CS 6543 Computer Networks

Spring 2007 – Midterm

March 8, 2006

Name:………………………   Score: ……./20

This exam has 6 questions in 7 pages. You have 75 minutes. Good luck.

1. (5 points) In this question, you will explain/discuss some concepts briefly.

   a. (1pt) What are the advantages and disadvantages of datagram networks (packet-switched networks) when compared to circuit-switched networks?

   b. (1pt) What are the key differences between client-server and peer-to-peer (P2P) application architectures?

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c. (1pt) How do overestimating and underestimating round trip time and timeout values impact the performance of TCP.

d. (1pt) Briefly explain the differences of Link State (LS) and Distance Vector (DV) routing protocols.

e. (1pt) Briefly explain the motivation/need for link layer addressing?

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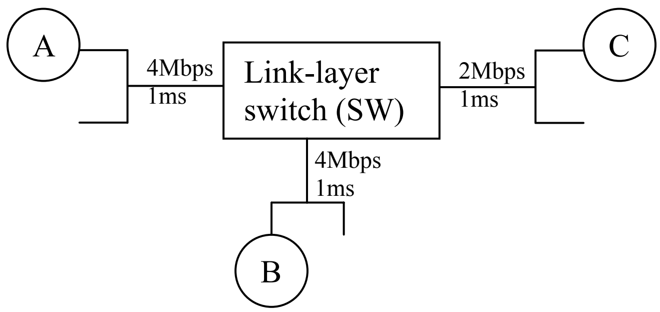
2. (3 points) Consider the below network. Each shared link has the same propagation delay of **1ms** from a node to the switch (SW) or vice versa. A's and B's segments have the capacity of **4Mbps** (mega bits per second) while the C's segment has the capacity of **2Mbps**. Packet processing time is zero at every node. A node can start transmitting as soon as the channel becomes idle from its point of view. Initially switch forwarding table is empty.



