

Operating System: Deadlock Avoidance & Banker's Safety Algorithm

By: Vishvadeep Gothi



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**AIR- 19, 119, 440, 682
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**ME from IISc Bangalore
Mtech BITS Pilani in Data
Science**



**14+ Years of Teaching Experience,
10+ Years in GATE/IES**



Subjects Taken:
Computer Organization & Architecture,
data structure, operating system,
C-Programming, Data science,
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coding interview problems,





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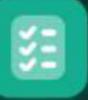
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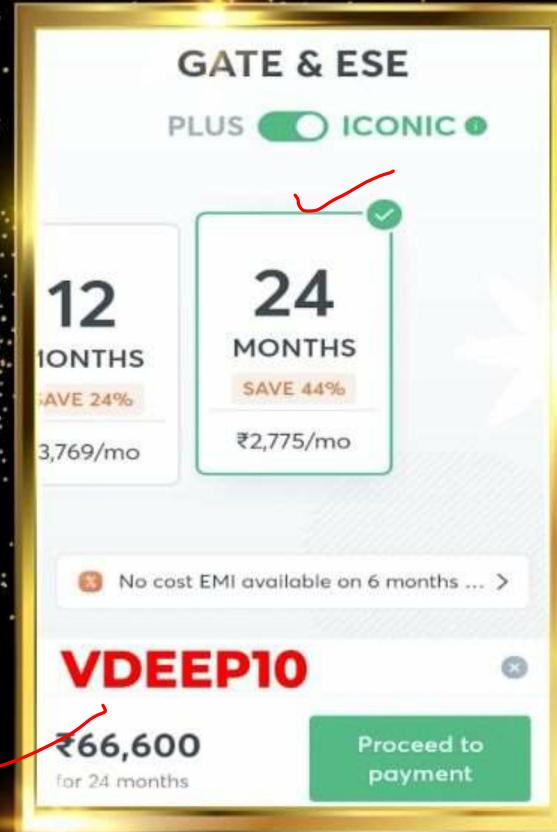
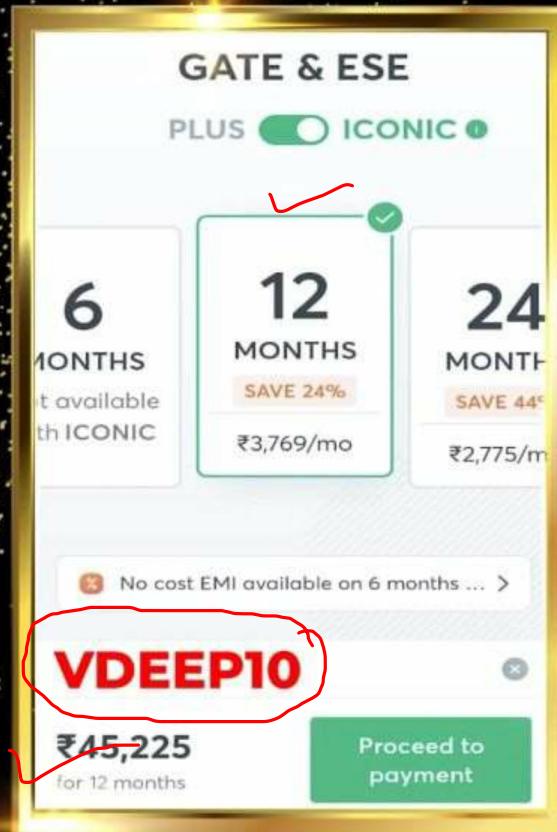
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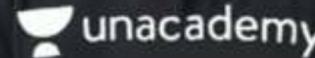
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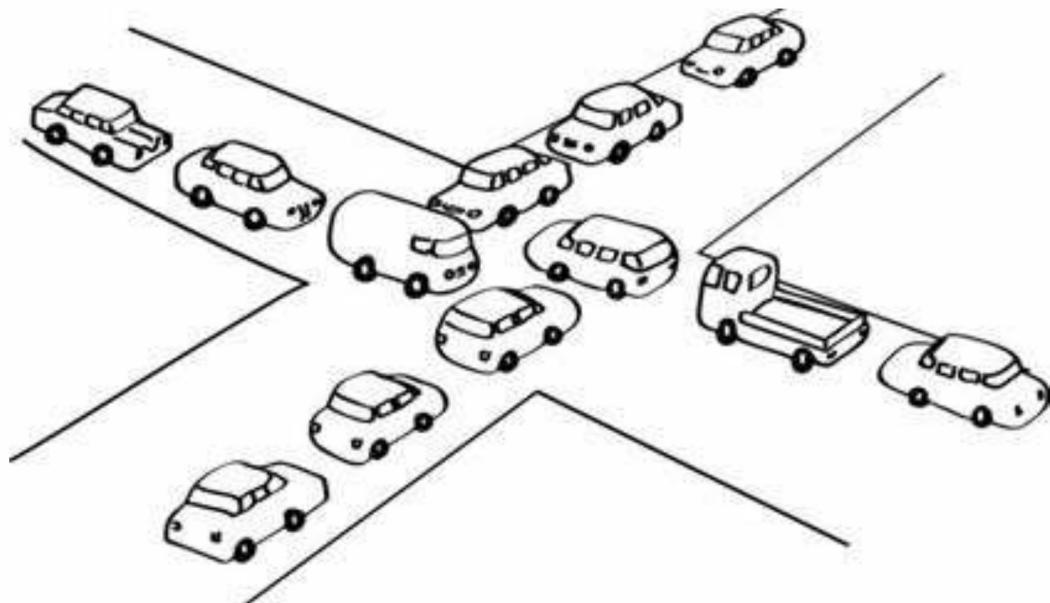
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Deadlock

