CS470/570 Fall 2003 A NAME_____

570 students must do all 10 problems. 470 students must do problems 1-9. Each problem is worth 10 points (470 students get 10 points free).

No calculators.

Answers will be graded based on accuracy and completeness. If you need extra space to write, make a note on the front and use the back of the sheet.

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1. Define the terms "LAN" and "MAN in terms of expected number of nodes, range or area covered, and bandwidth.

   See lecture notes

2. Draw the TCP/IP hourglass diagram and describe the functionality of each layer. Match each layer of the diagram with a layer from the OSI model.

   See lecture notes

3. With regard to socket processing, explain the difference between Active Open and Passive Open.

   When you open a socket using a Passive open, you are setting up the socket and making it ready to accept connections, but not actually establishing a connection. Passive opens are often used for Server processing.

   An Active open actually establishes a connection. It is usually used in Client processing.

4. A point-to-point copper link is 2300Km long and has a bandwidth of 2Mbps. For 10000-Byte packets, by how many milliseconds is the Transmission Delay larger than the Propagation Delay?

   Prop delay = 2300×10^3m / 2.3×10^8m/s = 1000×10^{-5}s = 10 ms
   Xmit delay = (10^4B x 8 b/B) / 2×10^6b/s = 8×10^4 / 2×10^6 s = 40 ms

   The transmission delay is larger by 30 mS

5. A voice modem uses FSK. The modem has a Baud rate of 2400 Baud and can transmit at 9600bps. How many frequencies does the modem transmit on?

   The bit rate is 4 times the Baud rate. This means there are 4 bits transmitted each time the frequency changes. So there have to be 2^4 = 16 frequencies.

6. A special-purpose voice-grade line has a frequency bandwidth of 10Khz. What is the data bandwidth of this line in bps?

   Part of being able to work this problem is understanding that you need to assume a sample size. 8 bits is a good choice. For 8 bit samples, we have:

   Sample rate = 2 x 10 kHz = 20 kHz (from Nyquist's Sampling theorem)

   Data bandwidth = 20 kHz x 8 bits = 160 kbps

7. A data link uses the Go-Back-N flow control algorithm. A data stream consisting of 1000 packets is transmitted. 100 of the packets arrive in error. Assuming that all re-transmissions arrive without error, what is the total number of packets transmitted, including both the original transmissions and re-transmissions. Assume N=20.

   1000 packets were sent originally. 100 of these were in error.

   For each of the 100 errors, we re-sent N=20 packets, so we re-sent a total of 2000 packets.

   So the total is 1000 + 2000 = 3000

8. We discussed a modification of the Ethernet frame format that is designed to support VLANs. Sketch the modified frame format and discuss how the added field(s) provide VLAN support.

   See lecture notes for format.

   The special type code "8100H" identifies this as a VLAN frame. The next (added) field identifies the particular VLAN this frame goes with. The following added field replaces the Length filed that was used for the special type code.

   When a bridge receives a VLAN-encoded frame, it sees the special type code and reads the VLAN number. It will forward the frame only to ports identified with that VLAN.

9. A 570 student develops a variation of the Exponential Backoff Algorithm. The student's algorithm is designed to wait $2^{(16-n)}$ slot times after the nth collision. A hardware failure is assumed after 16 collisions. Discuss advantages and disadvantages of this algorithm with respect to the regular Exponential Backoff algorithm.

   If you read this literally, every sender always waits exactly $2^{(16-n)}$ slot times. That means that once two nodes collide, they will always collide, so it isn't a working collision-resolution method. This is the major disadvantage. The major advantage probably that the calculation of wait time is simpler than the standard EB algorithm.

   I also accepted answers that assumed the wait time was 0 to $2^{(16-n)}$ slot times. For this answer, the major advantage would be that you would be quite likely to resolve the collision on the first round of the algorithm. The disadvantage is that the early rounds (the first 8) of the algorithm take much longer to execute than the EB algorithm. This algorithm would almost certainly run longer than the standard EB approach.

10. (570 STUDENTS ONLY)
    In the Cerf and Kahn paper that you read, the authors wrestle with the idea of "connections" in a "connection-free" network. They arrive at an idea that they call an "association." Outline what they meant by "association" and how it is different from a connection that you might find in the telephone system

    The key thing I was looking for here was a discussion of the idea of building a "connection" with a packet-switched media.