Name: _____

Directions: Work on this sheet (both sides, if needed) only; **do not turn in any supplementary sheets of paper**. There is actually plenty of room for your answers, as long as you organize yourself BEFORE starting writing. In order to get full credit, **WRITE LEGIBLY** (∞ points off for illegible handwriting!), and **SHOW YOUR WORK. The earlier problems, and the earlier parts within each problem, are intended to be easier—MAKE SURE YOU WORK ON THEM FIRST!**

1. Answer the following questions about Fig. 8.6, p.650:

(a) (10) In the Characteristics column, which two items represent the two main components of disk-access latency (the "garden-hose" notion of latency discussed in class)?

(b) (10) In the Characteristics column, which one item represents the main component of disk-access bandwidth?

(c) (10) Suppose we read a single 512-byte sector on the ST19171 in a track immediately adjacent to the track over which the read/write head is currently positioned. As measured from the time the request is made to the time the last bit is sent, what is the worst-case time in seconds for the request to be completed? **Leave your answer in "arithmetic" form, NOT as a single number. In other words, if your computation is 2 + 3 x 5, write down "2 + 3 x 5", NOT "17."**

2. (10) Fill in the blanks: For the faster I/O devices, we should use _____ instead of polling, so as to _____ the number of bus transactions.

3. (10) Fill in the blanks: A process in which two parties on a bus exchange signals, each acknowledging an action by the other, is called _____.

4. (10) Fill in the blank: On some buses, a device A could send memory a read request but before memory responds, another device B could send another read request. This is called _____.

5. (10) Fig. 7.22, p.584 is actually presented only in simplified form. Besides the Valid bit and the Physical Page Number, there are two other kinds of bits which definitely should be shown in each entry to the page table. What are they?

6. (10) Fill in the blank: Back on p.561, Fig. 7.13(c), a block of four words would be obtained from a single access request. The official term for this in Chapter 8 is _____.

7. (10) Look at Fig. 7.25, p.593, and consider what accesses to main memory might arise from a single read request. State the best- and worst-case number of words of memory which would be read to satisfy this request (including the requested read itself).

8. (10) Consider a system with memory-mapped I/O, with a printer whose Data and Status registers are at addresses 0x22 and 0x24, respectively. The Done bit is the most significant bit in the Status register, equal 1 for done, 0 for not yet done. Suppose in the printer device driver we have declarations

```
char *P;  int N;
```

and we need to print N characters starting at the one pointed to by P. Write C-language code to do the printing, using polling.