1. Consider the following page table for a process currently executing in a paging system. All numbers are decimal. Assume that the virtual addresses have 20 bits and the page size is 1 KB.

Page number	Present bit	Modified bit	Frame number
0	1	0	4
1	1	1	7
2	0	0	-
3	1	0	0
4	0	0	-
5	1	1	2

Convert the following decimal relative addresses, which are defined with reference to the origin of the program, to the corresponding binary virtual addresses. What is the 16-bit physical address which results from dynamic address translation, or would a page fault occur?

a) 5499
b) 2221

2. Consider a paged virtual memory system with 32-bit virtual addresses and 1 KB pages. Each page table entry requires 32 bits.

a) What is the frame size in this system?
b) What is the maximum size of the virtual address space?
c) What is the maximum number of entries in a page table?
d) How many levels of page tables are required if it is desired to limit the root page table size to one page?

3. Assume that a task is divided into four equal-sized segments and that the system builds an eight-entry page table for each segment. Thus, the system has a combination of segmentation and paging. Assume also that the page size is 2 KB.

a) What is the maximum size of each segment?
b) What is the maximum logical address space for the task?

4. Consider the following page address stream formed by executing a process:

7 0 1 2 0 3 0 4 2 3 0 3 2

Assuming that three frames are allocated to this process and the frames are initially empty, show what pages are in memory at each reference and find the number of page faults for the following replacement algorithms. **Before the frame allocation is initially filled, all first unique pages are also counted as page faults.**

a) OPT
b) FIFO
c) LRU
d) Clock

Self-test

1. A _____ is issued if a desired page is not in main memory.
A. paging error
B. page replacement policy
C. page fault
D. page placement policy

2. In a combined paging/segmentation system, a user's address space is broken up into a number of _____.
A. segments or pages, at the discretion of the programmer
B. fixed-size pages, which are in turn broken down into variable-sized segments
C. variable-sized segments, which are in turn broken down into fixed-size pages
D. All of the above

3. The _____ determines when a page should be brought into main memory.
A. page fault
B. fetch policy
C. page placement policy
D. page replacement policy

4. The _____ policy results in the fewest number of page faults.
A. optimal
B. FIFO
C. Clock
D. LRU

5. _____ is the concept associated with determining the number of processes that will be resident in main memory.
A. Virtual memory manager
B. Page fault frequency
C. LRU policy
D. Load Control

6. The situation where the processor spends most of its time swapping process pieces rather than executing instructions is called _____.
A. paging
B. principle of locality
C. thrashing
D. None of the above