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USCSP301-USCS303: Operating System(OS) Practical-09

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Practical - 09: Page Replacement Algorithm: LRU

• Content:

 In LRU page replacement algorithm, the page that has not been used for the longest period of the time is chosen and replaced.

Process:

o Implement LRU Algorithm and find out page hits and page faults.

• Prior Knowledge:

o Page Replacement Algorithm.

Page Replacement Algorithm

- In demand paging memory management technique, if a page demanded for execution is not present in main memory, then a page fault occurs.
- To load the page in demand into main memory, a free page frame is searched in main memory and allocated.
- If no page frame is free, memory manager has to free a frame by swapping its contents to secondary storage and thus make room for the required page.
- To swap pages, many schemes or strategies are used.

Batch: 01 Name: Shraddha Sawant Page 2

Least Recently Used (LRU)

- The **Least Recently used (LRU) algorithm** replaces the page that has not been used for the longest period of time.
- It is based on the observation that pages that have not been used for long time will probably remain unused for the longest time and are to be replaced.

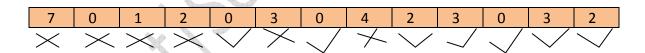
Example

- Apply the LRU replacement algorithm for the following page-reference strings: 7,0,1,2,0,3,0,4,2,3,0,3,2.
- Indicate the number paging with four frames.
- Find the number of hits, number of faults and hit ratio.

Page Reference String: 7,0,1,2,0,3,0,4,2,3,0,3,2

Demand Paging or Number of Frames: 4

7	7	7	7	7	3	3	3	3	3	3	3	3
-1	0	0	0	0	0	0	0	0	0	0	0	0
-1	-1	1	1	1	1	1	4	4	4	4	4	4
-1	-1	-1	2	2	2	2	2	2	2	2	2	2



Number of Hits: count of no replacements = 7

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Number of Faults: count of replacements = 6

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Hit Ratio: Number of Hits/Len(Ref String) = 7/13 = 0.53846157

Batch: 01 Name: Shraddha Sawant

Question:

Write a Java program that implements the LRU page-replacement algorithm.

Source Code:

```
//NAME: SHRADDHA SAWANT
//BATCH: B1
//PRN: 2020016400773862
//DATE: 30th Aug, 2021
//PRAC-08: PAGE REPLACEMENT ALGORITHM
import java.io.*;
import java.util.*;
public class P8 PR FIFO SS
{
 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[];
 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++)</pre>
  buffer[j] = -1;
System.out.println("Please enter the reference string: ");
for(int i=0; i<ref_len; i++)</pre>
{
 reference[i] = scan.nextInt();
}
System.out.println();
for(int i=0; i< ref_len; i++)</pre>
{
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++)</pre>
 mem_layout[i][j]=buffer[j];
}
for(int i=0; i<frames; i++)</pre>
{
 for(int j =0; j<ref_len; j++)</pre>
 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:

Output:

Sample Output - 01:

Sample Output – 02:

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_09_SS_30_08_2021>java P9_PR_LRU_SS

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 3 3

-1 -1 0 0 0 6 6

The number of Hits: 2

Hit Ratio: 0.2857143

Thne number of Faults: 5
```

Sample Output - 03:

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_09_SS_30_08_2021>java P9_PR_LRU_SS
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 1 1 1 1 1 1 1

-1 0 0 0 0 0 0 0 0 3 3 3 3 3 0 0 0 0 0

-1 -1 1 1 1 3 3 3 2 2 2 2 2 2 2 2 7 7 7

The number of Hits: 8
Hit Ratio: 0.4
Thne number of Faults: 12
```