Homework Three

CSCI 3753 - Operating Systems
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April 21, 2014

Problem 1

A memory manager for a variable-sized region strategy has a free list of blocks of size 600, 400, 1000, 2200, 1600, and 1050 bytes. What block will be selected to honor a request for:

a) 1603 bytes using a best fit policy?

Answer:

Best Fit, Smallest that is large enough: 2200

b) 949 bytes using a best-fit policy?

Answer:

Best Fit, Smallest that is large enough: 1000

c) 1603 bytes using a worst-fit policy?

Answer:

Worst Fit, Largest that is large enough: 2200

d) 349 bytes using a worst-fit policy?

Answer:

Worst Fit, Largest that is large enough: 2200

e) 1603 bytes using a first-fit policy? (Assume that the free list is ordered as listed above)

Answer:

First Fit, First that is large enough: 2200

f) 1049 using a first-fit policy?

Answer:

First Fit, First that is large enough: 2200

Problem 2

Given a memory of size 3 frames, and the following sequence of page references 3 2 4 3 4 2 2 3 4 5 6 7 7 6 5 4 5 6 7 2 1, and assuming that no page is initially loaded in the three frames, show the page faulting behavior using the following page replacement policies. How many page faults are generated by each page replacement algorithm?

a)FIFO

b)OPT

c)LRU

Problem 3

Suppose on-demand paging is employed in addition to TLB caching. The time for a TLB access (hit or miss) is $T = 1\ ns$, a memory read $M = 10\ ns$, and a disk read $D = 10\ ms$. Let p_{TLB} = the probability of a TLB hit, and p = the probability of a page fault given a TLB miss.

a) What is a general formula for the average memory access time expressed as a function of T, M, D, p, and p_{TLB}?

Answer:

$$T * p_{TLB} + (1 - p_{TLB}) * [(1 - p) * M + p * D]$$

b) Once parameter values are substituted, and assuming $p = .001$ and $p_{TLB} = 90\%$, what is the average memory access time?

Answer:

$$1 * 0.9 + (0.1) * [0.999 * 10 + 0.001 * 10000000] = 1001.99\ ns$$