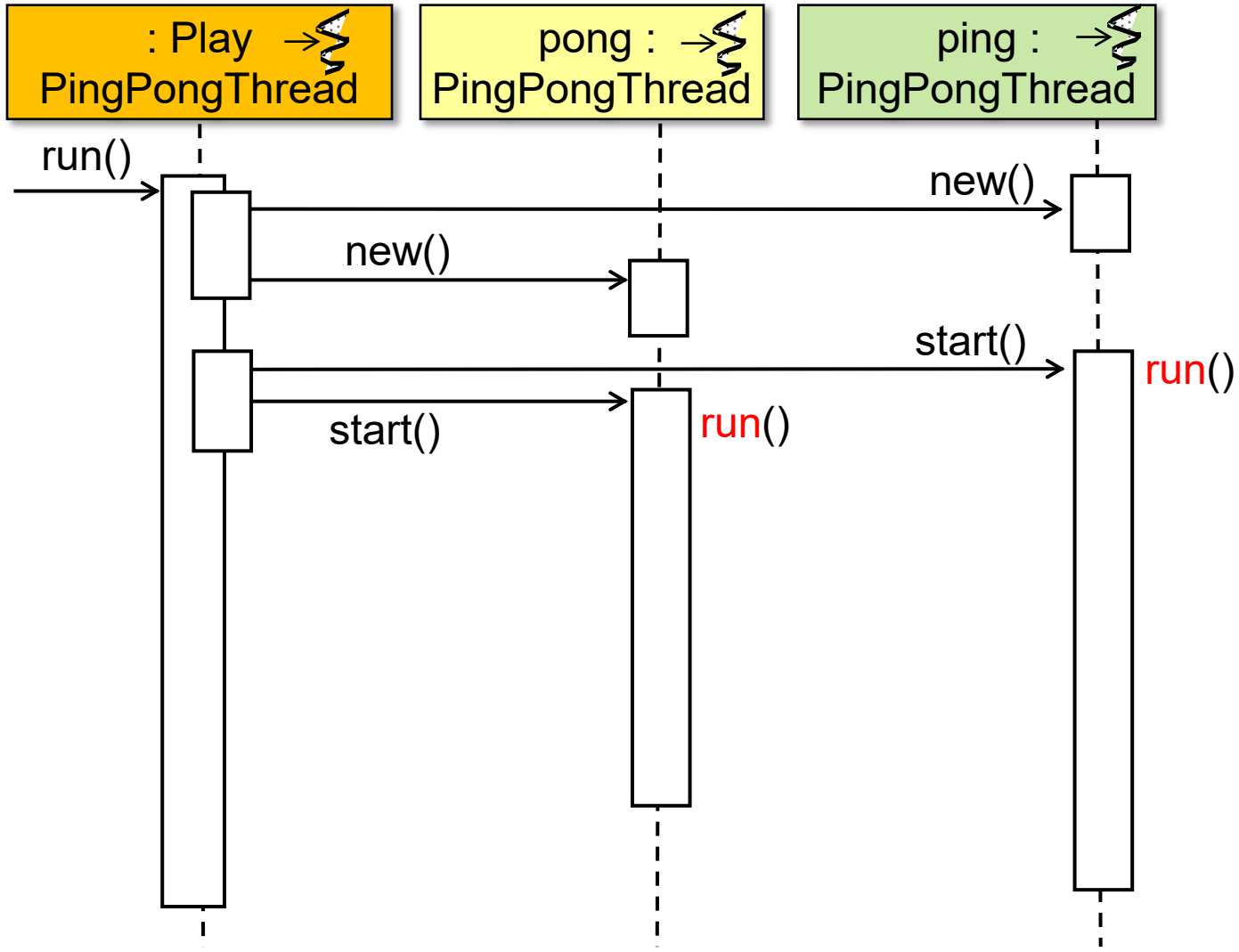
- UML sequence diagram for the ping-pong app

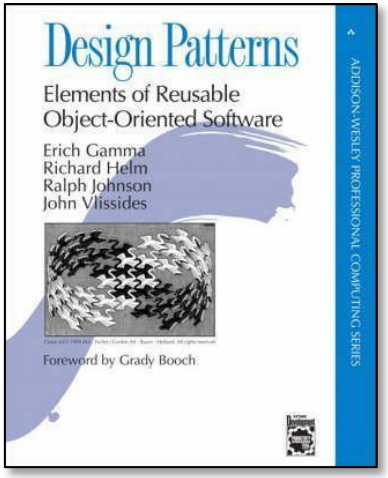


The PlayPingPongThread object starts two threads, ping & pong, that alternate printing "Ping" & "Pong", respectively, on the display

