

CSC369 Week 10 Notes

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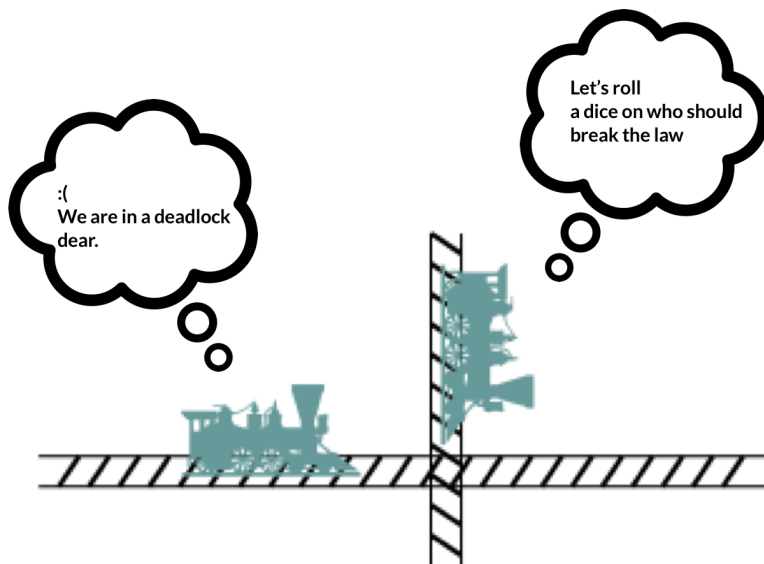
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- Deadlock Defined

- **Google Definition:** Is a situation one typically involving opposing parties, in which no progress can be made.
- Is permanent
- Happens to set of processes that
 - * Compete for same system resources
 - * Communicate with each other

- Example of Deadlock

- Law passed by Kansas Legislature in in early 20th century
 - * “When two trains approach each other at a crossing, both shall come to a full stop and neither shall start upon again until the other is gone”



- Conditions for Deadlock

- Necessary and Sufficient Conditions
 1. Mutual Exclusion
 - * Only one process may use a resource at a time
 2. Hold and wait
 - * A process may hold allocated resources while awaiting assignment of others
 3. No preemption
 - * No Resource can be forcibly removed from a process holding it
 4. Circular wait
 - * Each process must be waiting for a resource which is being held by another process, which in turn is waiting for the first process to release the resource

Aside

1. Wait. Necessary condition? ^[1]
 - We say N is a necessary condition for S if we don't have N , we won't have S .
2. Wait. Sufficient condition? ^[1]
 - We say S is a necessary condition for N if we have S , then we know that N must follow, i.e. $S \Rightarrow N$
3. Hold on. How about necessary and sufficient condition? ^[2]
 - Is when necessary and sufficient conditions are put together similar to if and only if ^[2]

Truth table

S	N	$S \Rightarrow N$	$S \Leftarrow N$	$S \Leftrightarrow N$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

Sufficient Condition (points to S)
 Necessary Condition (points to N)
 Is Sufficient (points to $S \Rightarrow N$)
 Is Necessary (points to $S \Leftarrow N$)
 Is Necessary and Sufficient (points to $S \Leftrightarrow N$)

References

- 1) Fayetteville State University: Necessary and Sufficient Conditions, link

2) Wikipedia: Necessity and Sufficiency, [link](#)

3) Wikipedia: Deadlock, [link](#)

- Solutions

- Prevention

- * Ensures that at least one of the necessary conditions to deadlock will never occur ^[1]

- Avoidance

- * Ensures that the system will not enter an unsafe mode ^[1]

- Detection and Recovery

- * Ensures that the system recovers from deadlock if a deadlock has occurred in the system. ^[2]

- Do Nothing!

References

1) pediaa: What is the Difference Between Deadlock Prevention and Deadlock Avoidance, [link](#)

2) Geeks for Geeks: Recovery from Deadlock in Operating System, [link](#)

- Safe States
- Unsafe States & Algorithm
- What is Atomicity?
- Why would atomicity fail?
- Definitions for Transactions
- How to ensure atomicity in the face of failures?
- Write-ahead logging
- Problems with logging
- Deadlock and Starvation
- Communication Deadlocks
- Livelock