

L8: Deadlocks

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Mapa Conceptual

Concurrency = Simultaneous + Nondeterminism + Interaction

Interaction = Communication | Synchronization

Synchronization = Mutual Exclusion | Conditional Synchronization

- Terminology:

atomic

interleaving

mutual exclusion

race condition

busy-wait

critical section

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Deadlock

Deadlock:

a deadlock is a situation in which two or more competing actions are each waiting for the other to finish, and thus neither ever does.

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, teal-colored font. The '99' is significantly larger and more prominent than the 'Cartagena' part. The text is set against a light blue, cloud-like background that tapers to the right. Below the text, there is a horizontal orange and yellow gradient bar.

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“When two trains approach each other at a crossing, both shall come to a full stop and neither shall start up again until the other has gone.”

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Livelock

Livelock:

A livelock is similar to a deadlock, except that the states of the processes involved in the livelock constantly change with regard to one another, none progressing.

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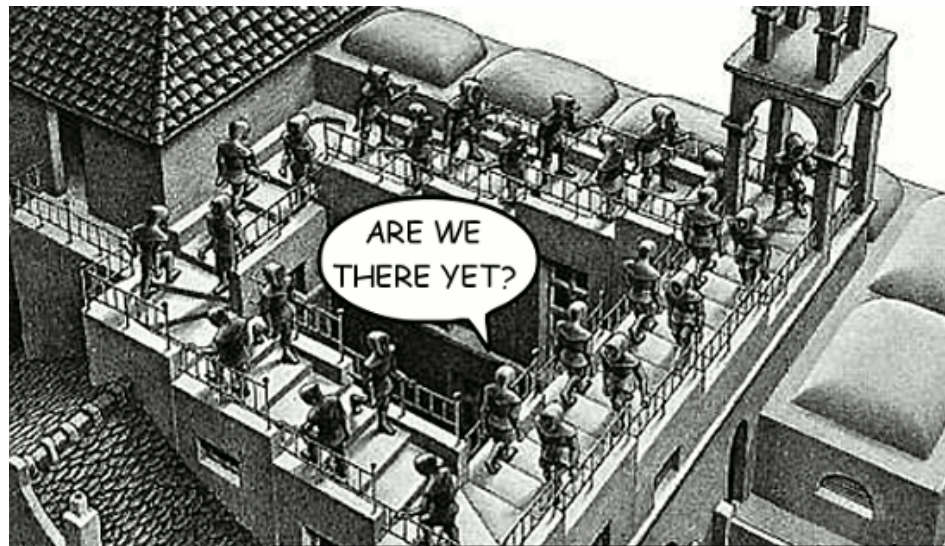
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Conditions for Deadlock (necessary and sufficient)

1. Mutual Exclusion

The resource is only accessed by one thread at a time.

2. Hold and wait

The resource is kept until the job is finished.

3. No preemption

A resource is not stolen.

