K213086 OS ASSIGNMENT 4

Qno1

FIFO replacement: This algorithm is the simplest and suffers from the most page faults, especially when the working set is large or when the reference pattern is not predictable. It does not suffer from Belady's anomaly.

Second-chance replacement: This algorithm provides a better page-fault rate than FIFO by giving a second chance to pages that are accessed frequently. However, it can still suffer from a high page-fault rate in some scenarios and does not guarantee optimal results. It does not suffer from Belady's anomaly.

LRU replacement: This algorithm provides better page-fault rate than FIFO and Second-chance as it evicts the least recently used page first. It does not suffer from Belady's anomaly.

Optimal replacement: This algorithm has the best possible page-fault rate as it always replaces the page that will not be used for the longest period of time in the future. However, it is not practical as it requires knowing the future reference pattern. It does not suffer from Belady's anomaly.

It's worth noting that Belady's anomaly can only occur with some algorithms like FIFO and Second-chance, but not with LRU or Optimal replacement. Belady's anomaly occurs when increasing the number of frames causes an increase in the number of page faults. This can happen when an algorithm makes decisions based on a limited view of the future reference pattern.

Qno2

a.0x621C: Physical address = contents of page table entry for page 0x62 + offset 0x1C, set reference bit for the page table entry.

0xF0A3: Physical address = contents of page table entry for page 0xF0 + offset 0xA3, set reference bit for the page table entry.

0xBC1A: Physical address = contents of page table entry for page 0xBC + offset 0x1A, set reference bit for the page table entry.

0x5BAA: Physical address = contents of page table entry for page 0x5B + offset 0xAA, set reference bit for the page table entry.

0x0BA1: Physical address = contents of page table entry for page 0x0B + offset 0xA1, set reference bit for the page table entry.

b. An example of a logical address that results in a page fault could be 0xCDEF, assuming that there is no page table entry for page 0xCD.

c. The LRU page-replacement algorithm will choose from the set of page frames that are currently in memory. These page frames may belong to different pages, depending on the current state of the system. The algorithm will select the page frame that has not been accessed for the longest time and replace it with the new page requested by the page fault.

Qno3

Question no.3:-

1. 2,6,9,2,4,2,1,7,3,0,5,2,1,2,9,5,7,3,8,5

Three frames:-
- LIFO = 16 page faults
- LRU = 14 page faults
- OPT = 10 page faults

Four frames:-
- LIFO = 15 page faults
- LRU = 12 page faults
- OPT = 10 page faults

2. 3,1,4,2,5,4,1,3,5,2,0,1,1,2,3,4,5,0,1

Three frames:-
- LIFO = 15 page faults
- LRU = 13 page faults
- OPT = 8 page faults

Four frames:-
- LIFO = 14 page faults
- LRU = 11 page faults
- OPT = 8 page faults

3. 3,1,4,2,5,4,1,3,5,2,0,1,1,0,2,3,4,5,0,1

Three frames:-
- FIFO = 15 page faults
- LRU = 14 page faults
- OPT = 10 page faults

Four frames:-
- FIFO = 13 page faults
- LRU = 12 page faults
- OPT = 10 page faults

4. 4,2,1,7,9,8,3,5,2,6,8,1,0,7,2,4,1,3,5,8

Three frames:-
- FIFO = 17 page fault
- LRU = 15 page fault
- OPT = 10 page fault

Four frames:-
- FIFO = 14 page fault
- LRU = 12 page fault
- OPT = 10 page fault

QNo4

The Least Recently Used (LRU) page-replacement algorithm is based on the principle that the page that has not been used for the longest time in memory is the least likely to be used in the near future. In contrast, the Least Frequently Used (LFU) page-replacement algorithm assumes that the page with the lowest frequency of use is the least likely to be used in the near future.

There are situations where the LFU algorithm performs better than LRU in terms of reducing the number of page faults. For example, if there are some pages that are used frequently initially, but then their usage drops off significantly over time, the LFU algorithm would be more effective. This is because the LRU algorithm will still keep these pages in memory, assuming that they are still likely to be used soon. On the other hand, the LFU algorithm will remove these pages from memory since they are no longer frequently used.

Conversely, there are situations where the LRU algorithm performs better than LFU. For example, if there are some pages that are used frequently, but only during specific periods, the LRU algorithm would be more effective. This is because the LRU algorithm will keep these pages in memory since they are likely to be used again soon. The LFU algorithm, however, may remove these pages from memory since their frequency of use is not high, even though they are still needed in the near future.

In general, the choice of page-replacement algorithm depends on the specific characteristics of the workload and the system. There is no single algorithm that performs best in all situations. It is therefore important to evaluate different algorithms and choose the one that works best for a particular system and workload.

Qno5

a. If a page fault occurs and the requested page does not exist in the free-frame pool, the KHIE operating system will use the FIFO replacement policy to select a resident page to replace. The selected resident

page will be written back to the disk if it has been modified, and the free frame it occupied will be allocated to the new requested page.

b. If a page fault occurs and the requested page exists in the free-frame pool, the KHIE operating system will remove the requested page from the free-frame pool and set it as a resident page. If the free-frame pool is full, then the KHIE operating system will use the LRU replacement policy to select a page to be removed from the free-frame pool and replaced with the newly requested page.

c. If the number of resident pages is set to one, then the KHIE operating system will only be able to keep one page in memory at a time. This means that whenever a page fault occurs, the resident page will be replaced by the newly requested page. This will result in a high number of page faults and slow down the system significantly.

d. If the number of pages in the free-frame pool is set to zero, then the KHIE operating system will not be able to allocate any free frames to incoming pages. This means that whenever a page fault occurs, the system will have to select a resident page to replace, without any option of keeping recently used pages in a free-frame pool. This will result in a high number of page faults and slow down the system significant