Applying Java Semaphores to Coordinate Threads

- UML sequence diagram for the ping-pong app

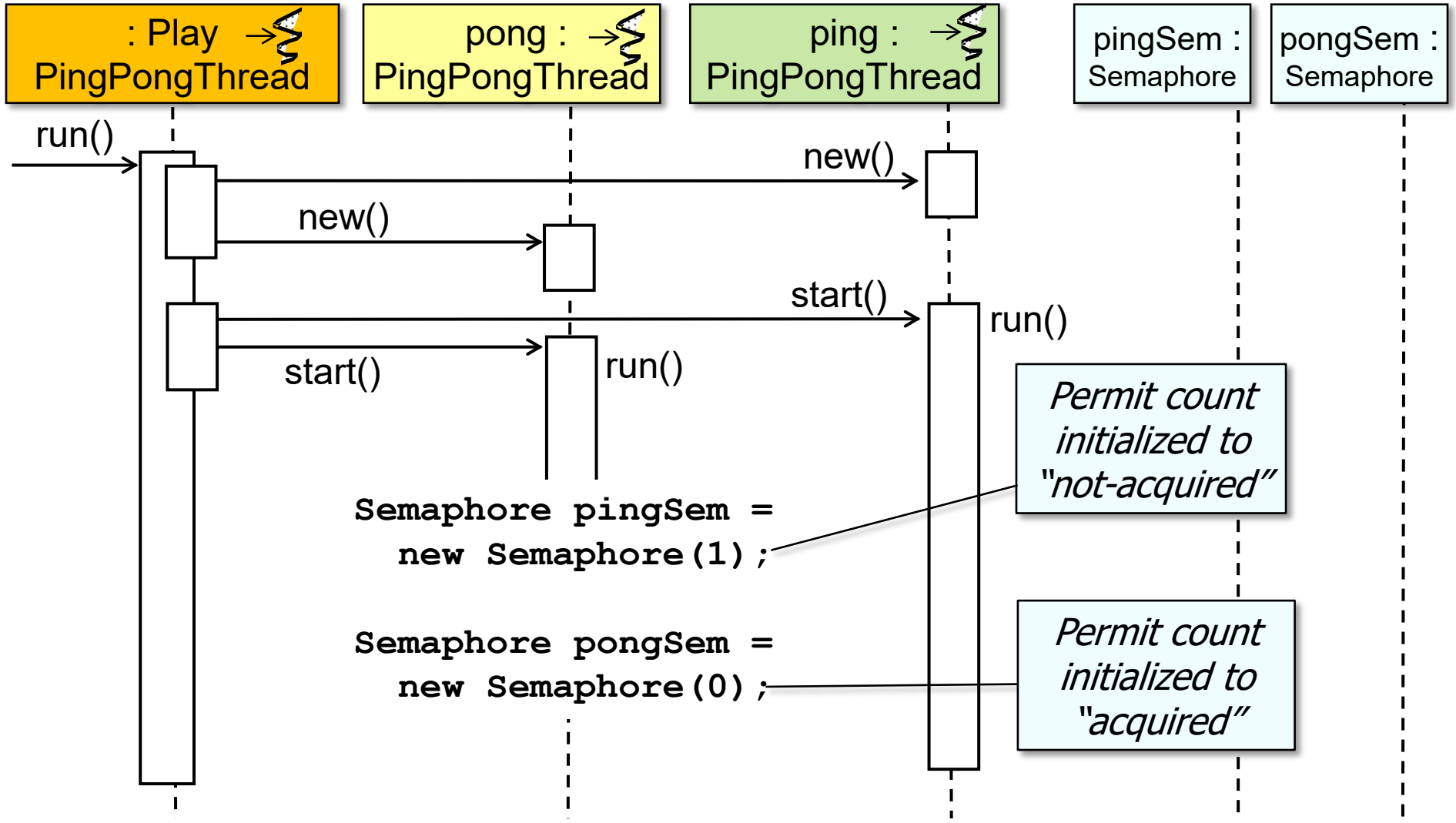




The PingPongThread class implements the core ping-pong algorithm, but defers synchronization aspects to subclasses via the *Template Method* pattern

