OS Tutorial 2 - Virtual Memory

Week 5

Question 1.

How much fragmentation occurs with paging? Which type?

Question 2.

A certain computer provides its user with 2^{32} bytes of virtual memory and 222 bytes of physical memory. The page size is 4,096 bytes. A process requests a read of address 11123456. Explain how the system establishes the corresponding physical location, distinguishing between software and hardware operations.

Question 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 we have only three memory frames? How many if we increase the memory to 5 frames?

- LRU replacement
- FIFO replacement
- Optimal replacement

Remember all frames are initially empty so your first unique pages will all cost one fault each.

Question 4.

Consider a demand-paging system with the following time-measured utilizations: CPU utilization 20%

Paging disk 97.7%

Other I/O devices 5%

Which (if any) of the following will (probably) improve CPU utilization? Explain your answer.

a. Install a faster CPU.

b. Install a bigger paging disk.

c. Increase the degree of multiprogramming.

d. Decrease the degree of multiprogramming.

e. Install more main memory.

f. Install a faster hard disk, or multiple controllers with multiple hard disks.

g. Add pre-paging to the page fetch algorithms.

h. Increase the page size.