Prob. How many page faults will occur with a reference string 0,1,7,2,3,2,7,1,0,3?There are four frames which are initially empty.Use

1. LRU Page replacement algorithm

Sol.

LRU Page replacement algorithm:
LRU stands for least recently used.It replaces the page that has been referenced for longest time.In FIFO Page replacement algorithm problem is, it may replace heavily used pages.

0	1	7	2	3	2	7	1	0	3

Above table is an example of page frame, which is empty initially. And first page is 0.
So 0 will get added here, but there will be a page fault.
What is a page fault?The page which is requested by the program is not present in the RAM, that means there is a page fault.
0 was not present in the page frame so there was a page fault.

0	1	7	2	3	2	7	1	0	3
0									

F									

The next page is 1 and there is space for two more pages.So 0 will remain there and 1 will get added there.And again there will be a page fault.

0	1	7	2	3	2	7	1	0	3
0	0								
	1								
F	F								

The next page is 7, which is not in the page frame, but there is place for one more page, so 0 and 1 will remain there and 7 will get added. And there will be a page fault.

0	1	7	2	3	2	7	1	0	3
0	0	0							
	1	1							
		7							
F	F	F							

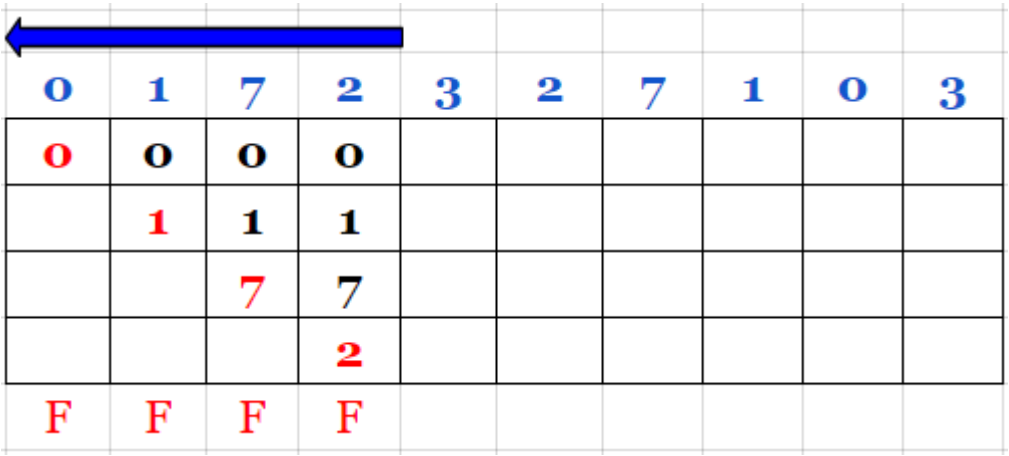
The next page is 2, which is not in the page frame, but there is place for one more page, so 0, 1 and 7 will remain there and 2 will get added. And there will be a page fault.

0	1	7	2	3	2	7	1	0	3
0	0	0	0						
	1	1	1						
		7	7						
			2						
F	F	F	F						

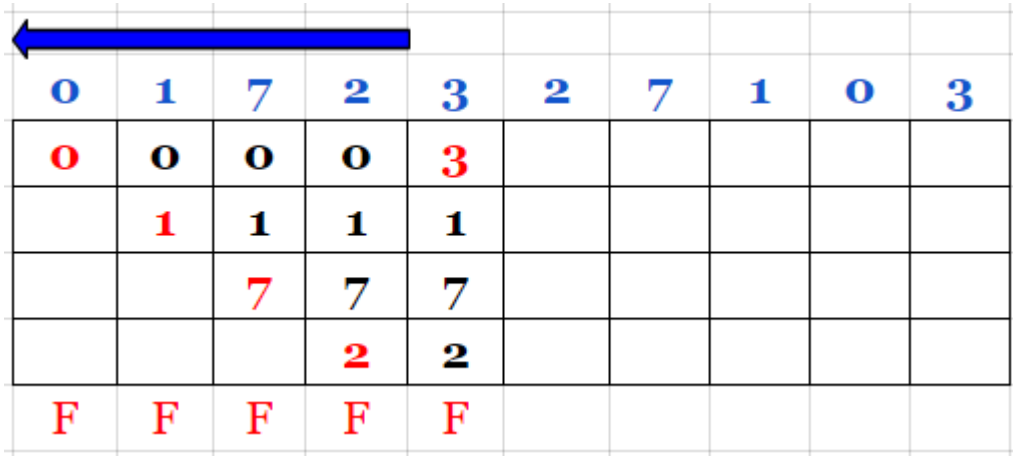
I have given red color when there is a page fault, and black color for rest of the pages, and green color for page hits.