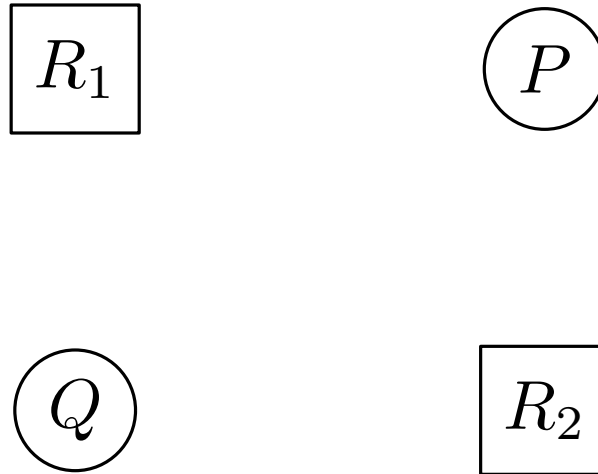
4. Circular wait

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Resource allocation graph

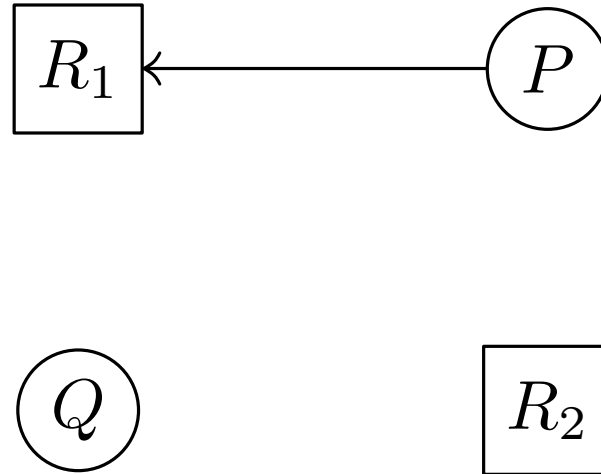


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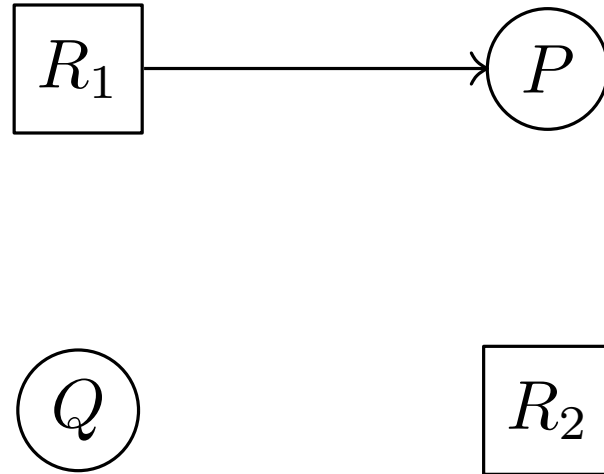


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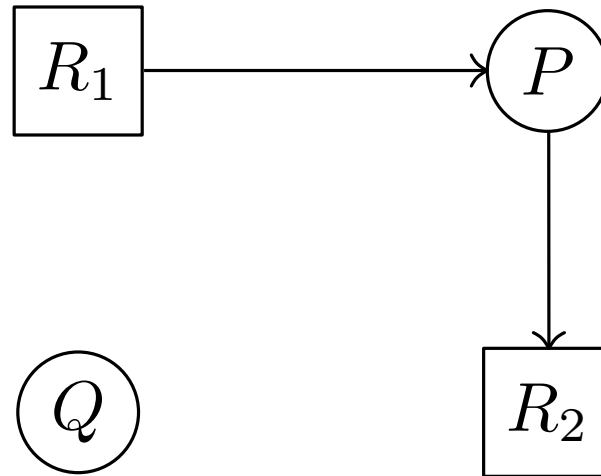


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Resource allocation graph

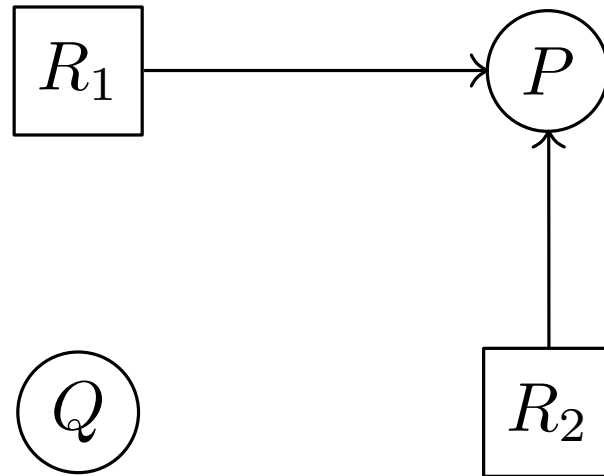


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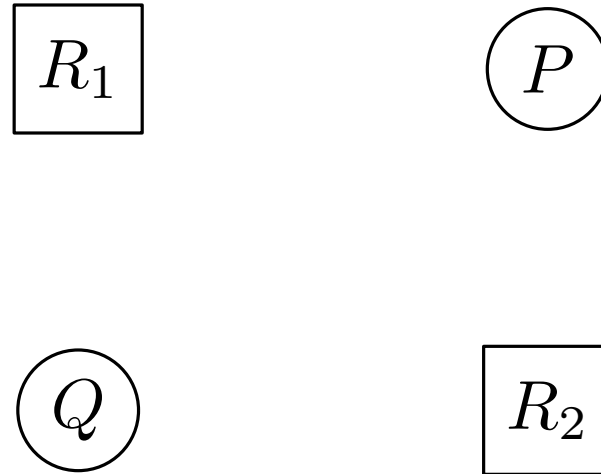


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Resource allocation graph (Deadlock Example)

