YOUR LASTNAME and NAME : _____

Midterm 2, December 19, 2002, 250/1000 points (Individual points are shown in paranthesis)

1. **(40=10+15+15)** Frames of 1000 bits are sent over a 1 Mbps satellite channel with 270 msec one way delay. Acknowledgements are always piggybacked and there is always reverse traffic. The headers are very short therefore could be ignored. Three bit sequence numbers are used. What is the maximum achievable channel utilization for **(i)** Stop and Wait, **(ii)** Go Back N (protocol 5) and **(iii)** Selective Repeat (protocol 6)?

2. **(30)** There are no frame start or stop flags or bit patterns in ATM cell/packet boundaries. Describe very briefly, perhaps by drawing a diagram, how cell/packet boundaries are located (i.e. the cell delineation heuristics).

3. **(40)** Explain why spanning tree bridges are necessary and what is the goal of spanning tree bridges?

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4. **(30, each 10)** Explain "nonpersistant", "1-persistant" and "p-persistant" CSMA (Carrier Sense Multiple Access) techniques comparatively, perhaps by drawing a timing diagram. How are collisions resolved in all three techniques?

5. **(40=20+20)** Consider a store-and-forward switch with eight 9600 bps input lines and one 14000 bps output line. Packet lengths are exponentially distributed with a mean of 1000 bits. Each of eight lines delivers Poisson traffic with an average 1.5 packets/sec. Switching time is zero.
   (i) What is the mean delay experienced by a packet from the moment the last bit arrives at the switch until the moment that bit is retransmitted on the output line ? **(20)**

   (ii) What is the mean number of packets in the switch, including the one in service ?**(20)**

6. **(20)** Data link protocols almost always put the CRC in a trailer, rather than in a header. Why?

7. **(50 total) (Answers on the back of this sheet)** Explain how the binary exponential backoff algorithm in Ethernet (IEEE 802.3) operates.

8. **(+5 for those who read the book carefully)** What happens in promiscuous mode?

9. **(Another +5 for those who read the book carefully)** What is 802.3z?