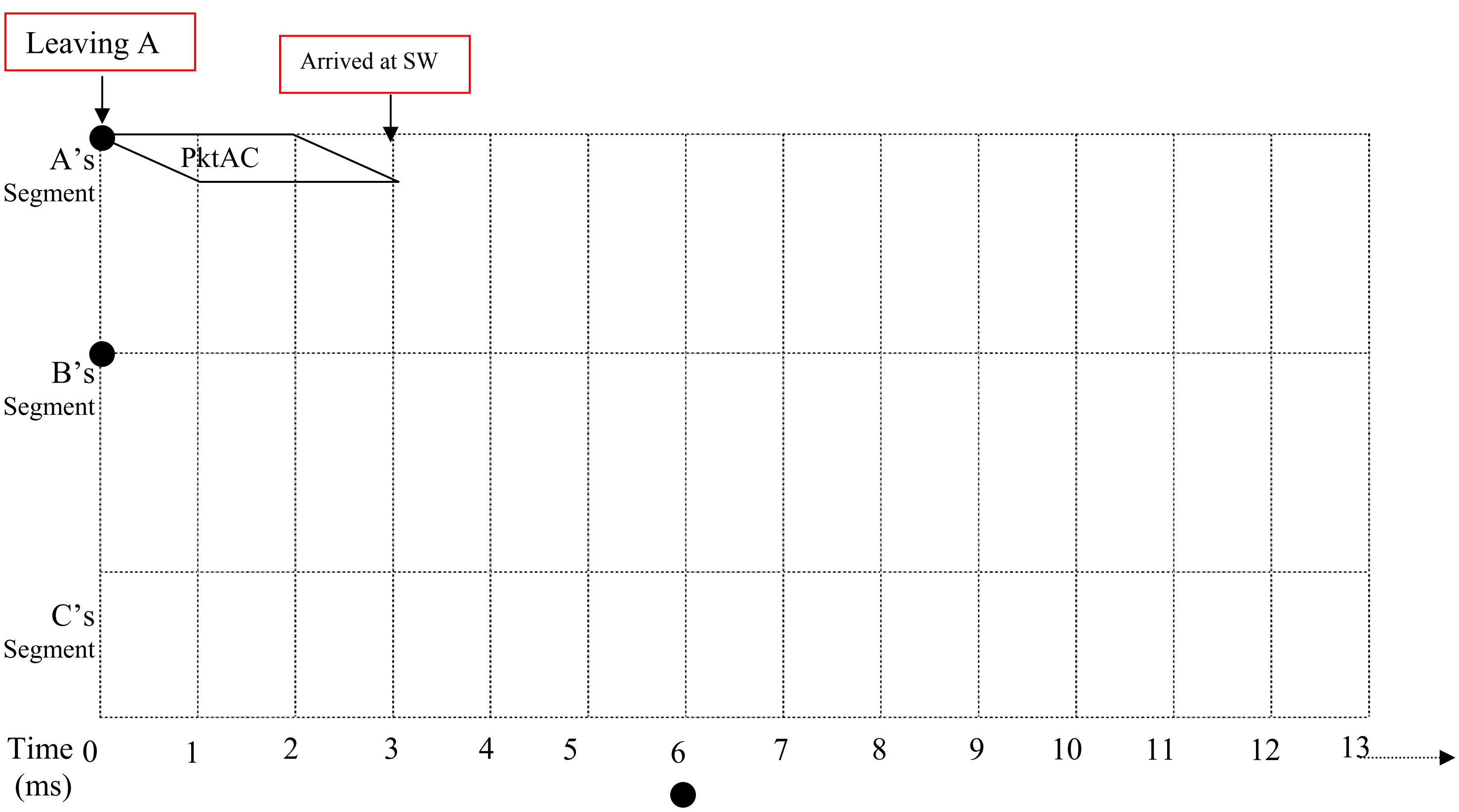
Switch fwd-ing table

Address	interface	when learned

Now suppose the following events happen:

At tine t=0ms, A wants to send a packet to C with the size of 1 KB (kilo-bytes)
At tine t=0ms, B wants to send a packet to A with the size of 2 KB (kilo-bytes)
At tine t=6ms, C wants to send a packet to B with the size of 500 B (bytes)

Using the following diagram, show which packets appear on which segment and the key events(e.g., leaving A, arrived at SW, SW learned that A is on interface 1 etc.).



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3. (3 points) Suppose we want to draw the **basic** FSM (finite state machine) for the Selective Repeat protocol (no programming statements like if0then0else, for etc) at sender side. Assume that the window size N=2 and sequence numbers are 0 1 2 3 0 1 2 3 0 1 2 3 …

Determine all the states, then just show the key **events** and **transitions** between these states (no need to specify the details of actions like make_packet, udt_send, etc).

As a hint, here are some states: **01** (both available), **01** (0 is not ACKed, 1 is available)
01 (both are not ACKed) **01**. (0 is not ACKed but 1 is ACKed)

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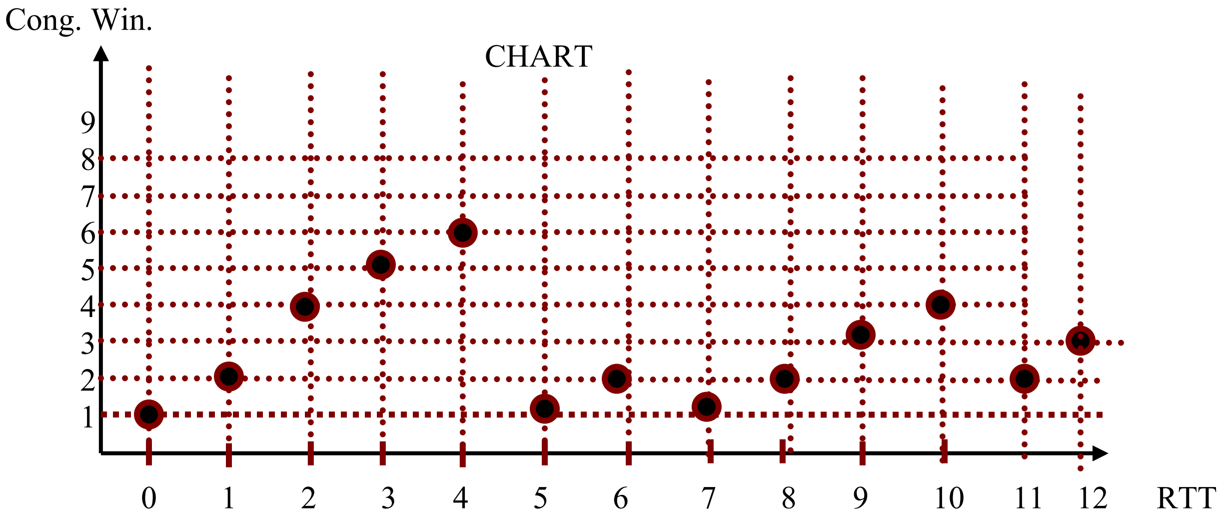
4. (3 points) Consider the following plot of TCP window size as a function of RTT.



a. (1pt) Complete the following table. When identifying/marking the lost segments, select the last segment that would cause the above behavior.

