

Smt. Chandibai Himathmal Mansukhani College

USCSP301 : USCS303 - Operating System (OS)

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USCS3P01:USCS303 – Operating System (OS) Practical 08

Practical Date: 31st August 2021

Practical Aim: Page Replacement Algorithm : FIFO

Page Replacement Algorithm : FIFO

- **Content:** In FIFO page replacement algorithm, the oldest page, which has spent the longest time in memory is chosen and replaced.
- **Process:** Implement FIFO Algorithm and find out page hits and page faults.
- **Prior Knowledge:** Page Replacement Algorithm.

Page Replacement Algorithm

- In Operating Systems that use paging for memory management, Page Replacement Algorithm is 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 pages.
- 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

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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 victim.
- This is not an effective way of page replacement but it can be used for small systems.

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Solved Example:

- 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 you algorithm assuming demand paging with four frames.
- Find the number of hits, number of faults and hit ratio.

Page-Reference String : 0,2,1,6,4,0,1,0,3,1,2,1.

Demand Paging or Number of Frames: 4

<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>4</u>		<u>4</u>		<u>4</u>		<u>4</u>		<u>4</u>		<u>2</u>		<u>2</u>
<u>-1</u>		<u>2</u>		<u>2</u>		<u>2</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>
<u>-1</u>		<u>-1</u>		<u>1</u>		<u>1</u>		<u>1</u>		<u>1</u>		<u>1</u>		<u>3</u>		<u>3</u>		<u>3</u>		<u>3</u>
<u>-1</u>		<u>-1</u>		<u>-1</u>		<u>6</u>		<u>6</u>		<u>6</u>		<u>6</u>		<u>6</u>		<u>6</u>		<u>1</u>		<u>1</u>

<u>0</u>	<u>2</u>	<u>1</u>	<u>6</u>	<u>4</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>1</u>
<u>W</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>R</u>	<u>R</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>R</u>

Number of Hits: count of number replacements = 3

Number of faults: count of replacements = 9 [R]

Hit Ratio : Number of hits / len(Ref string)= 3/12 = 0.25 [W]

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Do it yourself: 01

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

Do it yourself: 02

- 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 page using LRU Page Replacement Algorithm

Question:

Write a Java Program that implements the FIFO page-replacement algorithm.

Implementation:

```
// Name: Gaurang Sanyasi
// Batch: B2
// PRN: 2020016400785461
// Date: 31st August, 2021
// Prac-08: Page Replacement Algorithm FIFO
```

```
import java.io.*;
import java.util.*;
public class P8_PR_FIFO_GS
{
    public static void main(String[] args) throws IOException
    {
        Scanner scan = new Scanner(System.in);
        int frames,pointer = 0,hit = 0,fault = 0,ref_len;
        int buffer[];
        int reference[];
```

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```
int mem_layout[][];
System.out.print("Please enter the number of frames: ");
frames = scan.nextInt();
System.out.print("Please enter the length of 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++)
{
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++)
```

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```
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:

```
E:\>cd E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 4
Please enter the length of Reference string: 12
Please enter the reference string:
0 2 1 6 4 0 1 0 3 1 2 1
```

Output:

```
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
e number of Hits:3
t Ratio:0.25
e number of faults:9
\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```

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Sample Output01:

```
E:\>cd E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 4
Please enter the length of 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

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```

Input:

```
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 3
Please enter the length of Reference string: 7
Please enter the reference string:
1 3 0 3 5 6 3
```

Output:

```
    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

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```


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Sample Output 02:

```
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 3
Please enter the length of 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

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```

Input:

```
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 3
Please enter the length of 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
```

Output:

```
    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

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```

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Sample Output 03:

```
E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>javac P8_PR_FIFO_GS.java

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>java P8_PR_FIFO_GS
Please enter the number of frames: 3
Please enter the length of 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

E:\USCS3P01_USCS303_OS_B2\Prac_08_GS_31_08_2021>_
```