Branch : CSE & IT Batch : Hinglish

Operating Systems

Memory Management

DPP 09

[NAT]

1. Given 3 page frames and page references are in the order:
2, 3, 4, 5, 2, 3, 6, 2, 3, 4, 5, 6. By using LRU page replacement algorithm. The number of page faults will occur.

[MSQ]

2. Which of the following are virtual memory policies?
(a) Page replacement
(b) Page reduction
(c) Page selection
(d) Page fault.

[MCQ]

3. Suppose there are 4 frames in memory and consider the following reference string:
A, B, E, D, C, E, F, A, G, E, D, C, A, C, B.
Which of the following is correct?
(a) FIFO has less page faults then LRU.
(b) LRU has less page faults then FIFO.
(c) Both FIFO and LRU has equal page faults.
(d) FIFO has 12 page fault.

[NAT]

4. Consider a system with page fault service time of 158ns and page fault hit ratio is 75%. If memory dues time is 10ns then effective memory access time (EMAT) is?

[MCQ]

5. Consider a main memory with five page frames and the following sequence of page references are 4, 9, 3, 4, 10, 2, 7, 4, 9, 10, 4, 7, 3, 2, 4. Which of the statement is true with respect to page replacement policies, first in first out (FIFO) and least recently used (LRU)?
(a) Page faults in FIFO is more than LRU.
(b) Page faults in LRU is more than FIFO.
(c) Both LRU and FIFO has some number of page faults .
(d) Page faults in FIFO has 2 more than LRU.

[MSQ]

6. The Belady's phenomenon is commonly experienced in
(a) First in first out
(b) Second chance algorithm
(c) Random page replacement algorithm
(d) Least recently used algorithm

[NAT]

7. Given reference to the following page by a program :
1, 10, 1, 2, 9, 2, 9, 8, 9, 8, 2, 3, 9, 3, 8, 9, 3, 4, 9, 3
If the program contains 4 page frames. How many page fault will occur in optimal page replacement policy?

[NAT]

8. Given 3 pages frames and page references in the order: 2, 3, 4, 5, 2, 3, 6, 2, 3, 4, 5, 6. By using optimal page replacement algorithm, the number of pages faults will be?

Answer Key

1. **(9)**
2. **(a, c)**
3. **(b)**
4. **(47)**
5. **(c)**
6. **(a, b, c)**
7. **(7)**
8. **(7)**

Hints & Solutions

1. (9)

Page reference: 2 3 4 5 2 3 6 2 3 4 5 6

Frame 1 →	2	2	2	5	5	5	6	6	6	6	6	6
Frame 2 →		3	3	3	2	2	2	2	2	4	4	4
Frame 3 →			4	4	4	3	3	3	3	3	5	5
	PF	PF	PF	PF	PF	PF	PF	PH	PH	PF	PF	PH

Total number of page faults = 9.

2. (a, c)

OS need to decide on policies on page faults concerning:

→ page selection (when to bring in)

→ page replacement (what to replace)

So, 'a' and 'c' are correct answer.

3. (b)

Using FIFO:

	A	B	E	D	C	E	F	A	G	E	D	C	A	C	B
F_1	A	A	A	A	C	C	C	C	C	E	E	E	E	E	B
F_2		B	B	B	B	B	F	F	F	F	D	D	D	D	D
F_3			E	E	E	E	E	A	A	A	A	C	C	C	C
F_4				D	D	D	D	D	G	G	G	G	A	A	A
	PF	PF	PF	PF	PF	PH	PF	PF	PF	PF	PF	PF	PF	PH	PF

Total page fault = 13

Using LRU:

	A	B	E	D	C	E	F	A	G	E	D	C	A	C	B
F_1	A	A	A	A	C	C	C	C	G	G	G	G	A	A	A
F_2		B	B	B	B	B	F	F	F	F	D	D	D	D	D
F_3			E	E	E	E	E	E	E	E	E	E	E	E	B
F_4				D	D	D	D	A	A	A	A	C	C	C	C
	PF	PF	PF	PF	PF	PH	PF	PF	PF	PH	PF	PF	PF	PH	PF

Total page fault = 12

LRU has less page fault than FIFO.

4. (47)

EMAT = (1 – P)M + PS

= (0.75)10 + 0.25(158)

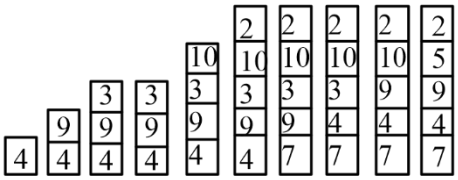
= 47 ns

5. (c)

FIFO

× × × ✓ × × × × × ✓ ✓ ✓ × ✓ ✓

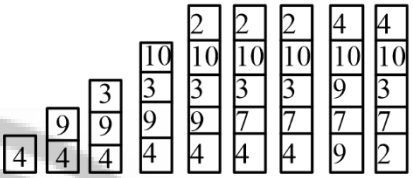
4 9 3 4 10 2 7 4 9 10 4 7 3 2 4



LRU:

× × × ✓ × × × ✓ × ✓ × ✓ ✓ × ✓

4 9 3 4 10 2 7 4 9 10 4 7 3 2 4



Both FIFO and LRU has same number of page faults

6. (a, b, c)

Belady's anomaly can never occur in LRU and optimal page replacement algorithm because these two algorithm belong to a class of stack-based page replacement algorithm.

7. (7)

1 10 1 2 9 2 9 8 9 8 2 3 9 3 8 9 3 4 9 3

× × ✓ × × ✓ ✓ × ✓ ✓ ✓ × ✓ ✓ ✓ ✓ ✓ × ✓ ✓

2 2 2 3 3

10 10 10 8 8 4

1 1 1 9 9 9

8. (7)

× × × × ✓ ✓ × ✓ ✓ × × ✓

2 3 4 5 2 3 6 2 3 4 5 6