COMP 304: Assignment 3

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May 21, 2019

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1 Problem 1

5 memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600KB (in order). How would you place the process of 212 KB, 417 KB, 112 KB, and 426 KB

Which of these algorithms has the most efficient memory usage?
Best-fit algorithm is the most efficient one in terms of memory usage utilization.

first-fit Algorithm

Allocate the first hole that is big enough.
100KB →
500KB → 212KB
200KB → 112KB
300KB →
600KB → 417KB
Due to external fragmentation 426KB couldn't allocated. Remaining partition of memory size is less than 426KB.
Total memory 1700KB , used memory 841KB. 49.41% using rate

best-fit Algorithm

Allocate the smallest hole that is big enough; must search entire list, unless ordered by size.
This strategy produces the smallest leftover hole.
100KB →
500KB → 417KB
200KB → 112KB
300KB → 212KB
600KB → 426KB

worst-fit Algorithm

Allocate the largest hole; must also search entire list.
100KB $\rightarrow$
500KB $\rightarrow$ 417KB
200KB $\rightarrow$
300KB $\rightarrow$ 112KB
600KB $\rightarrow$ 212KB
Due to external fragmentation 426KB couldn't allocated.

2 Problem 2

A system with 30-bit logical (virtual) address uses a two-level page table. Logical addresses are split into an 8-bit top-level page table field, a 12-bit second-level page table field, and an offset.

What is the size of a page in this system ?

20 bits are used for the virtual page numbers and 10 bits left for the offset. Thus, the size of page in the system is 1KB.

$$2^{10} = 1KB$$

How many pages are there in the address space ?

Since 20 bits are used for the virtual page numbers, there are 1048576 pages in the address space.

$$2^{20} = 1048576$$

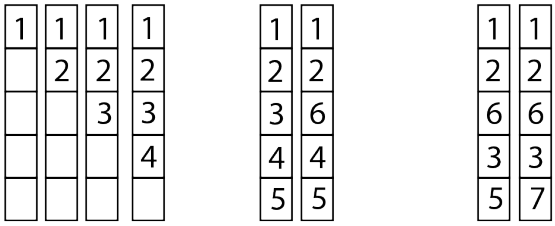
3 Problem 3 Paging

3.a 5 frames for process

LRU

Page fault number: 8

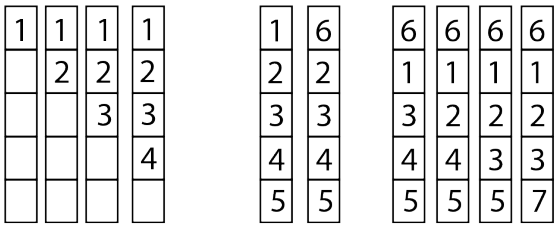
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6



FIFO

Page fault number: 10

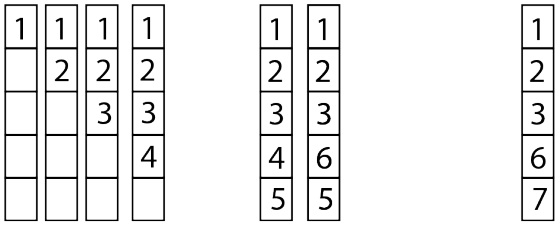
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6



Optimal

Page fault number: 7

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

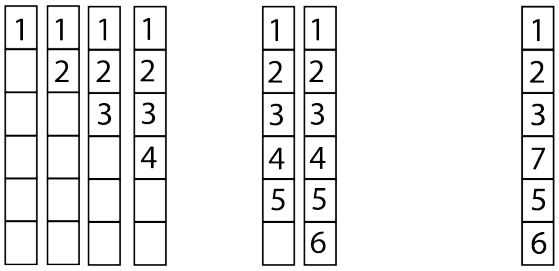


3.b 6 frames for process

LRU

Page fault number: 7

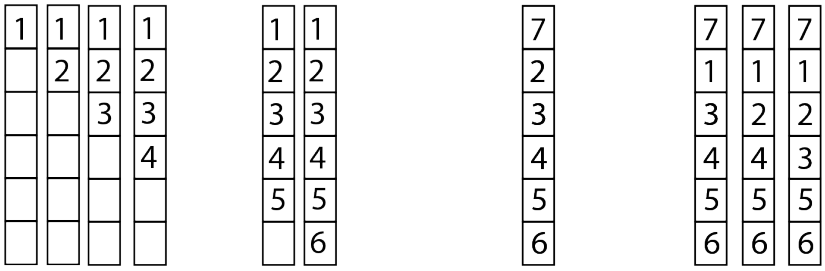
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6



FIFO

Page fault number: 10

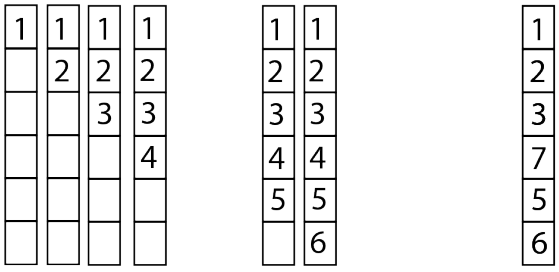
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6



Optimal

Page fault number: 7

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6



4 Problem 4 Pure Demand Paging

4.a Page fault rate when a process first starts execution

When a process starts execution, page fault rate will be high since required pages are not loaded into memory.

4.b Page fault rate once the working set for a process is loaded into memory

Page fault rate will be low since required pages are loaded into memory.

4.c Page fault rate when a process changes its locality and its new working set size is larger that the size of free memory

Again the page fault rate will be high. The system needs to get more free physical memory or reclaim more pages.