If two or more processes are waiting for such an event which is never going to occur



Deadlock



Recovery From Deadlock

1. Make Sure that deadlock never occur
 - Prevent the system from deadlock or avoid deadlock
2. Allow deadlock, detect and recover
3. Pretend that there is no any deadlock



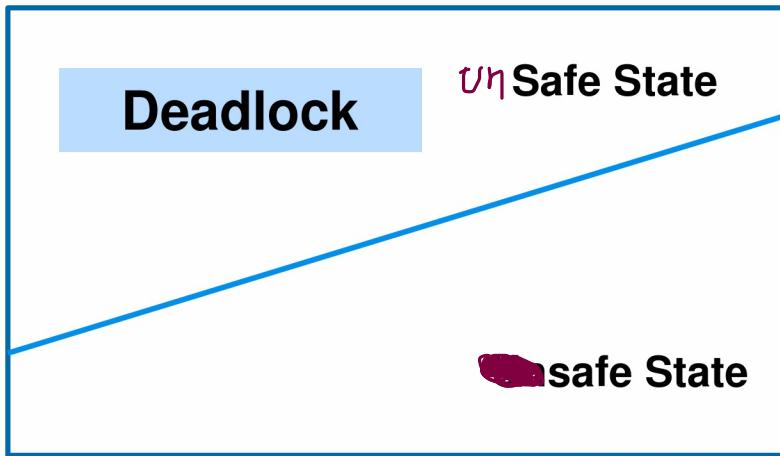
Deadlock Avoidance

In deadlock avoidance, the OS tries to keep system in safe state



Deadlock Avoidance

In deadlock avoidance, the OS tries to keep system in safe state



Deadlock Avoidance

In deadlock avoidance, the request for any resource will be granted if the resulting state of the system doesn't cause deadlock in the system.

Banker's Algorithm

The banker's algorithm is a resource allocation and deadlock avoidance algorithm that tests for safety

Banker's Algorithm

| Process | Allocation | Max | Available |
|---------|------------|-----|------------|
| P1 | 1 | 3 | 4 4 5 7 12 |
| P2 | 5 | 8 | |
| P3 | 3 | 4 | |
| P4 | 2 | 7 | |

