A process contains eight virtual pages ondisk and is given an allocation of four physical frames in main memory.

The program accesses memory pages in the following order:

1,0,2,2,1,7,0,1,2,0,3,0,4,5,1,5,2,4,5,6,7,6,2,4,2,7,3,3,2,3

* Show what virtual frames are stored in the physical frames as the process accesses memory if the VMM uses a FIFO replacement   strategy. Assume the physical frames are empty when the process  starts.  Compute the hit ratio in main memory.
* Now do the same thing when the VMM uses LRU replacement.   Compute the hit ratio.
* Given the respective hit ratios, would FIFO replacement approximate the behavior of LRU replacement for this memory trace? Why or why not?

1,0,2,2,1,7,0,1,2,0,3,0,4,5,1,5,2,4,5,6,7,6,2,4,2,7,3,3,2,3

LRU

1: 1 – 4 – 7

2: 0 – 1 – 6 – 3

3: 2 – 5 – 4

4: 7 – 3 – 2

FIFO:

1: 1 – 3 – 2 – 3

2: 0 – 4 – 6 – 2

3: 2 – 5 – 7

4: 7 – 1 – 4

A process references five pages, respectively labeled A, B, C, D, and E in the following order: A; B; D; A; B; C; D; E.

The Virtual Memory Manager (VMM) is using the first-in, first-out replacement strategy.   Start by assuming we have three physical frames.   Show how the pages get allocated to frames for the given reference string and determine the number of page swaps that occur.   Repeat this process for four frames.

A; B; D; A; B; C; D; E

5 transfers

Empty frames:

A, null, null

A, B, null

A, B, D

No transfer

No transfer

C, B, D

No Transfer

C, E, D

A; B; D; A; B; C; D; E

5 transfers

1: A – E

2: B

3: D

4: C

Null, null, null, null

A, null, null, null

A, B, null, null

A, B, D, null

No transfer

No transfer

A, B, D, C

No transfer

E, B, D, C

Consider the following workload:

|  |  |  |  |
| --- | --- | --- | --- |
| **Thread** | **Burst Time** | **Priority** | **Arrival Time** |
| T1 | 50ms | 2 | 0 ms |
| T2 | 20ms | 1 | 20ms |
| T3 | 100ms | 4 | 40ms |
| T4 | 40ms | 2 | 60ms |

Show how the threads would be scheduled using the following scheduling regimes: FCFS, SRT, non-premptive priority, preemptive priority, and robin with a 30ms quantum.

FCFS:

50ms of T1

50+20ms add T2

70+100ms add T3

170+40ms add T4

210ms finished

SRT:

20ms of T1

T2 shorter run it 20ms (40ms)

T1 almost done at 30ms finish it (70ms)

T4 shorter than T3 complete it add 40ms (110ms)

complete T3 100ms (210ms)

non-premptive:

T1 for 50ms as it arrived first

T1 is finished T2 goes first with the highest priority add 20ms (70ms)

T2 is finished T4 goes next with highest priority add 40ms (110ms)

T4 is finished T3 is last add 100ms (210ms)

preemptive:

T1 starts and runs until 20ms

T2 begins as it has a higher priority than T1 add 20ms (40ms)

T1 gets to finish add 30ms (70ms)

T4 has higher priority add 40ms (110ms)

T3 is last add 100ms (210ms)

Robin:

T1 arrives first run for 30ms: T1(30ms)

30ms are up T2 has arrived run it for 20ms (50ms): T1(30ms), T2

it finished before 30ms proceed to T3 for 30ms (80ms): T1(30ms), T2(X), T3

30ms complete run T4 for 30ms (110ms): T1(30ms), T2(X), T3(30), T4

30ms complete finish T1 for 20ms (130ms): T1(30ms), T2(X), T3(30), T4(30)

T1 finished so is T2 run t3 for 30ms (160ms): T1(X), T2(X), T3(30), T4(30)

30ms complete run T4 for 10ms (170ms): T1(X), T2(X), T3(60), T4(30)

T4, T1, T2 are finished run T3 in a 30ms burst and again for a 10ms burst to finish it off (210ms): T1(X), T2(X), T3(60), T4(X)