

Varun Verma
CS-B1 (Roll no-38)
1801010170

08	August 2020						
Wk	M	T	W	T	F	S	S
31	31				1	2	
32	3	4	5	6	7	8	9
33	10	11	12	13	14	15	16
34	17	18	19	20	21	22	23
35	24	25	26	27	28	29	30

2020
Thursday
July

30

212-154 • WK 31

Assignment -5 Operating System

9.00

Ques 1 → How many page faults would occur for the following reference string for four page frames using FIFO algorithm :-

11.00

12.00 1, 2, 3, 4, 5, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2

Sl. no.	Reference string	Frames (4)	Page fault
1.	1	1, -, -, -	Yes
2.00 2.	2	2, 1, -, -	Yes
3.	3	3, 2, 1, -	Yes
4.	4	4, 3, 2, 1	Yes
3.00 5.	5	5, 4, 3, 2	Yes
6.	5	5, 4, 3, 2	-
4.00 7.	3	5, 4, 3, 2	-
8.	4	5, 4, 3, 2	-
5.00 9.	1	1, 5, 4, 3	Yes
10.	6	6, 1, 5, 4	Yes
6.00 11.	7	7, 6, 1, 5	Yes
12.	8	8, 7, 6, 1	Yes
7.00 13.	7	8, 7, 6, 1	-
14.	8	8, 7, 6, 1	-
15.	9	9, 8, 7, 6	Yes
16.	7	9, 8, 7, 6	-
17.	8	9, 8, 7, 6	-
18.	9	9, 8, 7, 6	-
19.	5	5, 9, 8, 7	Yes
NOTES 20.	4	4, 5, 9, 8	Yes
21.	5	4, 5, 9, 8	-
22.	4	4, 5, 9, 8	-
23.	2	2, 4, 5, 9	Yes

No. of Page fault = 13

9.00

10.00

11.00

12.00

Q2] Consider the following reference 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 occurs for LRU Page Replacement algo? Assuming three frames and all frames are initially empty.

Sr. no.	Reference string	Frames (3)	Page fault
1.00 1.	1	1, -, -	Yes
2.	2	2, 1, -	Yes
2.00 3.	3	3, 2, 1	Yes
4.	4	4, 3, 2	Yes
3.00 5.	2	2, 4, 3	-
6.	1	1, 2, 4	Yes
4.00 7.	5	5, 1, 2	Yes
8.	6	6, 5, 1	Yes
5.00 9.	2	2, 6, 5	Yes
10.	1	1, 2, 6	Yes
6.00 11.	2	2, 1, 6	-
12.	3	3, 2, 1	Yes
7.00 13.	7	7, 3, 2	Yes
14.	6	6, 7, 3	Yes
15.	3	3, 6, 7	-
16.	2	2, 3, 6	Yes
17.	1	1, 2, 3	Yes
18.	2	2, 1, 3	-
NOTES 19.	3	3, 2, 1	-
20.	6	6, 3, 2	Yes
No. of Page fault = 15			

01

214-152 • WK 31

2020

Saturday

August

08

August 2020

Wk	M	T	W	T	F	S	S
31	31					1	2
32	3	4	5	6	7	8	9
33	10	11	12	13	14	15	16
34	17	18	19	20	21	22	23
35	24	25	26	27	28	29	30

Q3] Consider the following pages of a reference string 1, 2, 0, 3, 5, 1, 5, 7, 2, 0, 3, 5, 4, 1, 2, 5, 3, 7. Implement optional page replacement algorithm and calculate the number of page fault by considering three frames in a block

Sr. no.	Reference string	Frames (3)	Page fault.
1.	1	1, -, -	Yes
2.	2	1, 2, -	Yes
3.	0	1, 2, 0	Yes
4.	3	1, 2, 3	Yes
5.	5	1, 2, 5	Yes
6.	1	1, 2, 5	-
7.	5	1, 2, 5	-
8.	7	7, 2, 5	Yes
9.	2	7, 2, 5	-
10.	0	0, 2, 5	Yes
11.	3	3, 2, 5	Yes
12.	5	3, 2, 5	-
13.	4	4, 2, 5	Yes
14.	1	1, 2, 5	Yes
15.	2	1, 2, 5	-
16.	5	1, 2, 5	-
02 Sunday	3	3, 2, 5	Yes
18.	7	3, 7, 5	Yes.

No. of page fault = 12

NOTES

Q4] what do you mean by Belady's anomaly explain with a suitable example which algorithm suffers from Belady's anomaly?

Ans → Belady's Anomaly is the anomaly found in the number of page faults which tells that on increasing the no. of frames the no. of page fault also increases.

