ECE230X-D07 Quiz 1

Your Name: SOLUTION Your box #: _____

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1. 50 points. List all of the layers of 5-layer TCP/IP protocol architecture and describe their functions.

Application layer: This is the layer containing the applications, e.g. file transfer, ssh, http, ...

Transport layer: Handles local addressing (ports) May also add checksums (error detection) and sequence numbering to ensure reliable exchange of data.

Internet layer: Handles global addressing (IP address) Also adds checksums for error detection by routers

network access layer: Handles interfacing details of attached network, e.g. Ethernet. Typically adds more error checking, priority flags, and synchronization bits.

physical layer: Handles the conversion between signals and bits. At the transmitter, generates signals that efficiently propagate through the medium.

2. 50 points. Suppose computer A has a network interface card capable of transmitting signals with power up to 0.1mW onto a Category 5 UTP cable. Computer B has a network interface card capable of receiving signals on Category 5 UTP cable and has a receiver noise floor of -100dBm. If the minimum required SNR for reliable reception at computer B is 20dB and the Category 5 cable attenuates signals from computer A at a rate of 2.5dB/100m, what is the maximum length of Category 5 cable that can be used between computer A and computer B such that communications are reliable?

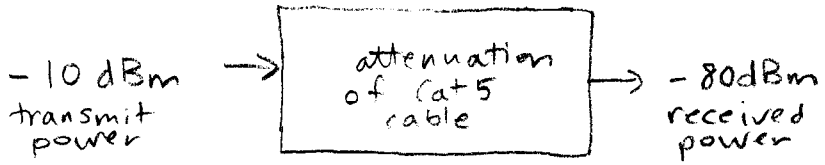
   Also, what could you do if computer A and computer B were separated by a longer distance than this?

$10 \log_{10}\left(\frac{0.1\,mW}{1\,mW}\right) = -10\,dBm$ transmit power

Noise floor at receiver is -100 dBm.

Minimum SNR for reliable transmission is 20dB

$\Rightarrow$ received signal must be $\geq -80\,dBm$



Hence, we can have up to 70dB of attenuation.

The cable attenuates the signal by 2.5dB every 100m

$$\frac{70\,dB}{N \text{ meters}} = \frac{2.5\,dB}{100 \text{ meters}}$$

solve for N.

$N = 2800$ meters

Hence, we can have up to 2800 meters of Cat 5 cable between computer A and computer B and have reliable communication.

If we needed to communicate over a longer distance, we would need to insert a repeater/amplifier or a router in between computer A and B.