

Smt.chandibai Himathmal Mansukhani College

Contents

USCSP30) USCS303-Operating System (OS)	2
Practical-08:Page Replacement Algorithm First In First Out (FIFO).....	2
Practical Date: 31 st August 2021	2
Practical Aim: Page Replacement Algorithm First(FIFO).....	2
Algorithm	2
• Page Replacement Algorithm	2
• First In First Out (FIFO).....	2
Solved Example	3
Example:01	3
Example:02	4
Example :03	5
Question	6
Implementation	6
File Name: P8_PR_FIFO_SJ.java	6
Input	9
Ouput	9
Sample Ouput of Example:01	10
Sample Ouput of Example:02	10
Sample Ouput of Example:03	11

USCSP30) USCS303-Operating System (OS)

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

Practical Date:31st August 2021

Practical 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)**.

Smt.chandibai Himathmal Mansukhani College

- ☆ 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	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
0	2	1	6	4	0	1	0	3	1	2	1
×	×	×	×	×	×	✓	✓	×	×	×	✓

Smt.chandibai Himathmal Mansukhani College

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
✗	✗	✗	✗	✗	✗	✓

Smt.chandibai Himathmal Mansukhani College

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:

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
7	0	1	2	0	3	0	4	2	3	0	3	2	0	1	1	2	0	1	7
✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✓	✓	✗	✗	✗

Number of Hits:count of no replacements=5 ✓

Number of Faults:count of replacement=15 ✗

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

Smt.chandibai Himathmal Mansukhani College

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);  
}  
}
```


Smt.chandibai Himathmal Mansukhani College

Input

□

```
C:\> 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>
```

Smt.chandibai Himathmal Mansukhani College

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>
```

Smt.chandibai Himathmal Mansukhani College

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>_
```