CMSC 417 Midterm #2 (Fall 2001)

1.) (20 points) Define and explain the following terms

a) Forbidden region

When using clocks for sequence numbers, it is the region where a sequence number from an old (due to a crash of one of the nodes) connection could be mistaken for a current sequence number.

b) LEO

Low Earth Orbit – Satellites in this orbit have lower latency than geo-synchronous satellites, but do not remain in a fixed location relative to a point on the Earth's surface

c) 3-way handshake

Connection establishment involving sending 3 messages. This approach ensures that both parties can start with their own initial sequence number at that the other party has ACK'd the selected initial sequence number

d) TPDU

Transport Protocol Data Unit – A message to be sent by a transport layer connection

2.) (15 Points) Explain what is meant by the term cellular radio? Which of the following systems use cellular technology AMPS, GSM, 802.11b?

Uses multiple small regions each with their own base station. This permits the re-use of frequencies in non-adjacent cells. Includes the ability to automatically handoff signals among different cells to support mobile users.

All three of AMPS, GDM, and 802.11b use cellular technology.

3.) (15 points) Explain why it is possible to get twice as much traffic through a busy networking using the slotted Aloha protocol vs. the regular Aloha protocol.

In slotted Aloha the collision period is half as long as with traditional Aloha. This is due to the fact that all stations start transmitting at the beginning of a slot time.

4.) (15 points) Recall that an IPv4 header is 20 bytes, and a TCP header is 20 bytes, and that a maximum IP packet is 65,536 bytes. Assume that you have a 1 Gbps channel from the sender to the receiver, what is the minimum BW required from the receiver to the sender to allow full use of the channel?

In order to fully use the forward channel, the backward channel (receiver to sender) must be able to send ACK's as fast as the packets can be sent on the forward channel. Assume one ACK per data packet sent. ACK's are 40 bytes and data packets 65536 bytes so the back channels must be 40/65536 times the 1 Gbps forward speed (or approximately 610,000 bits/sec)

5.) (15 Points) What signal to noise ratio (in dB) is needed to send gigabit Ethernet over a single pair of cat-6 wire (bandwidth 250 Mhz)?

$Bps = BW * \log_2(1 + S/N)$

$1{,}000{,}000{,}000 = 250{,}000{,}000 * \log_2(1 + S/N)$

$4 = \log_2(1 + S/N)$

$16 = 1 + S/N$

$S/n = 15$

$DB = 10 \log_{10}(S/N)$

$DB = 10 \log_{10}(15)$

$\log_{10}(15)$ is approximately 1.17

$DB = 11\text{-}12$

6.) (20 points) Congestion Control

a) (5 points) Why is it important to consider both the average round-trip time **as welll** as the variance in round trip time when deciding the re-transmission timeout value?

Average is typical case, but many packets take a bit longer than the mean (recall that if our measure of average is median, 50% will take longer than the median). By using the variance we can ensure that we will not induce undue timeouts that would slow down the protocol.

b) (5 points) Why does TCP use both a receiver window and a congestion window when deciding how big the current sliding window size should be?

The receiver window is for buffer and rate matching with the receiving hosts. The congestion window is used to compensate for network traffic. TCP uses the smaller of the two windows as its current window size.

c) (10 points) Explain what is meant by “slow-start” congestion control. How does the congestion window expand and contract using this protocol?

Slow start begins with an initial window equal to one segment size and exponentially grows to a threshold value as long as no packets are dropped. Once at the threshold, the current window size is incremented by one initial window size for each ACK received. When a packet is dropped, the current window size is reset to one segment, and the threshold is reset to ½ of the current window size.