1. Suppose we had a block transfer from an I/O device to memory. The block consists of 1024 words and one word can be transferred at a time. For each of the following, indicate the number of interrupts needed to transfer a block:
   a) programmed-I/O
   b) interrupt-driven I/O
   c) DMA (direct-memory access)

2. What is the main difference between programmed I/O and interrupt-driven I/O?

3. What is the main difference between interrupt-driven I/O and DMA?

4. Assume special I/O instructions are used to fill I/O-controller registers. Why can’t a user program use these instructions to communicate with the I/O device directly and “by-pass” the operating system’s protection checking?

5. Assume that memory-mapped I/O is used. Since Load and Store instructions are used to communicate with the I/O-controller registers, why can’t a user program communicate with the I/O device directly and “by-pass” the operating system’s protection checking?