Applying Java Semaphores to Coordinate Threads

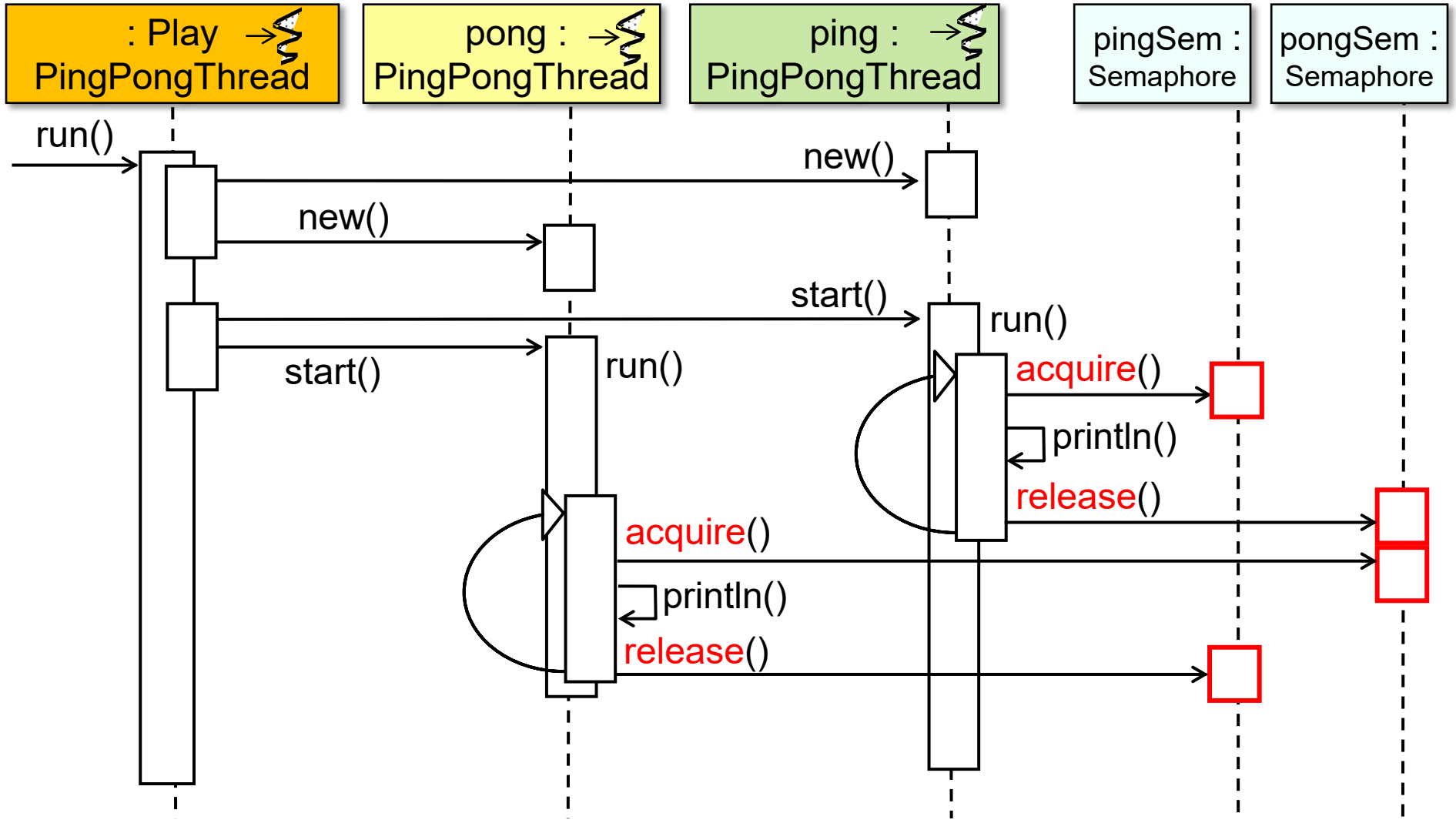
- UML sequence diagram for the ping-pong app



The pingSem & PongSem semaphores coordinate the order in which the "ping" & "pong" threads are called to play ping-pong