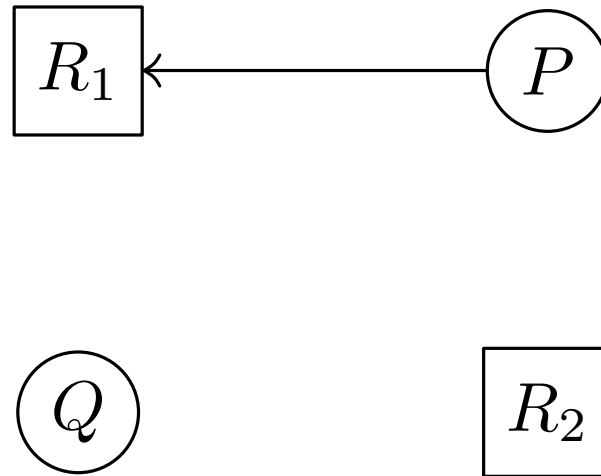


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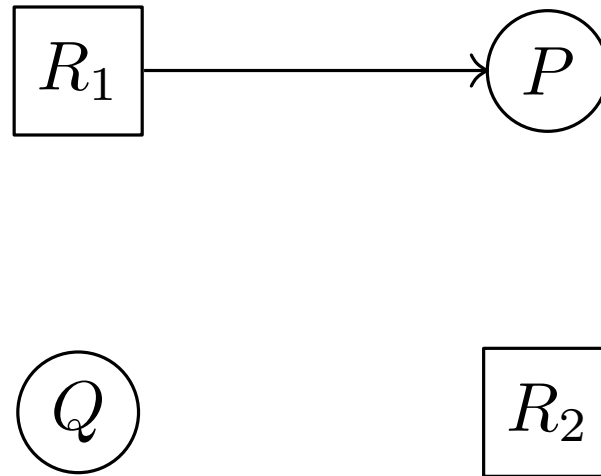


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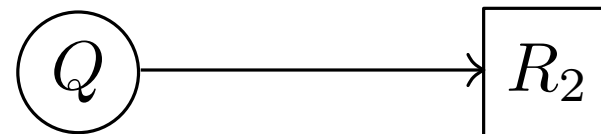
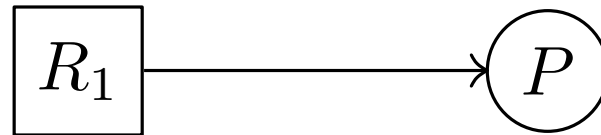


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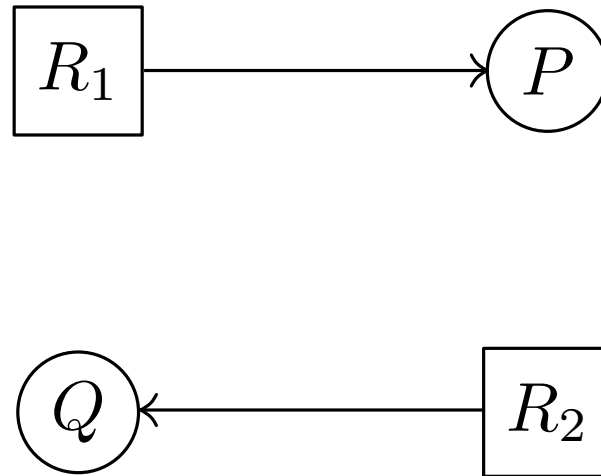


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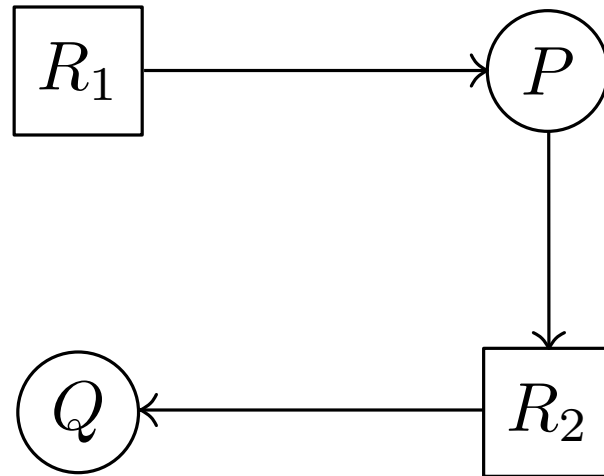


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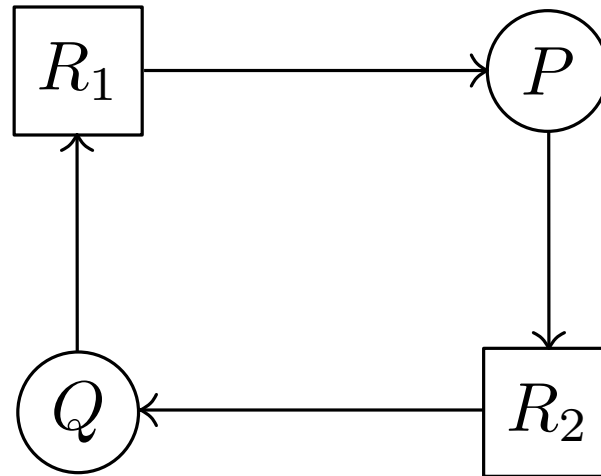


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Deadlock.java

```
public void run () {
    for (int n = 1; n <= Dining.ROUNDS; ++ n) {
        //think();
        left.take();
        System.out.println(me+" takes fork "+left.me);
        right.take();
        System.out.println(me+" takes fork "+right.me);
        eat();
        right.put_back();
        left.put_back();
    }
    System.out.println(me+" leaves");
}
```

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Starvation

Starvation:

Starvation describes a situation where a thread is unable to gain regular access to shared resources and is unable to make progress. This happens when shared resources are made unavailable for long periods by “greedy” threads.

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