

Assignment 4

Nikolaas Lam 10037136 T03

1.

	Allocation	Max	Available
P0	0	2	1
P1	0	1	
P2	1	2	

- If P0 requests <1> :
 - o Deadlock
- If P2 requests <1>:
 - o P2 -> P1 -> P0

2. Minimum value for x is 1

Process	Allocation	Max	Available
P0	1 0 2 1 1	1 1 2 1 3	0 0 1 1 2
P1	2 0 1 1 0	2 2 2 1 0	
P2	1 1 0 1 0	2 1 3 1 0	
P3	1 1 1 1 0	1 1 2 2 1	

Step 1

Process	Allocation	Max	Available	Need
P0	1 0 2 1 1	1 1 2 1 3	0 0 1 1 2	0 1 0 0 2
P1	2 0 1 1 0	2 2 2 1 0		0 2 1 0 0
P2	1 1 0 1 0	2 1 3 1 0		1 0 3 0 0
P3	1 1 1 1 0	1 1 2 2 1	1 1 2 2 2	0 0 1 1 1

Step 2

Process	Allocation	Max	Available	Need
P0	1 0 2 1 1	1 1 2 1 3	2 1 4 3 3	0 1 0 0 2
P1	2 0 1 1 0	2 2 2 1 0		0 2 1 0 0
P2	1 1 0 1 0	2 1 3 1 0		1 0 3 0 0
P3	1 1 1 1 0	1 1 2 2 1		0 0 1 1 1

Step 3

Process	Allocation	Max	Available	Need
P0	1 0 2 1 1	1 1 2 1 3		0 1 0 0 2
P1	2 0 1 1 0	2 2 2 1 0		0 2 1 0 0
P2	1 1 0 1 0	2 1 3 1 0	3 2 4 4 3	1 0 3 0 0
P3	1 1 1 1 0	1 1 2 2 1		0 0 1 1 1

Step 4

Process	Allocation	Max	Available	Need
P0	1 0 2 1 1	1 1 2 1 3		0 1 0 0 2
P1	2 0 1 1 0	2 2 2 1 0	5 2 6 5 4	0 2 1 0 0
P2	1 1 0 1 0	2 1 3 1 0		1 0 3 0 0
P3	1 1 1 1 0	1 1 2 2 1		0 0 1 1 1

Order of execution is P3 -> P0 -> P2 -> P1

3. First fist:

free	P10	P1	P3	Free	P11	Free	P12	Free	P13	P2	Free
100	30	212	112	176	30	200	30	300	30	417	183

P4 cannot fit

Best fit:

Free	P10	P2	Free	P11	P3	Free	P12	P1	Free	P13	P4	Free
100	30	417	83	30	112	88	30	212	88	30	426	174

Worst fit:

Free	P10	P2	Free	P11	Free	P12	P3	Free	P13	P1	Free
100	30	417	83	30	200	30	112	188	30	212	388

P4 cannot fit

Next fit:

Free	P10	P1	P3	Free	P11	Free	P12	Free	P13	P2	Free
100	30	212	112	176	30	200	30	300	30	417	183

P4 cannot fit

4.

Address	Page number	Offset
2375	000010	0101000111
19366	010010	1110100110
30000	011101	0100110000
256	000000	0100000000
16385	010000	0000000001

- 16 bit logical address and page size 2^{10} (1024)

5.

a. $2^{32} / 2^{12} = 2^{20} = 1,000,000$ entries

32 bit logical address, 12 bit offset (4KB page)

b. $2^{29} / 2^{12} = 2^{17} = 131,072$ entries

512MB = 2^{29} bytes, 4KB page

6.

a. 2 memory accesses = $2 \times 200\text{ns} = 400\text{ns}$

b. $p = 0.25$, EAT = $(.75 * 10) + (.25 * 200) = 57.5\text{ns}$

7.

LRU:

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6.
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----

1	1	1	4	4	4	5	5	5	1	1	1	7	7	7	2	2	2	2	2
	2	2	2	2	2	2	6	6	6	6	3	3	3	3	3	3	3	3	3
		3	3	3	1	1	1	2	2	2	2	2	6	6	6	1	1	1	6

Faults = 15

OPT:

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6.
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----

1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	6
	2	2	2	2	2	2	2	2	2	2	7	7	7	7	2	2	2	2	2
		3	4	4	4	5	6	6	6	6	6	6	6	6	6	1	1	1	1

Faults = 11