Smt.chandibai Himathmal Mansukhani College

Contents

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USCSP30) USCS303-Operating System (OS)

Practical-08:Page Replacement Algorithm First In First Out (FIFO)

Practical Date:31st August 2021

Pratical Aim: Page Replacement Algorithm First(FIFO)

Algorithm

- **Page Replacement Algorithm**
  - ☆ In operating systems that use paging for memory management, **page replacement algorithm** are needed to decide which page needed to be replaced when new page comes in.
  - ☆ Whenever a new page is referred and not present in memory, page fault occurs and Operating System replaces one of the existing pages with newly needed page.
  - ☆ Different page replacement algorithms suggest different ways to decide which page to replace.
  - ☆ The target for all algorithms is to reduce number of page faults.
  - ☆ **Page Fault** - A page fault happens when a running program accesses a memory page that is mapped into the virtual address space, but not loaded in physical memory.

    - ✦ **Step 1:** First of all, find the location of the desired page on the disk.

    - ✦ **Step 2:** Find a free Frame:

      - **Step 2.1:** If there is a free frame, then use it.
      - **Step 2.2:** If there is no free frame then make use of the page replacement algorithm in order to select the victim frame.
      - **Step 2.3**: Then after that write the victim frame to the disk and then make the changes in the page table and frame table accordingly.

    - ✦ **Step 3:** After that read the desired page into the newly freed frame and then change the page and frame tables.

    - ✦ **Step 4:** Restart the process.

- **First In First Out (FIFO)**
  - ☆ It is a very simple way of Page replacement and is referred to as **First In First Out (FIFO).**

- ☆ This algorithm mainly replaces the oldest page that has been present in the main memory for the longest time.
- ☆ This algorithm is implemented by keeping the track of all the pages in the queue.
- ☆ As new pages are requested and are swapped in, they are added to the tail of a queue and the page which is at the head becomes the victim.
- ☆ This is not an effective way of page replacement but it can be used for small systems.

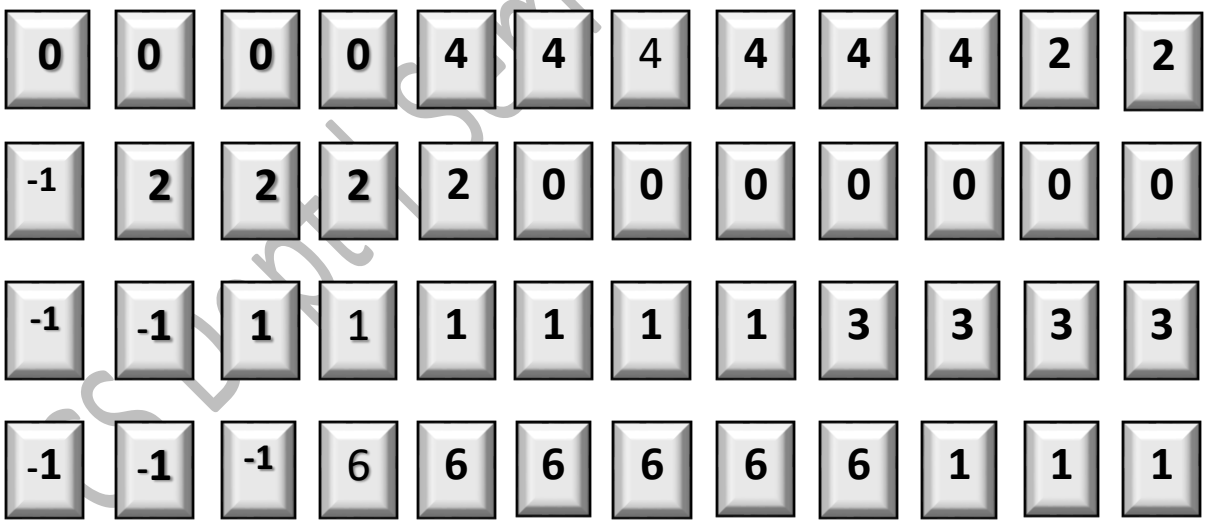
Solved Example

Example:01

- ☆ Apply the FIFO replacement algorithms for the following page-reference strings: 0, 2,1, 6, 4, 0, 1, 0, 3, 1, 2,1.
- ☆ Indicate the number of page faults for FIFO algorithm assuming demand paging with four frames.
- ☆ Find the number of hits, number of faults and hit.

