Problem 1: Now suppose that this is demand paged virtual memory system. The page table is stored in the main memory. The memory access time is 100 nano seconds. This system uses a TLB, which takes 20 nanoseconds for searching. Assume that the TLB hit rate was found to be 90% on this system. It takes 4 milliseconds to service a page fault if an empty frame is available or if the replaced page is not modified, and 8 milliseconds if the replaced page is modified.

Assume that the page to be replaced is modified 80% of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?

Problem 2: Chapter 3, Problem 16 (4th edition)
You are given the following data for a virtual memory system:
(a) The TLB can hold 1024 entries and can be accessed in 1 clock cycle (1 nsec).
(b) The page table entry can be found in 100 clock cycles or 100 nsec.
(c) The average page replacement time is 6 msec.
If page references are handled by the TLB 99% of the time, and only 0.01% lead to a page fault, what is the effective address-translation time?

Problem 3: Chapter 3, Problem 20 (4th edition) or Problem 14 (3rd edition)

Problem 4: Chapter 3, Problem 30 (4th edition) or Problem 24 (3rd edition)
Suppose that a page-fault occurs after the 8th clock tick. Which frame will be selected to bring the new page in memory?

Problem 5: Chapter 3, Problem 31 (4th edition) or Problem 25 (3rd edition)

Problem 6: Chapter 3, Problem 38 (4th edition) or Problem 29 (3rd edition)

Problem 7: (a) Consider a page reference string: (2 3 5 3 5 1 2). Given three page-frames, how many page replacements will happen with each of the LRU and FIFO algorithms?
(b) Extend the reference string in part (a) above with a small number of additional page references to yield an example in which LRU is better than FIFO for the case of three page frames.
(c) Now, extend this string in part (a) above with a different sequence of page references to yield an example in which FIFO is better than LRU.

Show the states of the page frames after each page fault in the above three cases.