Practical No 11

Aim : Develop, debug and Execute a C program to simulate Optimal page replacement algorithms

Apparatus: Mingw compiler for C/C++, and a text editor for developing C code file (Dev C++).

Theory :

What is Page Replacement algorithm?

- In an operating system that uses paging for memory management, a page replacement algorithm is needed to decide which page needs to be replaced when new page comes in.
- The page replacement algorithms do this task of deciding which page needs to be replaced when a new page arrives in the memory.

What are the components of Page Replacement Algorithms?

Page fault:

- A page fault happens when a running program accesses a memory page that is mapped into the virtual address space but is not loaded in physical memory.
- Since actual physical memory is much smaller than virtual memory, page faults can happen.
- In case of page faults, the operating system might have to replace one of the existing pages with the newly needed page.
- Different page replacement algorithms suggest different ways to decide which page to replace.
- The target for all algorithms is to reduce the number of page faults.

Page Hit:

- When we want to load the page on the memory, and the page is already available on memory, then it is called page hit.

What is Optimal Page Replacement?

- The idea is simple, for every reference we do following : If referred page is already present, increment hit count.
- If not present, find if a page that is never referenced in future. If such a page exists, replace this page with new page. If no such page exists, find a page that is referenced farthest in future. Replace this page with new page.

Example:

Reference string: 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1

No of frames: 4

F4				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
F3			1	1	1	1	1	4	4	4	4	4	4	1	1	1	1	1	1	1
F2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1	7	7	7	7	7	3	3	3	3	3	3	3	3	3	3	3	3	7	7	7
	*	*	*	*	HIT	*	HIT	*	HIT	HIT	HIT	HIT	HIT	*	HIT	HIT	HIT	*	HIT	HIT

Page fault (*): 8

Page hit (HIT): 12

Page fault ratio = No. of page fault / No. of reference string

= 8/20

= 40%

Page hit ratio = No. of page ratio / No. of reference string

= 12/20

= 60%

Code:

