CPSC 5510 Computer Networks

Written Assignments #2

Assigned: Monday, 11/06/2017

Due: 11:59PM, Sunday, 11/12/2017

Note: Please answer the questions briefly. Do not give long, winding, irrelevant answers. 16 points in total and 2 point per question.

1. Pipelined protocols
   a. Consider the pipelined protocol in Figure 1. Does this figure indicate that Go-Back-N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain your answer briefly.

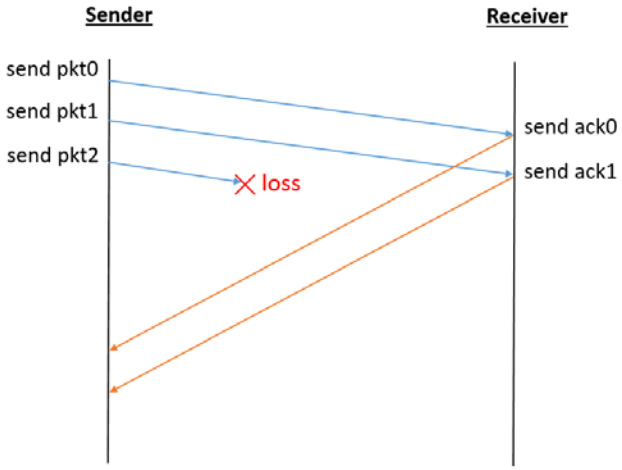


Figure 1

   b. Consider the pipelined protocol in Figure 2. Does this figure indicate that Go-Back-N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain your answer briefly.
   c. Consider Figure 2 again. Suppose the sender and receiver windows are of size N = 5 and suppose the sequence number space goes from 0 to 15. Show the position of the sender and receiver windows over this sequence number space at time t (the horizontal dashed line).

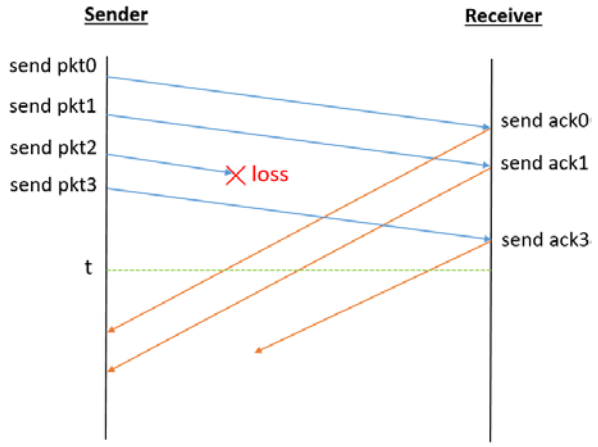
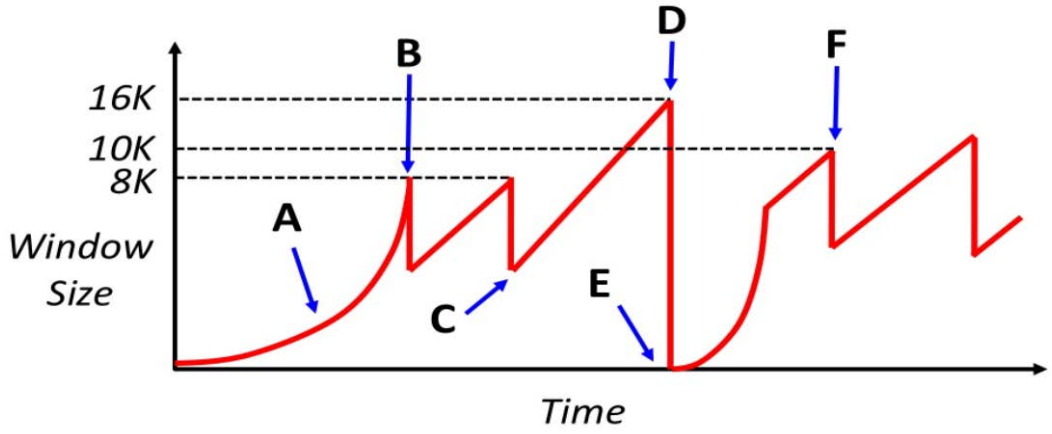


Figure 2

d. Suppose that it takes 1 ms to send a packet, with a 10 ms one-way propagation delay between the sender and receiver. The sliding windows size is again N = 4. What is the channel/link utilization (assume no message losses and message delays)?