Now the page frame is full, and the next page is 3 which is not there in the page frame. So we need to remove one page from the page frame, so we can add 3 there.

Now see in the table below,



2 is most recently used page, than 7 and than 1 and than 0.So 0 will get removed, and 3 will get added there. And there will be a page fault because 3 was not present in the page frame. And 1, 7, and 2 will remain there.



0	1	7	2	3	2	7	1	0	3
0	0	0	0	3					
	1	1	1	1					
		7	7	7					
			2	2					
F	F	F	F	F					

The next page is 2, which is already present in the page frame. This is known as page hit.

*What is page hit ?*The page which is requested by the program is already present in the RAM/page frame is known as page hit.

0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3				
	1	1	1	1	1				
		7	7	7	7				
			2	2	2				
F	F	F	F	F	H				

The next page is 7, which is already present in the page frame. This is known as page hit.

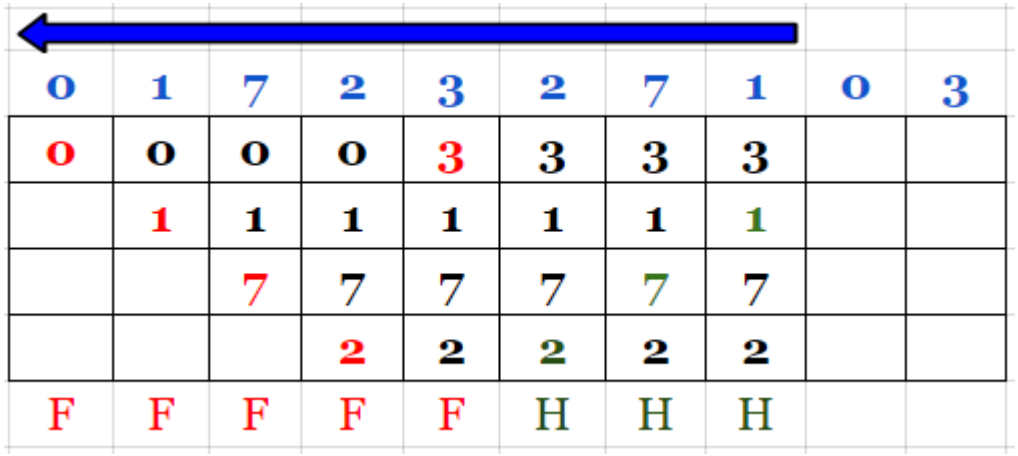
0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3			
	1	1	1	1	1	1			

		7	7	7	7	7			
			2	2	2	2			
F	F	F	F	F	H	H			

The next page is 1, which is already present in the page frame. This is known as page hit.

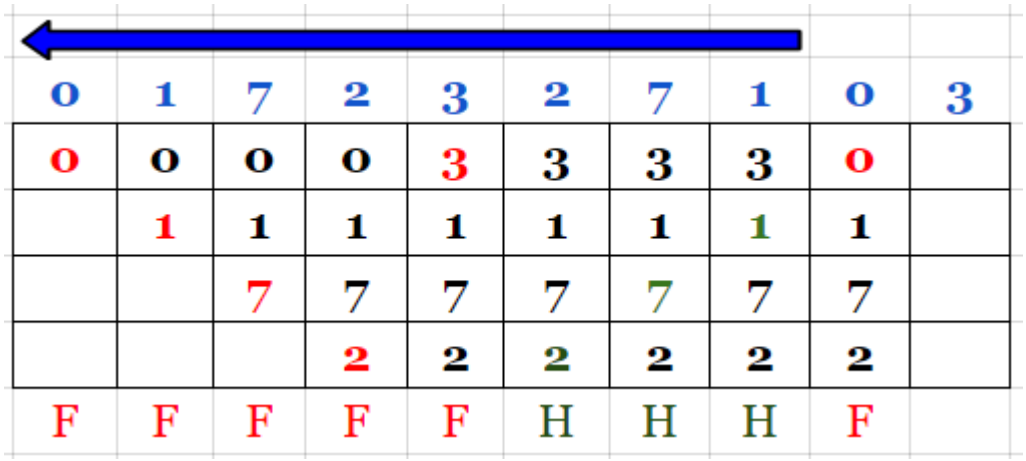
0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3	3		
	1	1	1	1	1	1	1		
		7	7	7	7	7	7		
			2	2	2	2	2		
F	F	F	F	F	H	H	H		

The page frame is full, and the next page is 0 which is not there in the page frame. So we need to remove one page from the page frame, so we can add 0 there.
Now see in the table below,