Applying Java Semaphores to Coordinate Threads

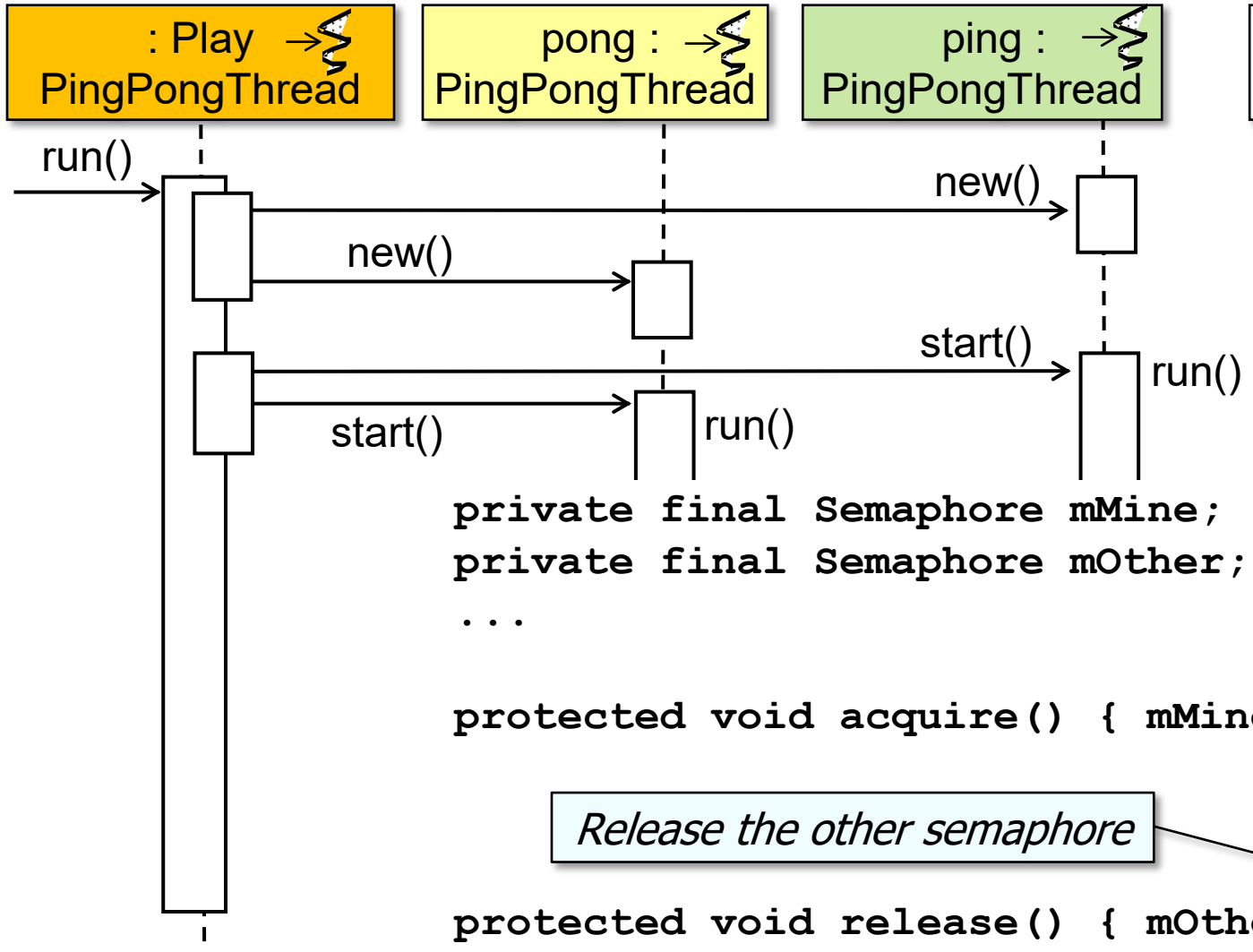
- UML sequence diagram for the ping-pong app



This example does *not* "fully bracket" acquiring & releasing permits, i.e., the thread acquiring a semaphore is different from the thread releasing it!

