Student Name: ______________________  Student ID #: ______________________

**UOSA Statement of Academic Integrity**

*On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.*

Signature: ______________________  Date: ______________________
Question 1: Resource Management (30 points)

A. Give an example of a computer resource managed by an OS that can be time-multiplexed but not space-multiplexed. Justify your answer.

B. Give an example of a computer resource managed by an OS that can be space-multiplexed but not time-multiplexed. Justify your answer.

C. Give an example of a computer resource managed by an OS that can be time-multiplexed and space-multiplexed. Justify your answer.
Question 2: Resource Management & I/O (10 points)

Explain one good reason that all I/O on modern computers is ultimately carried out by system calls.

Question 3: Process Scheduling & Hardware Support (10 points)

Explain one hardware component required for preemptive (involuntary) process scheduling strategies that is not required for non-preemptive (voluntary) process scheduling strategies.
**Question 4:** I/O & Hardware Support (10 points)

**Explain** one way in which direct memory access (DMA) improves average turnaround time.

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**Question 5:** Process Scheduling (20 points)

Suppose you have the following processes on a the same uni-processor computer: \( P_a \) which alternates between needing 39 time units of processing and 100 time units of I/O, and 25 other processes, \( P_b \) through \( P_z \), each of which alternates between needing 24 time units of computation time and 5 units of I/O. Which is likely to dispatch \( P_a \) to the CPU more times during one million time units of execution, round robin or virtual round robin? **Justify** your answer.
Question 5: Disk Scheduling (20 points)

Give one disk scheduling algorithm for which starvation is possible. Justify your answer.

Give one disk scheduling algorithm for which starvation is not possible. Justify your answer.