This is found in FIFO algorithm which can be seen by following ex:-

Sn. no.	Reference string	Frames (3)	Page fault
1	1	1, -, -	Yes
2	2	2, 1, -	Yes
3	3	3, 2, 1	Yes
4	4	4, 3, 2	Yes
5	1	1, 4, 3	Yes
6	2	2, 1, 4	Yes
7	5	5, 2, 1	Yes
8	1	5, 2, 1	-
9	2	5, 2, 1	-
10	3	3, 5, 2	Yes
11	4	4, 3, 5	Yes
12	5	4, 3, 5	-

no. of page fault = 9

4

7-149 • WK 32

2020
Tuesday
August

08

August 2020

wk	M	T	W	T	F	S	S
31	31					1	2
32	3	4	5	6	7	8	9
33	10	11	12	13	14	15	16
34	17	18	19	20	21	22	23
35	24	25	26	27	28	29	30

Sn. no.	Reference string	Frames (4)	Page fault
1	1	1, -, -, -	Yes
2	2	2, 1, -, -	Yes
3	3	3, 2, 1, -	Yes
4	4	4, 3, 2, 1	Yes
5	1	4, 3, 2, 1	—
6	2	4, 3, 2, 1	—
7	5	5, 4, 3, 2	Yes
8	1	1, 5, 4, 3	Yes
9	2	2, 1, 5, 4	Yes
10	3	3, 2, 1, 5	Yes
11	4	4, 3, 2, 1	Yes
12	5	5, 4, 3, 2	Yes

no. of Page fault = 10

So, we can see the Belady's anomaly here. when frames increased from 3 to 4 then page fault also increased from 9 to 10.

Q5] Prove that LRU policy do not suffer from Belady's anomaly using the following reference string : 1, 2, 3, 3, 4, 1, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 5, 4, 5, 4, 2. Assume that there are three and five frames which are initially empty.

OTES

St. no.	Reference string	Frames(3)	Page fault
9.00 1.	1	1, -, -	yes
2.	2	2, 1, -	yes
10.00 3.	3	3, 2, 1	yes
4.	3	3, 2, 1	-
11.00 5.	4	4, 3, 2	yes
6.	1	1, 4, 3	yes
12.00 7.	5	5, 1, 4	yes
8.	3	3, 5, 1	yes
1.00 9.	4	4, 3, 5	yes
10.	1	1, 4, 3	yes
2.00 11.	6	6, 1, 4	yes
12.	7	7, 6, 1	yes
3.00 13.	8	8, 7, 6	yes
14.	7	7, 8, 6	-
4.00 15.	8	8, 7, 6	-
16.	9	9, 8, 7	yes
5.00 17.	8	8, 9, 7	-
18.	7	7, 8, 9	-
6.00 19.	8	8, 7, 9	-
20.	9	9, 8, 7	-
7.00 21.	5	5, 9, 8	yes
22.	4	4, 5, 9	yes
23.	5	5, 4, 9	-
24.	4	4, 5, 9	-
25.	2	2, 4, 5	yes

NOTES

no. of page fault = ~~17~~ 16

06

219-147 • WK 32

2020

Thursday

August

08

August 2020

Wk	M	T	W	T	F	S	S
31	31					1	2
32	3	4	5	6	7	8	9
33	10	11	12	13	14	15	16
34	17	18	19	20	21	22	23
35	24	25	26	27	28	29	30

Sr. no.	Reference string	Frames (5)	Page fault
9.00			
1	1	1, -, -, -, -	Yes
10.00	2	2, 1, -, -, -	Yes
3	3	3, 2, 1, -, -	Yes
11.00	4	3, 2, 1, -, -	-
5	4	4, 3, 2, 1, -	Yes
12.00	6	1, 4, 3, 2, -	-
7	5	5, 1, 4, 3, 2	Yes
1.00	8	3, 5, 1, 4, 2	-
9	4	4, 3, 5, 1, 2	-
2.00	10	1, 4, 3, 5, 2	-
11	6	6, 1, 4, 3, 5	Yes
3.00	12	7, 6, 1, 4, 3	Yes
13	8	8, 7, 6, 1, 4	Yes
4.00	14	7, 8, 6, 1, 4	-
15	8	8, 7, 6, 1, 4	-
5.00	16	9, 8, 7, 6, 1	Yes
17	8	8, 9, 7, 6, 1	-
6.00	18	7, 8, 9, 6, 1	-
19	8	8, 7, 9, 6, 1	-
7.00	20	9, 8, 7, 6, 1	-
21	5	5, 9, 8, 7, 6	Yes
22	4	4, 5, 9, 8, 7	Yes
23	5	5, 4, 9, 8, 7	-
24	4	4, 5, 9, 8, 7	-
25	2	2, 4, 5, 9, 8, 7	Yes

NOTES

no. of Page fault = 12

So, Belady's anomaly is not present in LRU.