11

System has total $\Rightarrow 12$ resources

1. Execute P3.
2. —||— P1
3. —||— P2
4. —||— P4

Need = max - allocation

2

3

1

5

$\langle P_3, P_1, P_2, P_4 \rangle$ safe sequence

all processes
can execute,
hence
 \Downarrow
safe state

Banker's Algorithm

Calvin

| Process | Allocation | | | Max | | | Available | | |
|----------------|------------|---|---|-----|---|---|-----------|---|---|
| | A | B | C | A | B | C | A | B | C |
| P ₀ | 0 | 1 | 0 | 7 | 5 | 3 | 3 | 3 | 2 |
| P ₁ | 2 | 0 | 0 | 3 | 2 | 2 | 5 | 3 | 2 |
| P ₂ | 3 | 0 | 2 | 9 | 0 | 2 | 7 | 4 | 3 |
| P ₃ | 2 | 1 | 1 | 2 | 2 | 2 | 7 | 5 | 3 |
| P ₄ | 0 | 0 | 2 | 4 | 3 | 3 | 10 | 5 | 5 |

7 2 5

Safe sequence:-

$\langle P_1, P_3, P_0, P_2, P_4 \rangle$

| | Need | | |
|----------------|------|---|---|
| | A | B | C |
| P ₀ | 7 | 4 | 3 |
| P ₁ | 1 | 2 | 2 |
| P ₂ | 6 | 0 | 0 |
| P ₃ | 0 | 1 | 1 |
| P ₄ | 4 | 3 | 1 |

Banker's Algorithm

| | Available | | |
|----------------------|-----------|---|---|
| | A | B | C |
| | 3 | 3 | 2 |
| After P ₁ | 5 | 3 | 2 |
| After P ₃ | 7 | 4 | 3 |
| After P ₀ | 7 | 5 | 3 |
| After P ₂ | 10 | 5 | 5 |
| After P ₄ | 10 | 5 | 7 |

Banker's Algorithm

We have n number of processes
& m number of resources.

1. Allocation: matrix of size $n \times m$

2. Max: — || — $n \times m$

3. Need: — || — $n \times m$

4. Available: array of size m

5. Finish :- — / — n Finish []
 |

Banker's Algorithm

1. Let Work and Finish be vectors of length 'm' and 'n' respectively.
Initialize: Work = Available
 $\text{Finish}[i] = \text{false}$; for $i=1, 2, 3, 4....n$
2. Find an i such that both
 - (a) $\text{Finish}[i] = \text{false}$
 - (b) $\text{Need}_i \leq \text{Work}$
if no such i exists goto step (4)
3. $\text{Work} = \text{Work} + \text{Allocation}[i]$
 $\text{Finish}[i] = \text{true}$
goto step (2)
4. if $\text{Finish}[i] = \text{true}$ for all i
then the system is in a safe state

