4. Attempt **any two** of the following: 7 x 2

a. What is virtual memory? How does it work? What are the benefits and drawbacks of using virtual memory?

b. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128-page table entries and is 4-way set associative. What will be the minimum size of the TLB tag?

c. When a process has been allocated 3-page frames, none of the pages of the process are available in the memory initially. The process makes the following sequence of page references (reference string): 1, 2, 1, 3, 7, 4, 5, 6, 3, 1. Least Recently Used (LRU) page replacement policy is a practical approximation to optimal page replacement. For the above reference string, how many more page faults occur with LRU than with the optimal page replacement policy?

5. Attempt **any two** of the following: 7 x 2

a. Suddenly your new laptop is running low on memory, describe the steps an operating system would take to free up memory.

b. Starting from Track no. 50, apply SSTF when track request - 95, 180, 34, 119, 11, 123, 62, 64.

c. What are the differences between a file and a directory? How are files and directories organized in a hierarchical file system?