Assignment 4

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1 Question 1

Given Matrices

Allocation matrix (A):

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 2 & 3 & 1 \\ 1 & 3 & 6 & 5 \\ 0 & 6 & 3 & 2 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

Max matrix (M):

$$\begin{bmatrix} 0 & 2 & 1 & 0 \\ 1 & 6 & 5 & 2 \\ 2 & 3 & 6 & 6 \\ 0 & 6 & 5 & 2 \\ 0 & 6 & 5 & 6 \end{bmatrix}$$

Need Matrix

$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 4 & 2 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 6 & 4 & 2 \end{bmatrix}$$

Safety Algorithm

Available resources: 3 3 3 3

Process 0:

	Finish	Work + Alloc	Need	Finish
A	0	$0+0$	0	0
B	1	$1+1$	0	1
C	1	$1+1$	0	1
D	0	$0+0$	0	0

Safety Sequence: 0 1

Process 3:

	Finish	Work + Alloc	Need	Finish
A	1	$0+0$	0	1
B	1	$1+6$	0	1
C	1	$1+3$	2	0
D	0	$0+2$	0	0

Safety Sequence: 0 1 3

Process 2:

	Finish	Work + Alloc	Need	Finish
A	1	$1+1$	0	1
B	1	$1+3$	0	1
C	1	$1+6$	0	1
D	1	$0+0$	0	1

Safety Sequence: 0 1 3 2

Process 4:

	Finish	Work + Alloc	Need	Finish
A	1	$1+0$	0	1
B	1	$1+0$	6	1
C	1	$1+1$	4	0
D	1	$1+4$	2	1

Safety Sequence: 0 1 3 2 4

System is in a safe state.

2 Question 2

System Deadlock Analysis

Current Allocation

	$R1$	$R2$	$R3$	$R4$
$P1$	0	0	1	2
$P2$	2	0	0	0
$P3$	0	0	3	4
$P4$	2	3	5	4
$P5$	0	3	3	2

Maximum Need

	$R1$	$R2$	$R3$	$R4$
$P1$	0	0	3	2
$P2$	2	7	5	0
$P3$	6	6	5	6
$P4$	4	3	5	6
$P5$	0	6	5	2

Still Needs

	$R1$	$R2$	$R3$	$R4$
$P1$	0	0	2	0
$P2$	0	7	6	0
$P3$	6	6	2	2
$P4$	2	0	0	2
$P5$	0	0	2	0

The system is not currently deadlocked as all processes have some resources they still need. However, there is potential for deadlock if the processes cannot obtain the necessary resources.