0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3	3		
	1	1	1	1	1	1	1		
		7	7	7	7	7	7		
			2	2	2	2	2		
F	F	F	F	F	H	H	H		

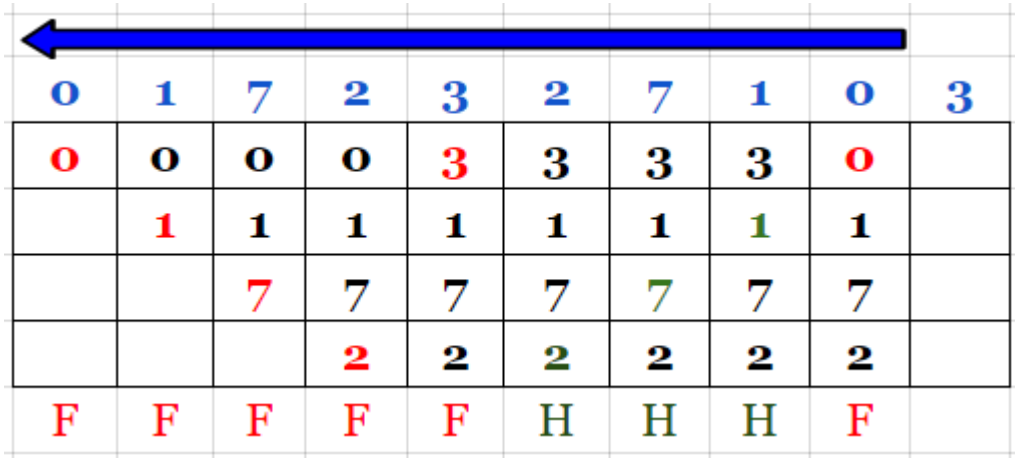
1 is most recently used page, than 7 and than 2 and then 3.So 3 will get removed, and 0 will get added there. And there will be a page fault because 0 was not present in the page frame. And 1, 7, and 2 will remain there.



0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3	3	0	
	1	1	1	1	1	1	1	1	
		7	7	7	7	7	7	7	
			2	2	2	2	2	2	
F	F	F	F	F	H	H	H	F	

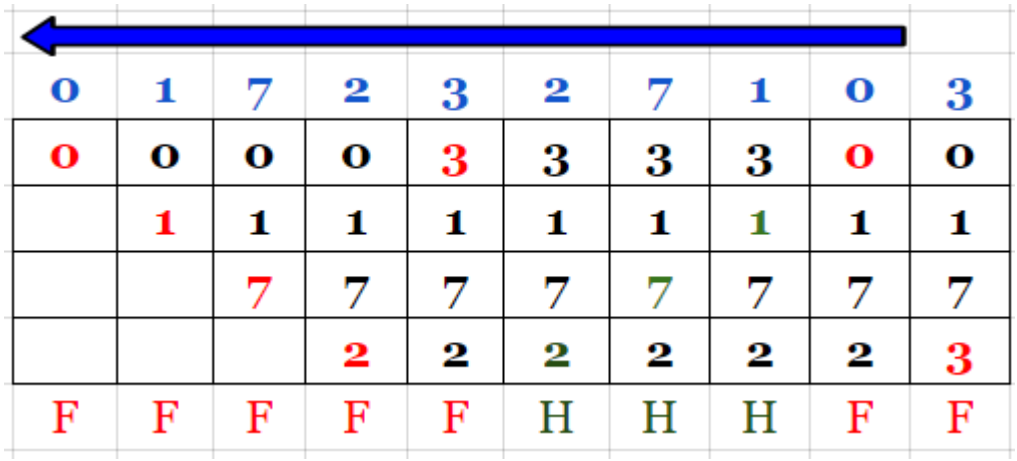
The page frame is full, and the next page is 3 which is not there in the page frame. So we need to remove one page from the page frame, so we can add 3 there.

Now see in the table below,



0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3	3	0	
	1	1	1	1	1	1	1	1	
		7	7	7	7	7	7	7	
			2	2	2	2	2	2	
F	F	F	F	F	H	H	H	F	

0 is most recently used page, than 1 and than 7 and then 2.So 2 will get removed, and 3 will get added there. And there will be a page fault because 3 was not present in the page frame. And 0, 1, and 7 will remain there.



0	1	7	2	3	2	7	1	0	3
0	0	0	0	3	3	3	3	0	0
	1	1	1	1	1	1	1	1	1
		7	7	7	7	7	7	7	7
			2	2	2	2	2	2	3
F	F	F	F	F	H	H	H	F	F

Total pages present in the pages is = 10.

0	1	7	2	3	2	7	1	0	3

Total page faults = 07.

F	F	F	F	F				F	F

Total page hits = 03

					H	H	H		

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