Exercise session
(Memory management / Virtual Memory)

Operating Systems – EDA092/DIT400

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Exercise 1

Jake and Finn have a computer whose memory access time is 150 nanoseconds and whose page-fault service time is 5 milliseconds. A process previously run in an operating system without virtual memory was 2 times faster than the same process run by the actualized operating system (the latter having virtual memory). Every how many page accesses are Jake and Finn experiencing a page fault on average? Would buying a new disk able to bring the page-fault service time to 2 milliseconds make the process no more than 1.5 times slower in the new operating system (compared to the previous one)?

Exercise 2

- Given the following reference string

$$7\ 2\ 1\ 2\ 0\ 1\ 1\ 4\ 2\ 3\ 0\ 7\ 0\ 1\ 2\ 7\ 7\ 3\ 0\ 0\ 3\ 0\ 3$$

  and assuming 4 frames are available, find:
  - The minimum number of page faults we can observe
  - The extra page faults caused by the FIFO replacement algorithm
  - The extra page faults caused by the LRU replacement algorithm

Exercise 3

- Given processes P_1, P_2, P_3 and P_4 having sizes of 20, 25, 50 and 4 pages and given a total number of frames equal to 80 (10% of which reserved to the OS), compute the number of frames allocated to each process if frames are allocated proportionally to the size of each program

Exercise 4

- Suppose a process P has size of 100 bytes. Compute (1) the number of wasted bytes caused by internal fragmentation if the page and frame sizes are set to 2^4 bytes and (2) the size in bits of the page table (assume each frame entry requires 1 byte and that dirty bits are also use to speed the swap out of pages).