2. Name the event at B which occurs that causes the TCP sender to decrease its window as shown in the graph below.
   a. Triple Duplicate ACKs
   b. Slow Start
   c. Packet loss
   d. Time out



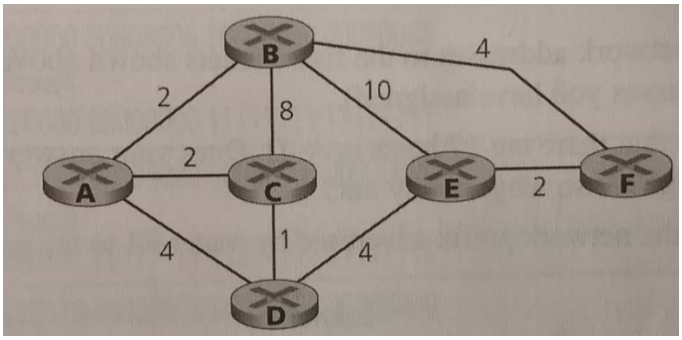
3. Suppose that in TCP, the sender window is size N, the base of the window is at sequence number x, and the sender has just sent a complete window's worth of segments. Let RTT be the sender-to-receiver-to-sender round-trip time, and let MSS be the segment size.
   a. Is it possible that there are ACK segments in the receiver-to-sender channel for segments with sequence number lower than x? Justify your answer.
   b. Assuming no loss, what is the throughput (in bytes/sec) of the sender-to-received connection? (Assume that transmission delay is zero)

c. Suppose TCP is in its congestion avoidance phase. Assuming no loss, what is the window size after the N segments are ACKed?

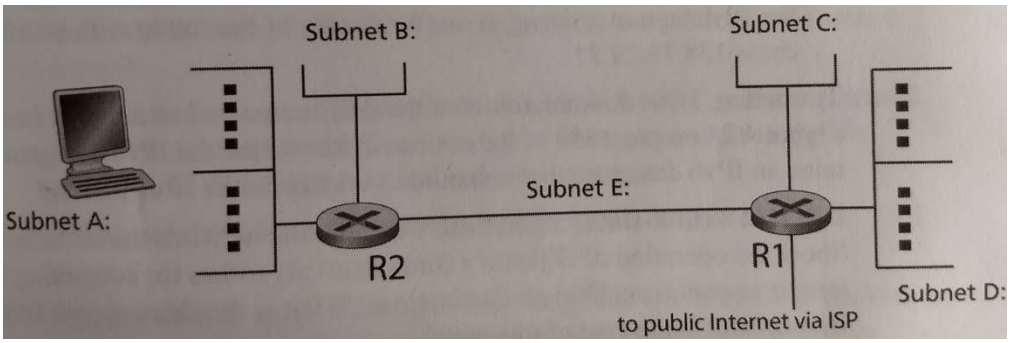
4. A sender sends same-sized segments over a TCP connection. Each segment is in the size of 1,000 bytes. The sender sends segments from "slow start" phase and the threshold window size is 64,000 bytes. Assume the round trip time for each segment is 1sec, and there is NEVER a *message loss or delay* during transmission. Assume that transmission delay is zerø. So, how long would it take the sender to send a 200,000 byte file? Explain your answer to receive full credits.

5. Consider sending a 2000-byte datagram into a link with a MTU of 980 bytes. Suppose the original datagram has the identification number 227. How many fragments are generated? For each fragment, what is its size, what is the value of its identification number, fragment offset, and fragment flag?

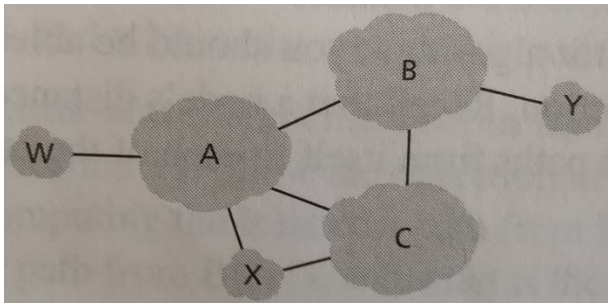
6. Consider the network shown below. Show the operation of Dijkstra's (link-state) algorithm for computing the least cost path from D to all destinations. Please also list the shortest path from D to B.



7. Consider the network shown below. Each of the subnets A-D contains at most 30 hosts; subnet E connects routers R1 and R2.
   a. Assign network addresses to the five subnets shown above using the standard syntax explained in Appendix. (You may use letters to represent the unknown bits assigned to this network IP prefix. For example, x.y.0010/20 represent the network prefix in which 24 bits are used for prefix. But the network addresses should contain enough information to differentiate subnets A-D)
   b. Suppose that there are 17 hosts in A-D. Does your answer to Question a) change?
   c. What is the network prefix advertised by Routers R1 to the public Internet?



8. Consider the network below in which network W is a customer of ISP A, network Y is a customer of ISP B, and network X is a customer of both ISPs A and C. A, B and C are peers. For each answer provide a one-sentence explanation.
    a. What BGP routes will A advertise to X?
    b. What routes will X advertise to A?
    c. What routes will A advertise to C?



Appendix

The standard syntax is to write the prefix bits that must match in dotted-quad format, followed by a slash and then the number of bits in the prefix. Any trailing bits, not part of the prefix, are written as zero. If an entire trailing byte is zero, it can be written explicitly, as in 128.8.0.0/16, or omitted, as in 128.8/16. Since only the first sixteen bits are significant (in this example), it would be meaningless to specify the remaining sixteen bits, so there's no ambiguity in omitting them.