Name: _____

Directions: Work on this sheet (**on 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, **SHOW YOUR WORK.**

1. (10) This question concerns Figure 8.10 of Patterson and Hennessy. Suppose the I/O device were to write to memory instead of read from it, so that the figure would also have a WriteReq line (also colored green, as with ReadReq). In the case of a write, what aspects of the picture would change, relative to the case of a read? (Hint: There won't be many changes.)

2. (10) Fill in the blank: A type of bus in which one I/O device might, in effect, say to another I/O device, "I don't need the bus right now; you go ahead and use it," is called a(n) _____.

3. (10) Consider two identical PCs, both running Linux, one a home with a single user and the other in our CSIF lab, with multiple users. Fill in the first blank with either "smaller" or "larger," and fill in the second blank with an official term from our course: The CSIF PC will probably have _____ mean seek time than the home one, due to lesser _____ of the disk references on the CSIF machine.

4. (15) Suppose a fourth column were added to the table of Figure 8.14 of Patterson and Hennessy, labeled "Ethernet." State what the contents of the five rows of that new column would be. Use specific data whenever possible. In the fourth row you must use a specific term from the textbook. The answer in the fifth row is "asynchronous." **Draw your answer in box format, showing the first and fourth columns.**

5. This question concerns the figure on p.653 of Patterson and Hennessy. There are two Source/Destination pairs in this picture, one green one and one black one.

(a) (15) Assume this packet was sent by a client to a server. Fill in the blanks (fill the first blank either with "green" or "black"). The number in the _____ Destination field was specified in an argument in the call to _____.

(b) (10) There is actually a third Source/Destination pair in the figure, though not shown. What is it?

6. (15) In this problem you will construct a counter which will display counts of pulses on a line named Pulse in 2-digit, base-3 arithmetic. The counter display will count up to 8 base-10 (22 base-3), cycling through 00, 01, 02, 10, 11, 12, 20, 21, 22, 00, 01, 02,...

You are required to use the following ingredients: Two 2-bit ripple counters; two hex displays; and miscellaneous AND, OR and NOT gates. Pins of the counters and displays are denoted as follows.

- The first (i.e. left-hand) ripple counter, R1, stores its count in bits R1C1 and R1C0 (R1C1 being the more significant); its increment input (the pin which makes the count advance by 1) is R1I; and it has a reset input, R1R. The second ripple counter, R2, has pins similarly denoted R2C1, R2C0, R2I and R2R.
- The first (i.e. left-hand) hex display has inputs H13, H12, H11 and H10 (from most to least significant), and similarly the second one has inputs H23-H20.

In your answer, do **not** draw a picture; instead, give your answer as a set of boolean equations. For example, if you want the most significantinput of the first hex display to consist of OR-ing together R2C1 and R2C0, you would write

```
R13 = R2C1 + R2C0
```

7. (15) Consider a four-track, two-headed disk. One of the two read/write heads handles requests for the inner two tracks, and the other covers the outer two tracks. Find the mean seek time under the assumptions that for any request each of the four tracks is equally likely to be chosen, and that successvie requests are independent. Give your answer worked out to an actual number, not in summation form.

Solutions:

1. Second Data section becomes green; second ACK becomes black; DataRdy becomes green.

2. Daisy chain bus.

3. Larger, locality.

4.

```
Option Ethernet

Bus width multiplex
Data width 1 bit
Transfer size multiple bits
Bus masters  multiple masters
Clocking asynchronous
```

5a. connect()

5b. Ethernet s/d pair.

6.

R1I = R2C1 $\overline{R2C0}$ Pulse

R2I = Pulse

R1R = R1C1 $\overline{R1C0}$ Pulse

R0R = R2C1 $\overline{R2C0}$ Pulse

H11 = R1C1

H10 = R1C0

H21 = R2C1

H20 = R2C0

7. 1/2.