Solution:

Page Reference String: 0, 2,1, 6, 4, 0, 1, 0, 3, 1, 2,1
Demand Paging Or Number of Frames:4



0	2	1	6	4	0	1	0	3	1	2	1

Number of Hits:count of no replacements=3 ✔

Number of Faults:count of replacement=9 ✘

Hit Ratio:Number of Hits/Len(Ref String)=3/12=0.25

Example:02

- Consider the following example 3 frames with 1,3,0,3,5,6,3 page reference strings.
- Find the number of hits,number of faultsand hit ratio using FIFO Page Replacment Algorithm

Solution:

Page Reference String: 1,3,0,3,5,6 ,3
Demand Paging Or Number of Frames:7

1	1	1	1	5	5	5
-1	3	3	3	3	6	6
-1	-1	0	0	0	0	3
1	3	0	3	5	6	3
✘	✘	✘	✘	✘	✘	✔

Number of Hits: Count of no replacements = 1 ✔

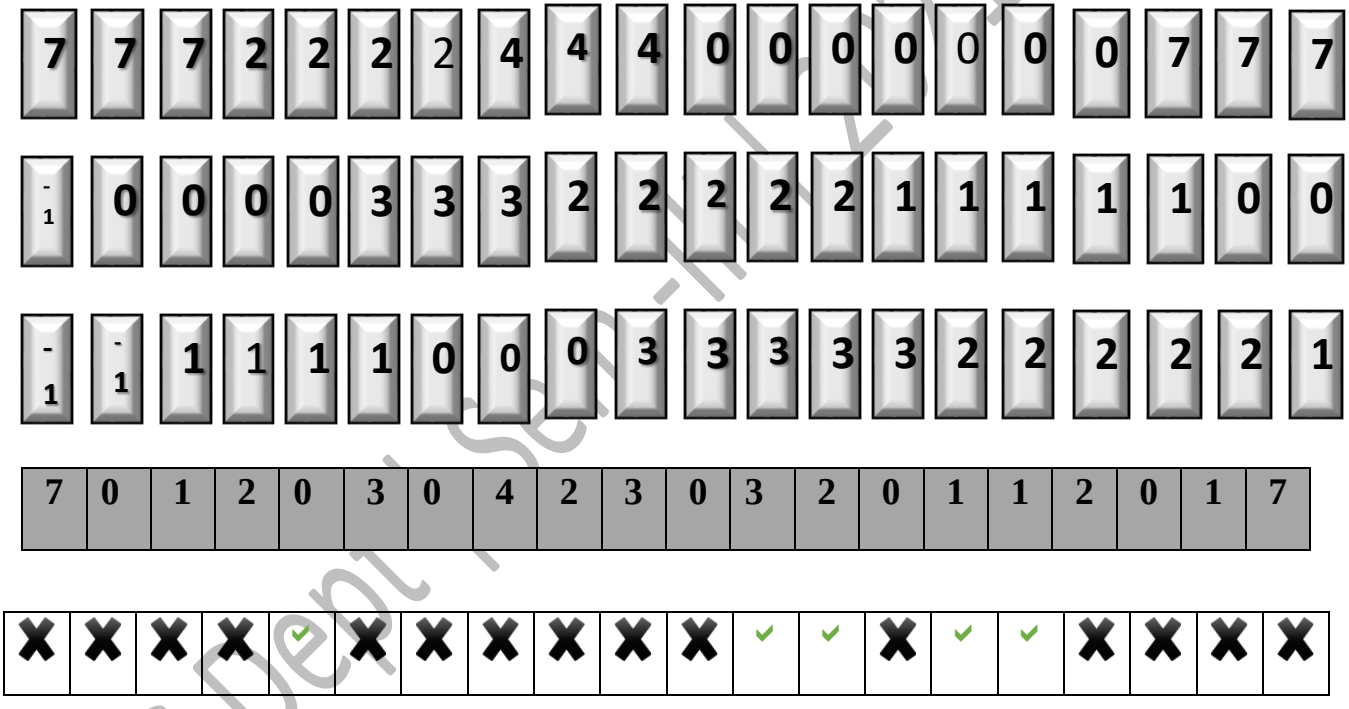
Number of Faults: Count of replacements = 6 ✘

Hit Ratio: Number of Hits/Len (Ref String) = 1/7= 0.14

Example :03

- Consider the following example 3 frames with 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1 page-reference strings.
- Find the number of hits, number of faults and hit ratio using FIFO Page Replacement Algorithm.

Solution:



Number of Hits:count of no replacements=5 ✔

Number of Faults:count of replacement=15 ✘

Hit Ratio:Number of Hits/Len(Ref String)=5/20=0.25

Question

Write a Java Program that implements the FIFO page-replacements Algorithm.

