Instructions

*Show your work for all problems. Be direct and convincing with your written answers.*

Section A: Questions (10 points each)

1. What is the difference between paging and segmentation? What must be added to a page table entry or segment table entry in order to support virtual memory?

2. Explain how a working set policy can be used to reduce the page fault frequency of a system and hence prevent thrashing.
3. With a round-robin CPU scheduler, what is the advantage of using a small time quantum? A large time quantum?

4. How does disk striping improve I/O throughput in a RAID system? What is the advantage of using a small block size? A large block size?
5. How does a disk scheduling algorithm improve I/O throughput?

6. Give a general formula for the maximum size of a file using $K$ direct pointers, 1 single indirect pointer, and 1 double indirect pointer. Assume a block size of $B$ bytes and a pointer size of $P$ bytes.
7. What operating system support is needed in order to support cluster computing features such as providing a logical view of the cluster as a single machine and the ability to balance the load on the cluster machines?

8. Give an example of a passive attack and an active attack on a computer system. Explain whether these two attacks break confidentiality, integrity, availability, and/or authenticity.
Section B: Problems (10 points each)

1. Compute the effective memory access time for the following system. The system has a demand-paged memory with the page table held in a TLB. The TLB hit rate is 90%, in which case the page table entry can be read in 100 nanoseconds. If a page table entry is not in the TLB it must be read from memory. For both the page table access and a memory reference, the page-fault rate is 10%. It takes 10 milliseconds to service a page fault if the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Assume the page to be replaced is modified 70 percent of the time. Memory access time is 100 nanoseconds.