

Tutorial - Memory Management

1. Describe the difference between swapping and paging in the context of virtual memory management.
2. What is the advantage of a paged virtual memory system with a
 - a. small page size?
 - b. large page size?
3. What is an associative memory? How does it work and how is it implemented?
4. Describe how a context switch affects the virtual memory system.

What must the OS do to ensure that memory references made by the newly-running process will be properly translated?

5. A system implements a paged virtual address space for each process using a one-level page table. The maximum size of an address space is 16 MB. The page table for the running process includes the following entries:

Page	Frame
0	4
1	8
2	16
3	17
4	9

The page size is 1024 bytes and the maximum physical memory size of the machine is 2 MB.

- a. How many bits are required for each page table entry?
 - b. What is the maximum number of entries in a page table?
 - c. How many bits are there in a virtual address?
 - d. To which physical address will the virtual address 1524 translate to?
 - e. Which virtual address will translate to physical address 10020?
6. A pure paging system uses a three level page table. Virtual addresses are decomposed into four fields (a , b , c , d) with d being the offset.

In terms of these constants, what is the maximum number of pages in a virtual address space?

7. Calculate the access times for a four-level paging system assuming a TLB hit ratio of 80% and 98%. Assume that time for a memory access is 100 ns and for TLB access 20 ns.

How does this compare to a single-level paging system?

8. Suppose that pages in a virtual address space are referenced in the following order:

1 2 1 3 2 1 4 3 1 1 2 4 1 5 6 2 1

There are three empty frames available. Assume that paging decisions are made on demand, i.e., when page faults occur.

Show the contents of the frames after each memory reference, assuming the LRU replacement policy is used.

Repeat assuming that the clock policy (second chance) is used.

How many page faults occur in each case?