8.28

	Allocation				Max				Available				Need			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
T_0	3	1	4	1	6	4	7	3	2	2	2	4	3	3	3	2
T_1	2	1	0	2	4	2	3	2					2	1	3	0
T_2	2	4	1	3	2	5	3	3					0	1	2	0
T_3	4	1	1	0	6	3	3	2					2	2	2	2
T_4	2	2	2	1	5	6	7	5					3	4	5	4

a. Illustrate that the system is in a safe state by demonstrating an order in which the threads may complete.

Safe State : $\langle T_2, T_1, T_3, T_0, T_4 \rangle$

	2	2	2	4
$\langle T_2 \rangle$ +	2	4	1	3
	4	6	3	7
$\langle T_1 \rangle$ +	2	1	0	2
	6	7	3	9
$\langle T_3 \rangle$ +	4	1	1	0
	10	8	4	9
$\langle T_0 \rangle$ +	3	1	4	1
	13	9	8	10

b. If a request from thread T_4 arrives for (2, 2, 2, 4), can the request be granted immediately?

(2, 2, 2, 4) ≤ (3, 4, 5, 4) => True

(2, 2, 2, 4) ≤ (2, 2, 2, 4) => True

	Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
T_0	3	1	4	1	3	3	3	2	0	0	0	0
T_1	2	1	0	2	2	1	3	0				
T_2	2	4	1	3	0	1	2	0				
T_3	4	1	1	0	2	2	2	2				
T_4	4	4	4	5	1	2	3	0				

Safe State : $\langle X \rangle$

因為 Available 變成 0 了, 所以

the request cannot be granted immediately.

c. If a request from thread T_2 arrives for (0, 1, 1, 0), can the request be granted immediately?

(0, 1, 1, 0) ≤ (2, 1, 3, 0)

(0, 1, 1, 0) ≤ (2, 2, 2, 4)

	Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
T_0	3	1	4	1	3	3	3	2	2	1	1	4
T_1	2	1	0	2	2	1	3	0				
T_2	2	5	2	3	0	0	1	0				
T_3	4	1	1	0	2	2	2	2				
T_4	2	2	2	1	3	4	5	4				

Safe State : $\langle T_2, T_1, T_3, T_0, T_4 \rangle$

	2	1	1	4
$\langle T_2 \rangle$ +	2	5	2	3
	4	6	3	7
$\langle T_1 \rangle$ +	2	1	0	2
	6	7	3	9
$\langle T_3 \rangle$ +	4	1	1	0
	10	8	4	9
$\langle T_0 \rangle$ +	3	1	4	1
	13	9	8	10

Ans : Yes, the request can be granted immediately.

Because it have safe state.

d. If a request from thread T_3 arrives for (2, 2, 1, 2), can the request be granted immediately?

(2, 2, 1, 2) ≤ (2, 2, 2, 2)

(2, 2, 1, 2) ≤ (2, 2, 2, 4)

	Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
T_0	3	1	4	1	3	3	3	2	0	0	1	2
T_1	2	1	0	2	2	1	3	0				
T_2	2	4	1	3	0	1	2	0				
T_3	6	3	2	2	0	0	1	0				
T_4	2	2	2	1	3	4	5	4				

Safe State : $\langle T_3, T_2, T_1, T_0, T_4 \rangle$

	0	0	1	2
$\langle T_3 \rangle$ +	6	3	2	2
	6	3	3	4
$\langle T_2 \rangle$ +	2	4	1	3
	8	7	4	7
$\langle T_1 \rangle$ +	2	1	0	2
	10	8	4	9
$\langle T_0 \rangle$ +	3	1	4	1
	13	9	8	10

Ans : Yes, the request can be granted immediately.

Because it have safe state.