COMP 346: Operating Systems
Theory Assignment 3

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1 General questions

1.1 Problems:

Answer the following questions:

- – What are relocatable programs?
  – What makes a program relocatable?
  – From the OS memory management context, why programs (processes) need to be relocatable?
- What is (are) the advantage(s) and/or disadvantage(s) of small versus big page sizes?
- What is (are) the advantage(s) of paging over segmentation?
- What is (are) the advantage(s) of segmentation over paging?

1.2 Answer:

- – A program is said to be relocatable that can be placed at any memory address and can be executed without any changes. A program can be relocatable only If it contains data with relative address.
  – If the program contains data with relative addresses, then it can be relocatable. In the other hand, if the program contains data with absolute addresses, then it cannot be relocatable.
  – There will be several programs that are in memory to be executed. So, it should be possible to load the program at any available memory location and execute it without doing any modifications.
- – Memory wastage will be less with pages with small size compared to pages with large size. A large page will waste memory. It may cause internal fragmentation in the last frame allocated to the program/process.
  – Pages with small size will require large page tables where as large page size will require small page tables. In other words, the number of entries in the page table will be more when the page size is small.
  – When the page size is small, the number of page faults will be more. When the page size is big, the number of page faults will be less.
- – There will be no external fragmentation
  – Swapping of pages between disk and memory is easy as the pages and frames are of equal size.
- – There will be no internal fragmentation.
  – The memory space occupied by segment table is less when compared to the memory space occupied by page table in paging mechanism.

2 Calculate EAT

2.1 Problem:

Consider a demand-paged system where the page table for each process resides in main memory. In addition, there is a fast associative memory (also known as TLB which stands for Translation Look-aside Buffer) to speed up the translation process. Each single memory access takes 1 microsecond while each TLB access takes 0.2 microseconds. Assume that 2% of the page requests lead to page faults, while 98% are hits. On the average, page fault time is 20 milliseconds (includes everything: TLB/memory/disc access time and transfer, and any context switch overhead). Out of the 98% page hits, 80 % of the accesses are found in the TLB and the rest, 20%, are TLB misses. Calculate the effective memory access time for the system.

2.2 Answer:

Effective Memory Access Time =
TLB hit ratio * (TLB access time + Main memory access time) + (1 hit ratio) * (TLB access time + 2 * main memory access time)
TLB hit ratio = (TLB hits) / (Number of queries into TLB)
$= \frac{80}{98} = 0.816$
Effective Memory Access Time is

$$
\begin{aligned}
&= \frac{80}{98} * (0.2 + 1) + (1 - (\frac{80}{98})) * (0.2 + 2 * 1) \\
&= (0.816 * 1.2) + (0.184 * 2.2) \\
&= (0.9792 + 0.4048) \\
&= 1.384 \text{ Microseconds}
\end{aligned}
$$

3 Advantages and Disadvantages of a global page replacement algorithm

3.1 Problems:

Explain (i) an advantage and (ii) a disadvantage that a global page replacement algorithm has over a local page replacement algorithm.

3.2 Answer:

Advantage of Global replacement algo over local replacement algorithm:

Working set of High priority process can grow and shrink as it can be allocated more or less frame accordingly, so high priority process cant get interuption, it lead to overally high throughput of system.

Disadvantage of Global replacement algo over local replacement algorithm 1.Page fault ratio of a process can be affected by other process also.

4 Automatically open file scheme

4.1 Problem:

Some systems automatically open a file when it is referenced for the first time and close the file when the job terminates. Discuss the advantages and disadvantages of this scheme as compared to the more traditional one, where the user has to open and close the file explicitly.

4.2 Answer:

Automatic opening and closing of files relieves the user from the invocation of these functions, and thus makes it more convenient to the user; however, it requires more overhead than the case where explicit opening and closing is required.

Automatic opening and closing of files relieves the user from the invocation of these functions, and thus makes it more convenient for the user; however, it requires more overhead than the case where explicit opening and closing is required. Furthermore, it removes needed flexibility

5 Advantages of scheduling quantum

5.1 Problem

What advantage is there in having different values of the scheduling quantum on different levels of a multilevel feedback queuing system? Your answer should consider all aspects such as fairness, starvation, efficiency, etc.

5.2 Answer

A process which doesn't need for frequent servicing may get queue up with the larger quantum, as for the smaller quantum, the queue is formed with a process which does need the servicing frequently. So that the processing of the computer might works more efficiently because, it might only need the fewer context switches.as for the process completion