

1. Describe the discrete multi-tone technique (DTM) which is used in ADSL. (15%)
2. Describe the functions of data link layer and transport layer. What are the differences between the two layers? (15%)
3. If your organization gets three subnets: 140.116.54.0, 140.116.97.0, 140.116.100.0, in class B network, what is the best choice of the net mask? Why? (15%)
4. Consider the effect of using slow start on a line with a 10-msec round-trip time and no congestion. The receive window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent? (15%)
5. Explain how the CSMA/CD protocol answer the following questions, (a) when should the computer access the medium? (b) what should be done if the medium is busy? (c) what should the computer do if there is an access conflict? When consider CSMA/CA, repeat (a) to (c). (20%)
6. Consider the TCP procedure for estimating RTT as the following:  
EstimatedRTT =  $(1-\alpha)$ \*EstimatedRTT +  $\alpha$  \*SampleRTT.  
Suppose that  $\alpha=0.1$ . Let SampleRTT<sub>1</sub> be the most recent sample RTT, and let SampleRTT<sub>2</sub> be the next most recent sample RTT, and so on.  
(a) For a given TCP connection, suppose four acknowledgements have been returned with corresponding sample RTTs SampleRTT<sub>4</sub>, SampleRTT<sub>3</sub>, SampleRTT<sub>2</sub>, SampleRTT<sub>1</sub>. Express EstimatedRTT in terms of the four sample RTTs. (5%)  
(b) Generalize your formula for  $n$  sample round-trip times. (5%)  
(c) For the formula in part (b) let  $n$  approach infinity. Comment on why this averaging procedure is called an exponential moving average. (10%)