Name:

CSCI 460 Operating Systems

Participation Test 3

Instructions: Write your name above. Relax and attempt the problems below. This is NOT a quiz and participation credit will be given for any sincere attempt. (Later, solutions will be posted on the course webpage.) Turn in the sheet at the end of the class to receive your participation credit.

This question is on the Banker's Algorithm. We have 6 processes $P_0, \cdots, P_5$. Four types of resources A (15 copies), B (6 copies), C (9 copies), and D (10 copies). At time 0, we have the following snapshot:

Process	A	B	C	D
P0	2	0	2	1
P1	0	1	1	1
P2	4	1	0	2
P3	1	0	0	1
P4	1	1	0	0
P5	1	0	1	1

Allocation matrix.

Process	A	B	C	D
P0	9	5	5	5
P1	2	2	3	3
P2	7	5	4	4
P3	3	3	3	2
P4	5	2	2	1
P5	4	4	4	4

Maximum demand matrix.

(1.1) Calculate the available resource vector.

A: $15 - (2+0+4+1+1+1) = 6$

B: $6 - (0+1+1+0+1+0) = 3$

C: $9 - (2+1+0+0+0+1) = 5$

D: $10 - (1+1+2+1+0+1) = 4$

So $V = \langle 6, 3, 5, 4 \rangle$.

(1.2) Calculate the Need matrix.

Need matrix = Max demand matrix − Allocation matrix

	A	B	C	D
P_0	7	5	3	4
P_1	2	1	2	2
P_2	3	4	4	2
P_3	2	3	3	1
P_4	4	1	2	1
P_5	3	4	3	3

(1.3) Is the current state safe? Why?

It is safe. With the current $V = <6, 3, 5, 4>$, we could satisfy either P_1, P_3, P_4. And it is easy to obtain a sequence of finishing processes, for instance,

$P_4, P_5, P_3, P_2, P_1, P_0$.

(1.4) Given the request (3,2,3,3) from P_5, should this request be granted? Why?

If this request were granted, the new allocation matrix would be

	A	B	C	D
P_0	2	0	2	1
P_1	0	1	1	1
P_2	4	1	0	2
P_3	1	0	0	1
P_4	1	1	0	0
P_5	4	2	4	4

, and new need matrix:

	A	B	C	D
P_0	7	5	3	4
P_1	2	1	2	2
P_2	3	4	4	2
P_3	2	3	3	1
P_4	4	1	2	1
P_5	0	2	0	0

.

The new available vector $V = <3, 1, 2, 1>$.

Now, the available resource cannot satisfy any process and we would be at an unsafe state.