Homework Assignment #9

Due: Sunday, November 21, 2021

1. Under what circumstances do page faults occur? Describe the actions taken by the operating system when a page fault occurs.

2. 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
   b. FIFO replacement
   c. Optimal replacement
   d. Second-chance replacement

3. 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 three, five, 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

4. Consider the parameter Δ used to define the working-set window in the working-set model. When Δ is set to a small value, what is the effect on the page-fault frequency and the number

of active (nonsuspended) processes currently executing in the system? What is the effect when Δ is set to a very high value?

5. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?