CS 4251: Computer Networks II

Midterm exam

March 18, 2004

Duration: 80 minutes

Name: _____

Part	**Maximum**	**Obtained**
I	25	
II	25	
III	25	
IV	25	

Final grade:

Problem 1-A (15 points)

Consider the time-space-time switch of Figure 4.40 with N=8 inputs/outputs, n=2 slots, and k=3 slots. The required connections are shown next as pairs of input-output ports: (1,4), (2,8), (3,1), (4,6), (5,2), (6,3), (7,7), (8,5). For example, (1,4) means that input-1 should be connected to output-4. Show the configuration (i.e., internal connections) of the intermediate 4-by-4 crossbar in each of the three time slots.

Problem 1-B (10 points)

Suppose that we use a Stop-and-Wait protocol to transfer a message over a communication link. The message is 64KB (1KB = 1024 bytes), the maximum packet size (including headers) is 2KB, while the header size is 16 bytes. The link has a transmission rate of 2Mbps and a round-trip time of 20msec. The ACK size is only 1 byte and so you can ignore its transmission delay. The bit error rate in the link is 10^{-6}. How long would it take, on the average, to transmit the message? What is the bandwidth-delay product of the link? What is the efficiency of the protocol?

Problem 2-A (10 points)

Consider a full-duplex link with a capacity of 40Mbps, and with one-way propagation delay of 10msec. The data packets transmitted from the sender to the receiver are 1,000 bytes, while the acknowledgments from the receiver to the sender are only 10 bytes. The sender introduces 100 microseconds of processing delay per packet, while the receiver introduces 10 microseconds of processing delay per ACK. What is the round-trip trip of this link?

Problem 2-B (15 points)

The sender and the receiver at the two ends of the previous link use the TCP sliding window algorithm to do flow control. The sender window size is 90,000 bytes, while the receiver window size is 120,000 bytes. What is the maximum possible throughput, in bits-per-second, from the sender to the receiver?

Problem 3-A: (15 points)

Suppose that a music signal has a bandwidth of 20KHz. The signal's maximum amplitude is V=1 Volt, the mean is zero, and the standard deviation is σ=0.25 Volts.

You are to quantize the music signal with a uniform quantizer, and transmit it over a 128kbps modem. How many bits can you transmit with each sample? What is the SNR of the signal after quantization?

Problem 3-B (10 points)

Suppose now that the previous 128Kbps modem uses a 3KHz communication channel. What is the minimum transmission SNR that is required to meet this bit rate?

Problem 4-A: (15 points)

Consider a CRC code with a generator polynomial $g(x)=x^3+x+1$. Suppose that the data word is 10110110. What is the corresponding codeword?

Problem 4-B: (10 points)

Suppose that an error occurs at the following bits of the transmitted codeword: first (least-significant) bit, second bit, third bit, and sixth bit. Would the previous CRC code be able to detect this four-bit error case?