Implementation

File Name: P8_PR_FIFO_SJ.java

```
// Name: Sahil Jadhav
// Batch: B2
// PRN: 2020016400783091
// Date: 31 August,2021
// Prac-08: Page Replacement Algorithm(FIFO)

import java.io.*;
import java.util.*;
public class P8_PR_FIFO_SJ
{
	public static void main(String[] args) throws IOException
	{
		Scanner scan = new Scanner(System.in);
		int frames, pointer = 0, hit = 0, fault = 0,ref_len;
		Boolean isFull=false;
		int buffer[];
		ArrayList<Integer>stack=new ArrayList<Integer>();
		int reference[];
		int mem_layout[][];
		System.out.print("Please enter the number of Frames: ");
		frames= scan.nextInt();
		System.out.print("Please enter the length of the Reference string: ");
		 ref_len = scan.nextInt();
```

```
reference = new int[ref_len];
mem_layout= new int[ref_len][frames];
buffer = new int[frames];
for(int j = 0; j < frames; j++)
buffer[j] = -1;
System.out.println("Please enter the reference string: ");
for(int i = 0; i < ref_len; i++)
{
        reference[i] = scan.nextInt();
}
System.out.println();
for(int i = 0; i < ref_len; i++)
{
        if(stack.contains(reference[i]))
        {

                stack.remove(stack.indexOf(reference[i]));
        }
        stack.add(reference[i]);
        int search=-1;
        for (int j=0;j<frames;j++)
        {
                if(buffer[j]==reference[i])
        {
                search =j;
                hit++;
                break;
        }
}
if(search == -1)
```

```
            {
                buffer[pointer] = reference[i];
                fault++;
                pointer++;
                if(pointer == frames)
                pointer = 0;


            }
            for(int j = 0; j <frames; j++)
                mem_layout[i][j]=buffer[j];
            }
            for(int i = 0; i < frames; i++)
            {
            for(int j = 0; j <ref_len; j++)
                 System.out.printf("%3d",mem_layout[j][i]);
               System.out.println();
            }

            System.out.println("The number of Hits: " + hit);
            System.out.println("Hit Ratio: " + (float)((float)hit/ref_len));
            System.out.println("The number of Faults: " + fault);

            }

        }
```

Input

Command Prompt

```
C:\Users\SAHIL>cd\

C:\>cd C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>javac P8_PR_FIFO_SJ.java

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>java P8_PR_FIFO_SJ
Please enter the number of Frames: 4
Please enter the length of the Reference string: 12
Please enter the reference string:
0 2 1 6 4 0 1 0 3 1 2 1

  0  0  0  0  4  4  4  4  4  4  2  2
 -1  2  2  2  2  0  0  0  0  0  0  0
 -1 -1  1  1  1  1  1  1  3  3  3  3
 -1 -1 -1  6  6  6  6  6  6  1  1  1
The number of Hits: 3
Hit Ratio: 0.25
The number of Faults: 9

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>
```

Ouput

```
0 2 1 6 4 0 1 0 3 1 2 1

  0  0  0  0  4  4  4  4  4  4  2  2
 -1  2  2  2  2  0  0  0  0  0  0  0
 -1 -1  1  1  1  1  1  1  3  3  3  3
 -1 -1 -1  6  6  6  6  6  6  1  1  1
The number of Hits: 3
Hit Ratio: 0.25
The number of Faults: 9

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>
```

Sample Ouput of Example:01

```
C:\>cd C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>javac P8_PR_FIFO_SJ.java

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>java P8_PR_FIFO_SJ
Please enter the number of Frames: 4
Please enter the length of the Reference string: 12
Please enter the reference string:
0 2 1 6 4 0 1 0 3 1 2 1

  0  0  0  0  4  4  4  4  4  4  2  2
 -1  2  2  2  2  0  0  0  0  0  0  0
 -1 -1  1  1  1  1  1  1  3  3  3  3
 -1 -1 -1  6  6  6  6  6  6  1  1  1
The number of Hits: 3
Hit Ratio: 0.25
The number of Faults: 9
```

Sample Ouput of Example:02

```
C:\>cd C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>javac P8_PR_FIFO_SJ.java

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>java P8_PR_FIFO_SJ
Please enter the number of Frames: 3
Please enter the length of the Reference string: 7
Please enter the reference string:
1 3 0 3 5 6 3

  1  1  1  1  5  5  5
 -1  3  3  3  3  6  6
 -1 -1  0  0  0  0  3
The number of Hits: 1
Hit Ratio: 0.14285715
The number of Faults: 6

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>
```

Sample Ouput of Example:03

Command Prompt

```
C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>javac P8_PR_FIFO_SJ.java

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>java P8_PR_FIFO_SJ
Please enter the number of Frames: 3
Please enter the length of the Reference string: 20
Please enter the reference string:
7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1

  7  7  7  2  2  2  2  4  4  4  0  0  0  0  0  0  0  7  7  7
 -1  0  0  0  0  3  3  3  2  2  2  2  2  1  1  1  1  1  0  0
 -1 -1  1  1  1  1  0  0  0  3  3  3  3  3  2  2  2  2  2  1
The number of Hits: 5
Hit Ratio: 0.25
The number of Faults: 15

C:\USCSP301\USCS303_OS_B2\prac_08_SJ_31_08_21>_
```