Introduction to Computer Networks

Midterm-2, Fall 2010

1. (8%) Describe why an application developer may choose to run an application over UDP rather than TCP?
2. (4%) What mechanisms can be used to handle packet losses in a reliable transfer protocol?
3. (8%) (a) What are the drawbacks of the Go-Back-N protocol? (b) What mechanisms are used in the Selective-Repeat protocol to remedy the drawbacks?
4. (6%) What are the mechanisms in the TCP for reliable data transfer that are different from the selective repeat protocol?
5. (6%) Describe the TCP connection set-up procedure.
6. (6%) What are the causes for wasted network capacity?
7. (6%) (a) How does a TCP sender detect congestion? (b) How does a TCP sender adjust send rate?
8. (4%) (a) How does TCP sender increase send rate exponentially? (b) How does TCP sender increase send rate linearly?
9. (4%) Describe the additive-increase and multiplicative-decrease algorithm in the TCP congestion control mechanism.
10. (4%) Describe the difference between TCP Tahoe and TCP Reno.
11. (4%) Suppose Host A sends two TCP segments consecutively to Host B over a TCP connection. The first segment has sequence number 35; the second has sequence number 155.
    (a) How much data is in the first segment?
    (b) Suppose that the first segment is lost but the second segment arrives at Host B. In the acknowledgement that Host B sends to Host A, What will be the acknowledgement number?
12. (4%) A datagram of 1000 bytes (20 bytes of IP header plus 980 bytes of IP payload) arrives at a router and must be forwarded to a link with an MTU of 500 bytes. How many fragments are generated? What are the offsets of the fragments?
13. (5%) Why do you think TCP avoids measuring the SampleRTT for retransmitted segments?
14. Consider a datagram network using 32-bit addresses. Suppose that a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

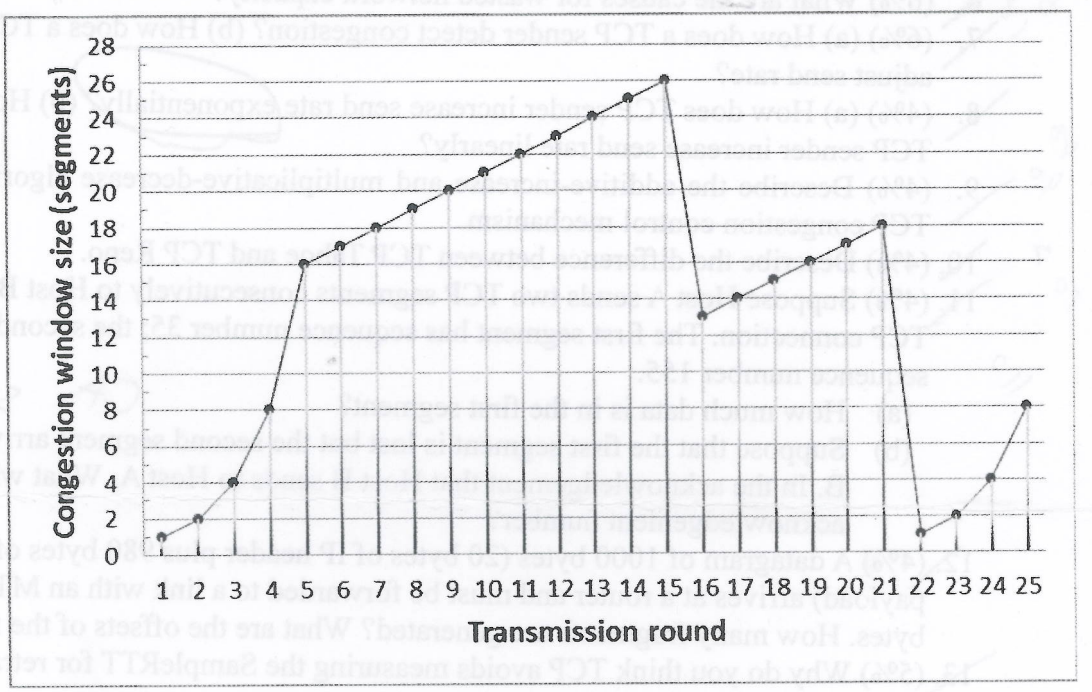
Destination Address Range				Link Interface
11100000	00000000	00000000	00000000	
	Through			0
11100000	00000000	11111111	11111111	
11100000	00000001	00000000	00000000	
	Through			1
11100000	00000001	00000000	11111111	
11100000	00000001	00000000	00000000	
	Through			2
11100000	00000001	11111111	11111111	
	Otherwise			3

a) (8%) Provide a forwarding table that has four entries, uses longest-prefix matching, and forwards packets to the correct link interfaces.

b) (6%) Describe how your forwarding table determines the appropriate link interface for datagrams with the following destination addresses:

11001000	10010001	01010001	01010101
11100000	00000001	11000011	00111100
11100000	00000001	00000000	01110111

15. (10%) Consider the following plot of window size as a function of transmission round. Assuming TCP Reno is the protocol experiencing the behavior shown below.



a) Identify the intervals of time when TCP slow start is operating.

b) Identify the intervals of time when TCP congestion avoidance is operating.

c) After the 15th transmission round, is segment loss detected by a triple duplicate ACK or by a time out?

d) After the 21st transmission round, is segment loss detected by a triple duplicate ACK or by a time out?

e) During what transmission round is the 25th segment sent?

16. (8%) Describe how network address translation (NAT) works.

17. (10%) Describe how the *traceroute* program works.