Assignment-04

Q.1 Describe various page replacement algorithms?

Ans Page replacement algorithms decide which memory page to page to swap out when a new page needs to be loaded and memory is full. Common algorithms include:

- FIFO (First-in-First-Out): Replaces the oldest page in memory.
- LRU (Least Recently Used): Replaces the oldest page that hasn't been used for the longest time.
- Optimal: Replaces the page that won't be used for the longest time in the future.
- LFU (Least Frequently Used): Replaces the most recently accessed page

Q.2 What is virtual memory? Explain the concept of demand paging.

Ans
- Virtual Memory is a memory management technique that gives the illusion of a large memory

by using disk space as an extension of RAM

• Demand Paging is a method where pages are loaded into memory only when they are needed. Initially, no pages are loaded; when a page is accessed a page fault occurs and the OS loads it from disk.

Benefits:

- Efficient memory usage.
- Allows running large programs on limited RAM.
- Reduces load time

Q what is meant by thrashing? Explain various causes of thrashing?

Ans Thrashing occurs when the system spends more time swapping pages than executing processes, leading to poor performance.

causes:

- High degree of multiprogramming: Too many processes competing for memory

- Insufficient frames: Each process get fewer frames than needed.
- Poor locality: Processes frequently access pages outside their current working set.
- Bad page replacement policy: Frequent replacements increase page faults

Q.4 Consider the main memory with capacity of 4 page frame. Assume that the pages of a referenced in the order as given below -

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

which one is better FIFO or LRU and why?

Ans. Step 1: Simulate FIFO page Replacement

The FIFO algorithm replaces the page that has been memory the longest.

Memory capacity is 4 frames.

Initially all frames are empty.

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Ref	Frame	Page Fault?
1	[1]	No
3	[1,3]	yes
4	[1,3,4]	yes
4	[1,3,4]	No
3	[1,3,4]	No
2	[1,3,4,2]	yes
1	[3,4,2,1]	yes (Replaced 1)
7	[4,2,1,7]	yes (4 3)
5	[2,1,7,5]	yes (1 4)
6	[1,7,5,6]	yes (4 2)
4	[7,5,6,4]	yes (1 2)
2	[5,6,4,2]	yes (1 7)
1	[6,4,2,1]	yes (1 5)
2	[6,4,2,1]	No

Total page fault for FIFO: 10

Step2: simulate LRU Page Replacement

LRU Reference	frames	Page-fault
1	[1]	✓
3	[1 3]	✓
4	[1,3,4]	✓
4	[1,3,4]	X
3	[1,3,4]	X

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2	1 3 4 2	✓
1	3 4 2 1	X
7	4 2 1 7	✓
5	2 1 7 5	✓ (3 removed)
6	1 7 5 6	✓ (4 removed)
4	7 5 6 4	✓ (2 removed)
2	5 6 4 2	✓ (1 removed)
1	6 4 2 1	✓ (7 removed)
2	6 4 1 2	X (5 removed)

Total page faults = 10

Q.5 Consider the following sequence string 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2 3, 7, 6, 3, 2, 1, 2, 3, 6

How many page faults will occur for LRU, FIFO and optical page requirement algorithms assuming 4 available frames?

One FIFO (14 faults)

Step	Reference	Frames (L→R)	page fault
1	1	1	F
2	2	1, 2	F
3	3	1, 2, 3	F
4	4	1, 2, 3, 4	F
5	2	1, 2, 3, 4	H
6	1	1, 2, 3, 4	H

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SESSIONAL PAPERS

7	5	5, 2, 3, 4	F
8	6	5, 6, 3, 4	F
9	2	5, 6, 2, 4	F
10	1	3, 6, 2, 1	F
11	2	5, 6, 2, 1	H
12	3	3, 6, 2, 1	H
13	7	3, 7, 2, 1	F
14	6	3, 7, 2, 6	F
15	3	3, 7, 2, 6	H
16	2	1, 7, 2, 6	H
17	1	1, 2, 7, 6	F
18	2	1, 2, 3, 6	F
19	3	1, 2, 3, 6	F
20	6	1, 2, 3, 6	H

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