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All of these must hold for it to be *possible* to deadlock

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Which may require it to drop the new resource while waiting. . .

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It is easy to get into a situation where the process never manages to get all the resources it needs: called *indefinite postponement*

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This says that deadlock is happening as in the formal definition

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Dining Philosophers

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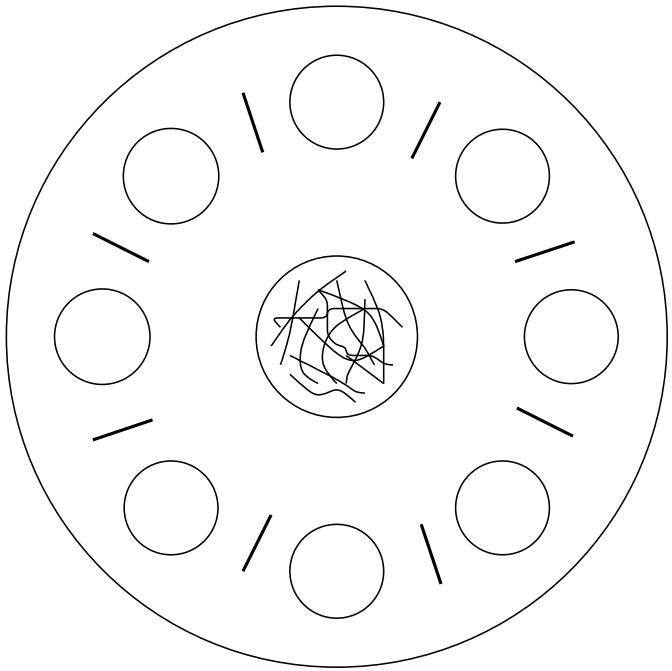
Some Philosophers wish to share a plate of spaghetti, but they have only been provided with chopsticks

Unfortunately, there is not quite enough chopsticks to go around

Deadlock

Dining Philosophers



Dining Philosophers

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Each Philosopher needs two chopsticks to eat, one from each side of their plate

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1. Mutual exclusion. Only one Philosopher can use a chopstick at a time
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Dining Philosophers

Each Philosopher needs two chopsticks to eat, one from each side of their plate

We have

1. Mutual exclusion. Only one Philosopher can use a chopstick at a time
2. Hold-and-wait. Each Philosopher wants to eat and won't let go of a chopstick until they have eaten
3. No preemption. No-one is going to tell a Philosopher what to do!

Deadlock

Dining Philosophers

And if they all grab the left chopstick simultaneously

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4. Circular Wait. There is a circular chain of Philosophers where each holds a chopstick that is needed by the next in the circle

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4. Circular Wait. There is a circular chain of Philosophers where each holds a chopstick that is needed by the next in the circle

Of course, if the Philosophers were a bit more friendly, or polite, there would not be a problem

Deadlock

Dining Philosophers

Exercise. Identify the conditions in the car gridlock scenarios

□