Q:1- Given page reference string:

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
Total references: 20, number of page frames = 4.

Simulate the following page replacement algorithms:

- (a) FIFO (b) LRU (c) Optimal(d) Second Chance

For each algorithm:

$$page\ fault\ ratio = page\ miss\ ratio$$

- Write **H (Hit)** or **F (Fault)** below each page reference also calculate Page Fault Ratio.

a-FIFO: 1 2 3 4/2 1 5 6 2 1 2 3 7 6 3 2 1 2 3 6

Hit : 6   Fault : 14   Page Fault Ratio : 14/20

F1	1	1	1	1	5	5	5→5	3	3	3→3	1	1					
F2		2	2	2→2	6	6	6→6	7	7	7→7	3						
F3			3	3	3→3	2	2	2→2	6	6	6→6						
F4				4	4	4→4	1	1	1→1	2	2	2					

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

b- LRU: Hit : 10   Fault : 10

F1	1	1	1	1	1	1	1	1	6	6							
F2		2	2	2	2	2	2	2	2								
F3			3	3	5	5	3	3	3	3							
F4				4	4	6	6	7	7	1							

Page Fault ratio : 10/20 = 1/2

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

c-Optimal:

Page Hit : 12   Page Fault : 8   Page Fault Ratio : 8/20

F1	1	1	1	1	1	1	7	1												
F2		2	2	2	2	2	2	2												
F3			3	3	3	3	3	3												
F4				4	5	6	6	6												

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

d-Second chance:
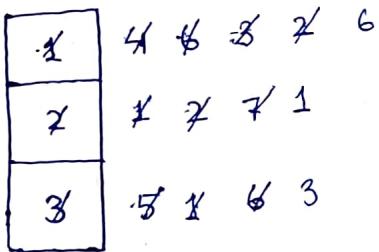
Page Hit : 10   Page Fault : 10   Page Fault Ratio : 10/20

F1	1(0)	1(0)	1(0)	1(0)	1(0)	1(1)	1(0)	1(0)	1(0)	1(1)	1(0)	1(0)	6(0)	6(1)	6(1)	6(1)	6(1)	6(1)		
F2		2(0)	2(0)	2(0)	2(1)	2(1)	2(0)	2(0)	2(1)	2(1)	2(0)	2(0)	2(0)	2(0)	2(0)	2(1)	2(0)	2(1)		
F3			3(0)	3(0)	3(0)	3(0)	5(0)	5(0)	5(0)	5(0)	3(0)	3(0)	3(0)	3(0)	3(1)	3(1)	3(0)	3(1)		
F4				4(0)	4(0)	4(0)	4(0)	6(0)	6(0)	6(0)	6(0)	7(0)	7(0)	7(0)	7(0)	7(0)	1(0)	1(0)		

e- If frame size is decreased to 3, will FIFO show Belady's Anomaly in this case? Write Yes or No with a short reason.

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

Page Hit = 13

Page Fault Ratio = 18/20 → for 3 frames

Page Fault Ratio : 14/20 → for 4 frames

~~Yes~~ No, FIFO will not show Belady's Anomaly as more frame → ~~more~~ page faults less.