Question

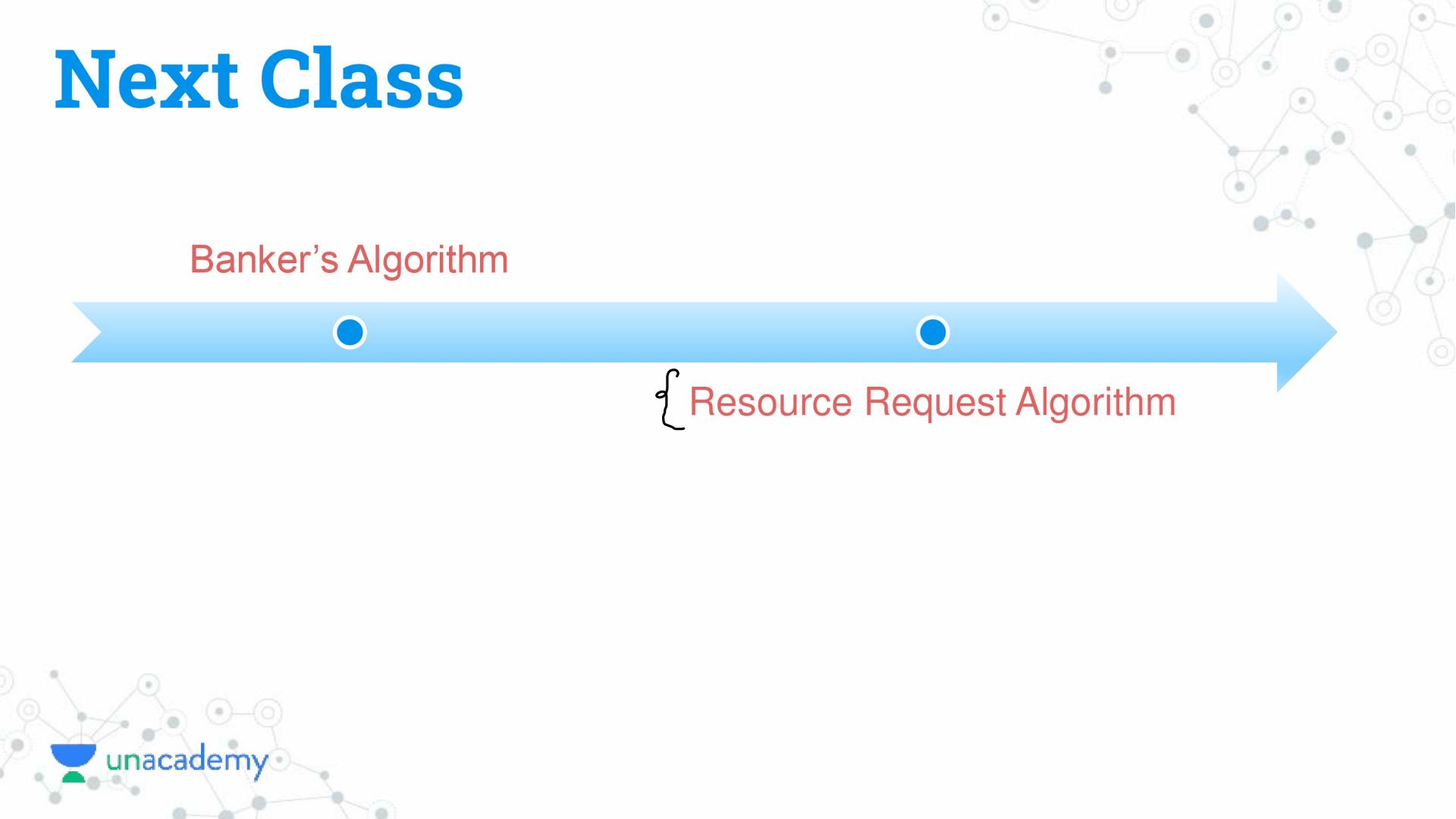
(Homework)

| Process | Allocation | | | | Max | | | | Available | | | |
|---------|------------|---|---|---|-----|---|---|---|-----------|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D |
| P1 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 1 | 5 | 2 | 0 |
| P2 | 1 | 0 | 0 | 0 | 1 | 7 | 5 | 0 | | | | |
| P3 | 1 | 3 | 5 | 4 | 2 | 3 | 5 | 6 | | | | |
| P4 | 0 | 6 | 3 | 4 | 0 | 6 | 5 | 2 | | | | |
| P5 | 0 | 0 | 1 | 4 | 0 | 6 | 5 | 6 | | | | |

Next Class

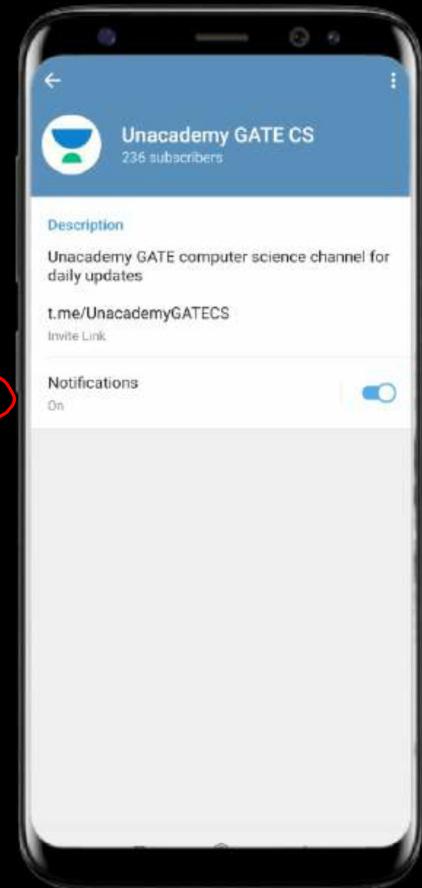
Banker's Algorithm

{ Resource Request Algorithm





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MONTHS

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24
MONTHS

SAVE 44%
₹2,775/mo

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