RTT	Threshold	Congestion Window	Segments that are sent
0		1	1
1		2	2, 3
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

b. (1pt) Identify ALL the intervals of time when `TCP congestion avoidance` is operating.

c. (1pt) What is the average goodput within 12 RTT (assume that 1 RTT=1 msec and TCP segment size (packet size) =1000 bytes) ?

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5. (3 points) Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. The system admin assigned the following network addresses to these subnets respectively: 135.5.17.0/25, 135.5.17.128/25, and 135.5.17.224/27.

   a. (1pt) What will be the aggregated address (in the form of a.b.c.d/x) to represent all three subnets as a single network, note that the router will advertise this aggregated network address into the Internet?

   b. (1pt) At most how many hosts can we have in each subnet? (Note: some subnets cannot use all the bits allocated for host id since the other subnets may be using some combinations)

   c. (1pt) Suppose the main router receives a packet with destination id of 135.5.17.168. How/where does the main router forward that packet?

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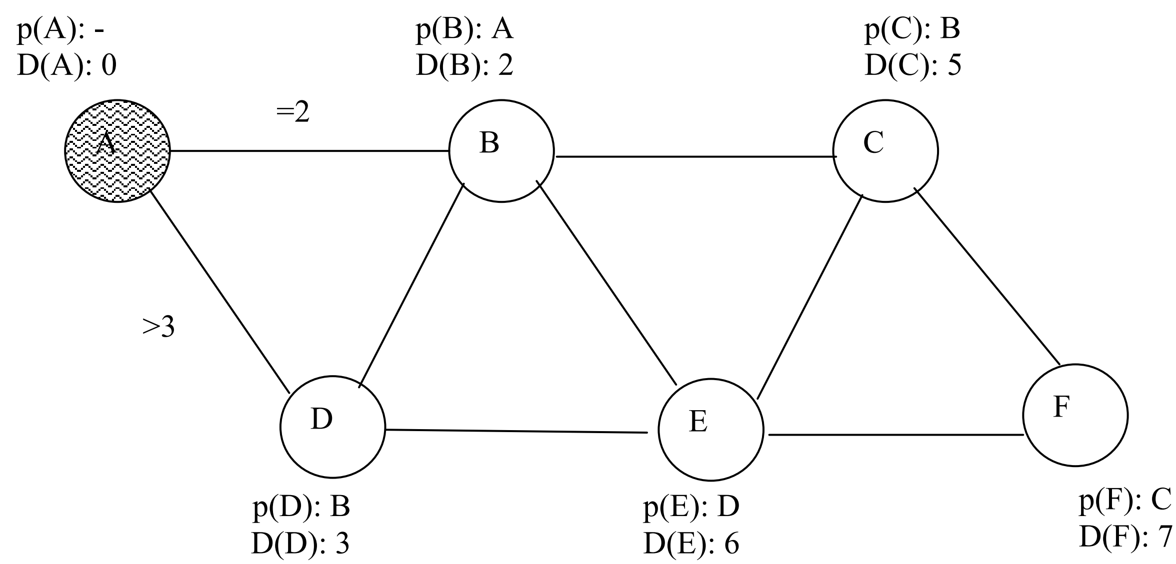
6. (3pt) Suppose we executed the Dijkstra's algorithm and determined the shortest paths from source node A to every other nodes and updated D() and p() for each node as shown in the below network.

   a. (2pt) Now you are asked to do reverse-engineering of Dijkstra's algorithm and determine the cost of each link. Note in some cases, you might not be sure about the exact value of a link cost but you can (and must) say that the link weight/cost is greater than some minimum value. For example, c(A,B)=2 but c(A,D) > 3. Suppose the link costs use integer numbers.



   b. (1pt) Give the fwd table at node A based on the above graph.