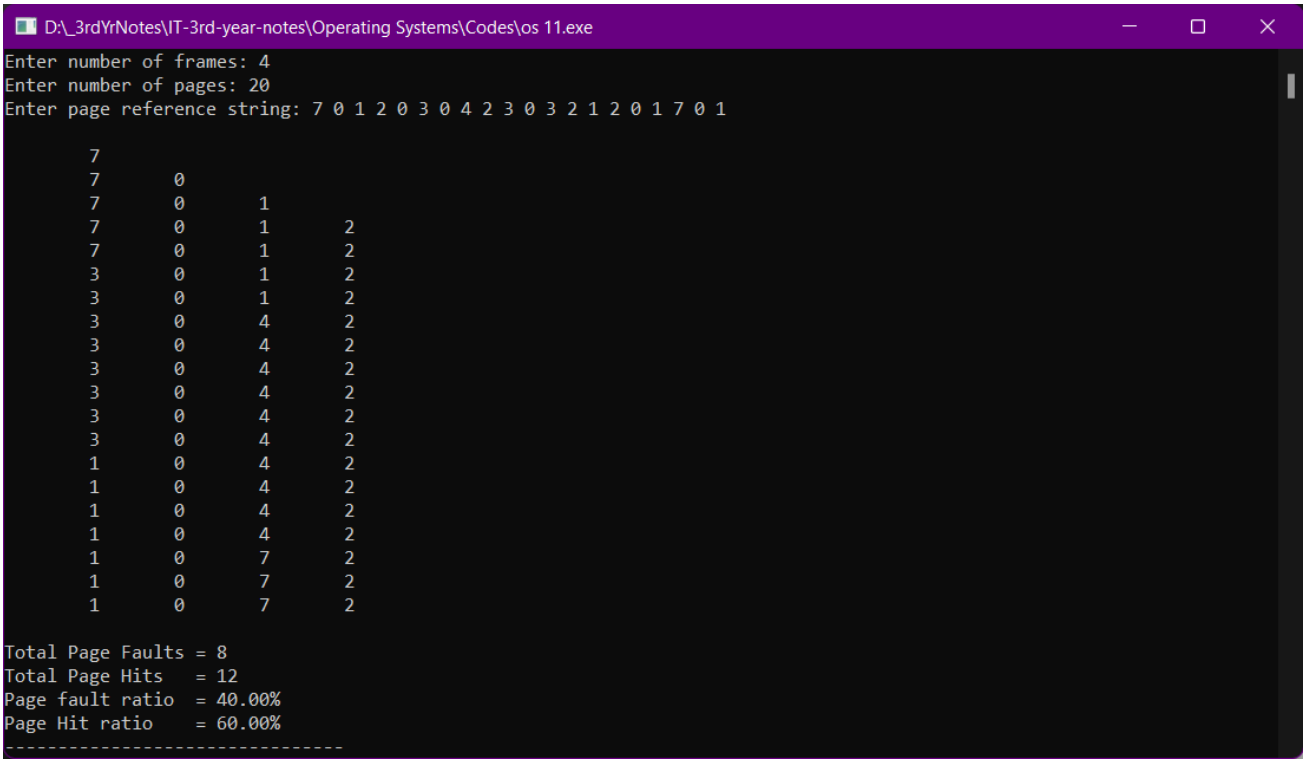
```
#include<stdio.h>
int main()
{
    int no_of_frames, no_of_pages, frames[10], pages[30], temp[10], hit_miss_flag =
0,flag1, flag2, flag3, i, j, k, pos, max, faults = 0;
    int isfault = 0, ishit = 0;
      printf("Enter number of frames: ");
    scanf("%d", &no_of_frames);

    printf("Enter number of pages: ");
    scanf("%d", &no_of_pages);
```

```
printf("Enter page reference string: ");

for(i = 0; i < no_of_pages; ++i){
    scanf("%d", &pages[i]);
}

for(i = 0; i < no_of_frames; ++i){
    frames[i] = -1;
}

for(i = 0; i < no_of_pages; ++i){
  isfault = 0;
    flag1 = flag2 = 0;

    for(j = 0; j < no_of_frames; ++j){
        if(frames[j] == pages[i]){
               flag1 = flag2 = 1;
               break;
           }
    }

    if(flag1 == 0){
        for(j = 0; j < no_of_frames; ++j){
            if(frames[j] == -1){
                faults++;
                isfault = 1;
                frames[j] = pages[i];
                flag2 = 1;
                break;
            }
        }
    }

    if(flag2 == 0){
     flag3 =0;

        for(j = 0; j < no_of_frames; ++j){
         temp[j] = -1;

         for(k = i + 1; k < no_of_pages; ++k){
         if(frames[j] == pages[k]){
         temp[j] = k;
         break;
         }
         }
```

```
            }

            for(j = 0; j < no_of_frames; ++j){
             if(temp[j] == -1){
             pos = j;
             flag3 = 1;
             break;
             }
            }

            if(flag3 ==0){
             max = temp[0];
             pos = 0;

             for(j = 1; j < no_of_frames; ++j){
             if(temp[j] > max){
             max = temp[j];
             pos = j;
             }
             }
            }
frames[pos] = pages[i];
faults++;
        }

        printf("\n");
        int prevFrames[no_of_frames];
        int hit_miss_flag[no_of_frames] ;
        int sum = 0;
        for(j = 0; j < no_of_frames; ++j){

             if(frames[j] == -1)
             printf("\t ");
             else
            printf("\t%d", frames[j]);

        }

    }

    printf("\n\nTotal Page Faults = %d", faults);
    printf("\nTotal Page Hits   = %d", no_of_pages-faults);
    printf("\nPage fault ratio  = %0.2f%%",faults/(float)no_of_pages * 100);
    printf("\nPage Hit ratio    = %0.2f%%",(no_of_pages-faults)/(float)no_of_pages *
100);
```

```
    return 0;
}
```

Output:



Conclusion:

Hence, by performing this practical I got to know about the concept of Page replacement, page fault and page hit. I also learnt about optimal page replacement algorithm. I also developed, debugged and executed a C program to simulate optimal page replacement algorithm.