Sample Questions on Transport Layer

1) Which protocol – Go-Back-N or Selective-Repeat - makes more efficient use of network bandwidth? Why?

2) Consider a reliable data transfer protocol that uses only negative acknowledgements. Suppose the sender sends data only infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why? Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In this second case, would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?

3) Refer to Figure 3.56 of the textbook (or a similar figure from the Week 5 lecture notes), which illustrates the convergence of TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm (i.e. the figure which plots the throughput of two connections that share a bottleneck link). Suppose that instead of a multiplicative decrease, TCP decreased the window size by a constant amount. Would the resulting AIAD (Additive Increase Additive Decrease) algorithm converge to an equal share algorithm? Justify your answer using a similar figure.

4) Consider two TCP senders. They are at different sending hosts and go to different destinations, but pass through a common bottleneck link (that is the only bottleneck link on either of their paths). What does is mean to say that TCP provides fair sharing of bandwidth at the bottleneck link? Suppose the RTTs of the two connections are very different. Is TCP "fair" in this case? Justify your answer.

5) If the RTT from London to Cape Sydney is 120ms and all links in the network have a 155 Mbits/second data-rate, how much data can fit in the "pipe"? Express your answer in bytes.

6) Consider the GBN and SR protocols. Suppose the sequence number space of size k. What is the largest allowable sender size window that will avoid the occurrence of the problems such as that in Figure 3.27 of the textbook (or as discussed in the Week 4 lecture).

7) Solve Problem 40 from Chapter 3 of the textbook. (Note: If you have an older edition of the textbook, this is the problem concerning the plot of the TCP window size as a function of time and which has (a) – (i) sub-questions)

8) In protocol rdt 3.0. the ACK packets flowing from the receiver to the sender do not contain any sequence numbers. What do you think is the reason for this?

9) Draw the FSM (finite state machine) for the receiver side of protocol rdt 3.0.

10) Two 16-bit words 1011 0101 1010 1000 and 0101 1001 0000 0101 are received, along with another 16-bit word, 1101 0001 0101 0001, which is the UDP checksum of the first two words. Will the receiver detect an error?

11) Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so, how?

12) Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110. (EXAM PROBLEM FROM PREVIOUS SEMESTERS)

(a) How much data is in the first segment?
(b) Suppose the first segment is lost but the second segment arrives at B. In the acknowledgement that Host B sends to Host A, what will be the acknowledgement number?

13) Consider a TCP connection between Host A and Host B. Suppose that the TCP segments travelling from Host A to Host B have source port number x and destination port number y. What are the source and destination port numbers for the segments travelling from Host B to Host A?

14) Because of the connection-oriented nature of TCP, a connection setup phase is required at the beginning of each session, as well as a connection tear-down phase at the end of the session. Enumerate the events below in the order they occur as host A opens a TCP connection to host B, transmits data and then closes the connection. Write a 1 next to the event that occurs first and continue like that until all occurring events are enumerated (the first event has been enumerated for you). You may assume that no segments are lost. Also indicate at which host the event happens. Please note that there might be events listed below that are not a part of the above data transfer and hence should not be enumerated. (EXAM PROBLEM FROM PREVIOUS SEMESTERS)

Order	Host	Event
		Send an ACK segment
		Do the rest of the data exchange
		Close the connection
		Send an ACK segment
		Send a FIN segment
1	A	Send a SYN segment
		Send a FIN segment
		Send a RST segment
		Send a SYN-ACK segment
		Enter the TIME-WAIT state
		Send an ACK+DATA segment
		Close the connection

15) Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely sure that no bit errors have occurred? Explain. Would things be different with TCP?

16) Consider the cross-country pipelined RDT example shown in Figure 3.17. How big would the window size have to be for the channel utilisation to be greater than 90%?