Worksheet 2

Allocation

	A	B	C	D
P0	2	0	0	1
P1	3	—	2	—
P2	2	—	0	3
P3	—	3	—	2
P4	—	4	3	2

Need

	A	B	C	D
P0	4	2	1	2
P1	5	2	5	2
P2	2	3	—	6
P3	1	4	2	4
P4	3	6	6	5

Available

A	B	C	D
3	3	2	1

(i) Determine if the system is in a safe state

(ii) Determine if a request of $(1,1,0,0)$ by P4 should be granted

(iii) Determine if a request of $(0,0,2,0)$ by P4 should be granted

(i)

Need = Max − Allocation

	A	B	C	D
P0	2	2	1	—
P1	2	—	3	—
P2	0	2	—	3
P3	0	1	—	2
P4	2	2	3	3

Av start available 3 3 2 1

P0 finishes
2 0 0 1
5 3 2 2

P3 finishes
1 3 1 2
6 6 3 4

P1 finishes
3 1 2 1
9 7 5 5

P2 finishes
2 1 0 3
11 8 5 8

P4 finishes
1 4 3 2
12 12 8 10

The system is in a safe state
with a safe sequence

P0, P3, P1, P2, P4.

(ii)

The allocation matrix is updated to reflect P_1 receiving $(1,1,0,0)$

	A	B	C	D
P_0	2	0	0	1
P_1	4	2	2	0
P_2	2	1	3	3
P_3	1	3	0	2
P_4	1	4	3	2

Available is updated to

A	B	C	D
2	2	2	1

Need MATRIX

	A	B	C	D
P_0	2	2	—	—
P_1	2	0	2	—
P_2	—	2	3	—
P_3	—	0	—	3
P_4	2	2	—	3

Available start at 2 2 2 1

P_0 finishes

$$\begin{array}{rrrr} 2 & 2 & 0 & 1 \\ 4 & 2 & 2 & 2 \end{array}$$

P_1 finishes

$$\begin{array}{rrrr} 1 & 3 & 1 & 2 \\ 5 & 5 & 3 & 4 \end{array} = 8$$

P_2 finishes

$$\begin{array}{rrrr} 2 & 1 & 0 & 3 \\ 7 & 6 & 3 & 7 \end{array}$$

P_3 finishes

$$\begin{array}{rrrr} 4 & 2 & 2 & 1 \\ 8 & 5 & 5 & 8 \end{array}$$

P_4 finishes

$$\begin{array}{rrrr} 1 & 4 & 3 & 2 \\ 12 & 12 & 8 & 10 \end{array}$$

The request should be granted and system
still has a safe sequence P_0, P_3, P_2, P_1, P_4

Re ordered

(iii) The allocation matrix is updated to show P4 receiving (0,0,2,0).   Available is updated to

	A	B	C	D
P0	2	0	0	1
P1	3	-	2	-
P2	2	-	a	3
P3	-	3	-	2
P4	1	4	3	2

Available is updated to

A	B	C	D
3	3	0	1

The request should not be granted as it would lead to an unsafe state as not process can complete due to no "C" resource being available.

Need Matrix

	A	B	C	D
P0	2	2	-	0
P1	2	-	3	-
P2	0	2	-	3
P3	0	-	1	2
P4	2	2	1	3