Applying Java Semaphores to Coordinate Threads

- UML sequence diagram for the ping-pong app




```
private final Semaphore mMine;
private final Semaphore mOther;
...

protected void acquire() { mMine.acquire(); }
```

Block until semaphore is acquired

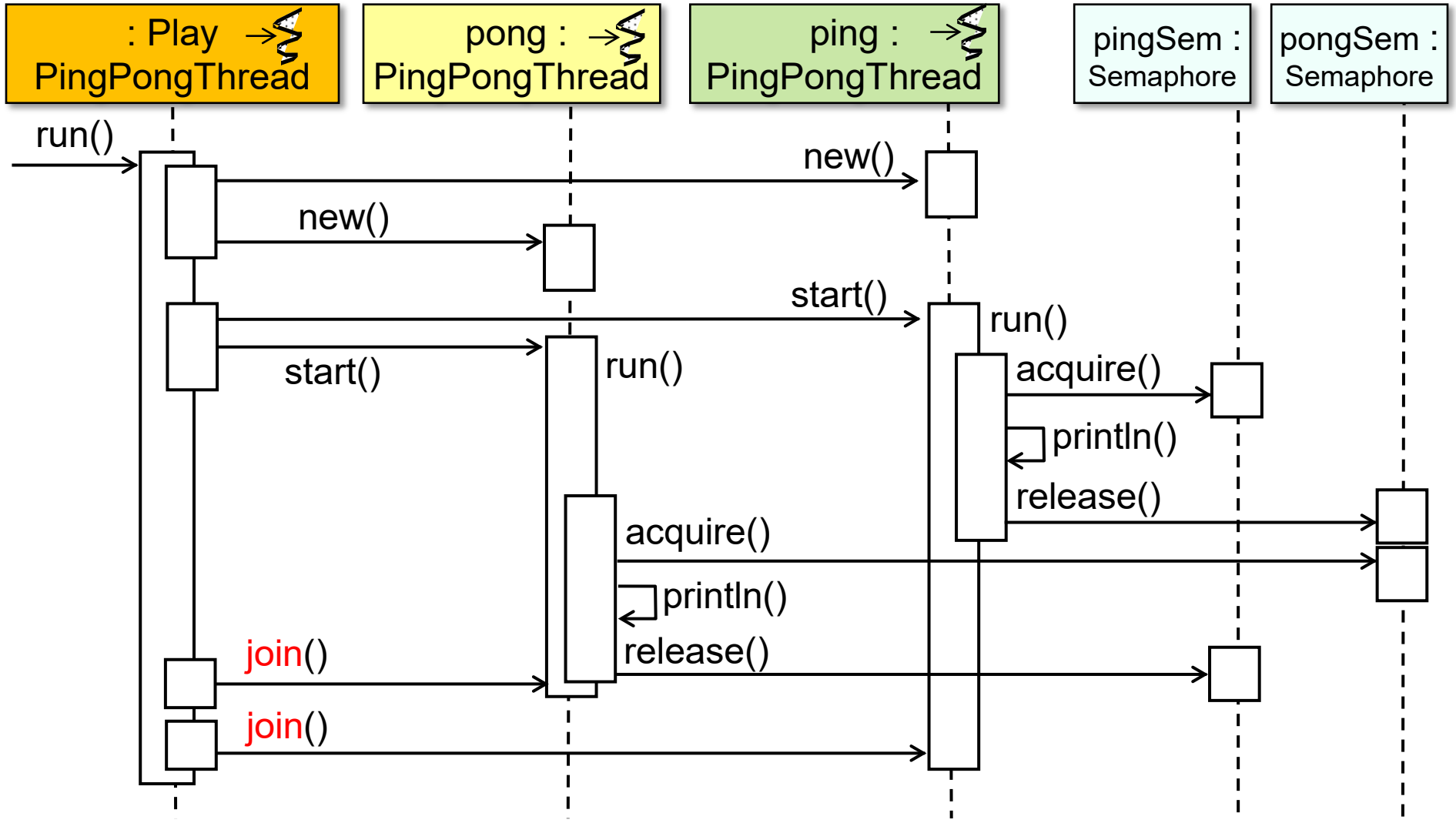
Release the other semaphore

```
protected void release() { mOther.release(); }
```

This example does *not* "fully bracket" acquiring & releasing permits, i.e., the thread acquiring a semaphore is different from the thread releasing it!

Applying Java Semaphores to Coordinate Threads

- UML sequence diagram for the ping-pong app



PlayPingPongThread joins with the ping & pong threads once they finish

End of Coordinating Threads via Java Semaphore