Methods to handle deadlock.

① Deadlock Ignorance.

OS. } function + code. for deadlock handle.

② Deadlock prevention.

T Mutual exclusion { f → shareable resources
T Non preemption. { f → Preemption).
T hold & wait. } True. → System is in deadlock state.
T Circular wait

(resource ← f)
(process sequence for higher priority ← f)

But.

T
T
F
T

fail atleast 1 condition → No deadlock.

③ Deadlock Avoidance.

[Safe state (No deadlock) { Safe sequence).
[unsafe state (deadlock).

Banker's algo.
(Check sequence of process).

provides Safe sequence.

(4) Deadlock detection & Recovery.

(2)

Consider the system with 5 process $< P_0\ P_1\ P_2\ P_3\ P_4 >$ & 3 resources

A	B	C
10	5	7

Total

	Allocation			Max			Need.			Available.	
	A	B	C	A	B	C	A	B	C	A	B C
P_0 x	0	1	0	7	5	3	7	4	3	3	3 2
P_1 x	2	0	0	3	2	2	1	2	2	5	3 2
P_2	3	0	2	9	0	2	6	0	0	7	4 3
P_3 x	2	1	1	2	2	2	0	1	1	7	4 5
P_4 x	0	0	2	4	3	2	4	3	0	7	5 5
	7	2	5								

a) final Need Matrix

b) Is the system in a Safe state, if yes final safe sequence.

Solution

Need = Max − allocation

Available = Total − allocation

= [10 | 5 | 7] − [7 | 2 | 5]

= [3 | 3 | 2]

Safety algo. to find safe seq.

if Need ≤ available.

execute Process.

New available = Old available + allocation

else.

forward.

Banker's Algo.

$\langle P_1, P_3, P_4, P_0, P_2 \rangle$ (14)

$\Rightarrow P_0$ Need | available.

7	4	3

3	3	2

7	4	3

$\not\leq$

3	3	2

forward.

$\Rightarrow P_1$ Need | available

1	2	2

$\leq$

3	3	2

↓ execute P_1

New av. = old av. + allocation

= | 3 | 3 | 2 | + | 2 | 0 | 0 |

= | 5 | 3 | 2 |

$\Rightarrow P_2$ Need | available.

6	0	0

$\not\leq$

5	3	2

forward

$\Rightarrow P_3$.

0	1	1

$\leq$

5	3	2

execute P_3.

New av. = | 5 | 3 | 2 | + | 2 | 1 | 1 |

```
 3 3 2
-1 2 2
-------
 2 1 0
-------

 2 0 0
+1 2 2
-------
 3 2 2
-------
 execute.
 Terminate.

 2 1 0
+3 2 2
-------
 5 3 2
-------
```

| 7 | 4 | 3 |

$P_4 \Rightarrow$ | 4 | 3 | 0 | $\leq$ | 7 | 4 | 3 |

execute P_4

New. av = | 7 | 4 | 3 | + | 0 | 0 | 2 |

= | 7 | 4 | 5 |

$P_0 \Rightarrow$ | 7 | 4 | 3 | $\leq$ | 7 | 4 | 5 |

execut P_0

New av. = | 7 | 4 | 5 | + | 0 | 1 | 0 |

= | 7 | 5 | 5 |

$P_2 =$ | 6 | 0 | 0 | $\leq$ | 7 | 5 | 5 |

execute P_2.

New av = | 7 | 5 | 5 | + | 3 | 0 | 2 |

= | 10 | 5 | 7 |

$\Rightarrow$ Safe State

= Safe sequence

$\langle P_1 P_3 P_4 P_0 P_2 \rangle$

(6)

Consider the system with 5 processes $\langle P_0 P_1 P_2 P_3 P_4 \rangle$ & 3 Resources (A B C)
11 7 8

a) find Need Matrix

b) Is the system in a safe state, if yes find safe sequence.

	Allocation			Max		
	A	B	C	A	B	C
P_0	1	0	1	7	5	3
P_1	2	1	0	3	2	2
P_2	2	1	2	9	0	2
P_3	1	2	0	2	2	2
P_4	1	0	0	4	3	2