Homework 7 - 5/28/2019

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Exercise 9.4:

Consider the following page-replacement algorithms. Rank these algorithms on a five-point scale from "bad" to "perfect" according to their page-fault rate.
Separate those algorithms that suffer from Belady's Anomaly from those that do not.

a. LRU replacement
   - Doesn't suffer from Belady's Anomaly
b. FIFO replacement
   - Suffers from Belady's Anomaly
c. Optimal replacement
   - Doesn't suffer from Belady's Anomaly
d. Second-chance replacement
   - Suffers from Belady's Anomaly

5 Point Scale
Perfect - Optimal
Great - LRU
Good -
Okay- Second chance
Bad - FIFO

Given only 4 algorithms to rank them in, only 4 of the points are filled. For simple ranking:

1. Optimal Replacement
2. LRU Replacement
3. Second-chance Replacement
4. FIFO replacement

Exercise 9.8:

Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.
How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, and seven frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each.

•LRU replacement
•FIFO replacement
•Optimal replacement

Number of page reference string: 20
Ordered page reference string: 1,1,1,1,2,2,2,2,5,3,3,3,3,3,4,5,6,6,6,7

Number Of Frames	LRU Replacement	FIFO Replacement	Optimal Replacement
1	20	20	20
2	18	18	15
3	15	16	11
4	10	14	8
5	8	10	7
6	7	10	7
7	7	7	7

Exercise 9.27:
Consider a demand-paging system with the following time-measured utilizations:
CPU utilization 20%
Paging disk 97.7%
Other I/O devices 5%
For each of the following, indicate whether it will (or is likely to) improve CPU utilization.
Explain your answers.

a. Install a faster CPU.
    - No, the CPU it not the primarily utilization and most of the time the disk is in access. Which leads to the suspicion of thrashing, where a faster CPU doesn't help CPU utilization.
b. Install a bigger paging disk.
    - No, thrashing is caused by main memory capacity and disk accessing speed, as such a bigger paging disk doesn't help CPU utilization.
c. Increase the degree of multiprogramming.
    - No, less frame per processes occur then, which will worsen the thrashing and actually cause worse CPU utilization.
d. Decrease the degree of multiprogramming.
    - Yes, more frames are used per processes, which reduced thrashing and can increase CPU utilization.
e. Install more main memory.
    - Likely, as CPU utilization is improved given less paging is required to and from disks due to a larger memory.
f. Install a faster hard disk or multiple controllers with multiple hard-disks.
    - Likely, as the disk bottleneck is lessened by a faster response and throughput, the CPU can get data faster as a result.
g. Add pre-paging to the page-fetch algorithms.
    - Likely, as the CPU can fetch data faster which increases utilization. This is assuming at least some of the paging access is sequentially performed.
h. Increase the page size.
    - Unlikely. While increasing page size will result in fewer page faults, this only applies to sequential data access. In the case of random data access, more paging could occur due to less pages being kept in memory and more data transferred per page fault. Overall causing CPU utilization to decrease.