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EECS 122 Midterm Exam

March 12, 2004

- **Please write your name on top of each page.**
- **If required, use the blank side of each page.**

Problem 1: Consider the scenario where Host A is sending three packets to Host B. Each packet is 1000 bits long. Assume that all the delay from Host A to Host B is due to queueing delay at a bottleneck queue along the path and transmission delay from that queue (i.e., all other contributions to the end-to-end delay are negligible). This queue is served by a 1 Mbps link on the first-come-first-served basis.

Assume that the bottleneck queue is empty initially. The three packets from Host A are inserted in this queue at 0 ms, 2 ms, and 4 ms, respectively. Some other ongoing connections to destinations other than Host B share the bottleneck queue with the connection from Host A to Host B. These other connections insert in the bottleneck queue a 3000 bit packet at 0.5 ms and a 2000 bit packet at 3 ms.

(a) Find the times when the packets from Host A are delivered to Host B. **(15 points)**

(b) Suppose that the Host B wants to display these packets with the spacing between consecutive packets same as at the time of origination (i.e., 2 ms). A commonly implemented strategy for displaying packets at a regular interval calls for applying a “build-out delay” to the first packet such that the packets are displayed as early as possible while meeting the requirement of the fixed spacing between consecutive packets. Under this strategy, for the packets receive from Host A, what “build-out delay” should Host B apply? **(15 points)**

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Problem 2: Answer the following questions briefly. At most 2-3 sentences should suffice for each part.

(1) In Ethernet we impose a spanning tree in the network to prevent loops. Why is it such a big problem if we have loops in an Ethernet? **(6 points)**

(2) Existence of loops is not as severe a problem for IP routing. Why? **(6 points)**

(3) How is the Network Allocation Vector (NAV) field in the frame header is used in 802.11 wireless networks? **(6 points)**

(4) Suppose you have a PC connected to port 12 of an Ethernet switch and it is receiving traffic (i.e. the switch has learnt of its existence on port 12). Now you unplug the switch from port 12 and connect it to port 13. What will happen to the next packets destined for the PC assuming that the PC has received a packet from the switch in the recent past? How/when does the switch correct its switching table? **(6 points)**

(5) You have seen several calculations showing that the efficiency of an Ethernet random access scheme is well below 100%. Suppose we knew that there are exactly N nodes in the Ethernet. Here's a strategy: we divide the time into N slots and make the 1st node use the 1st slot, 2nd node use 2nd slot and so on (this is called time division multiplexing). This way, we could achieve 100% efficiency and there would never be any collision!! What's the problem with this plan? **(6 points)**

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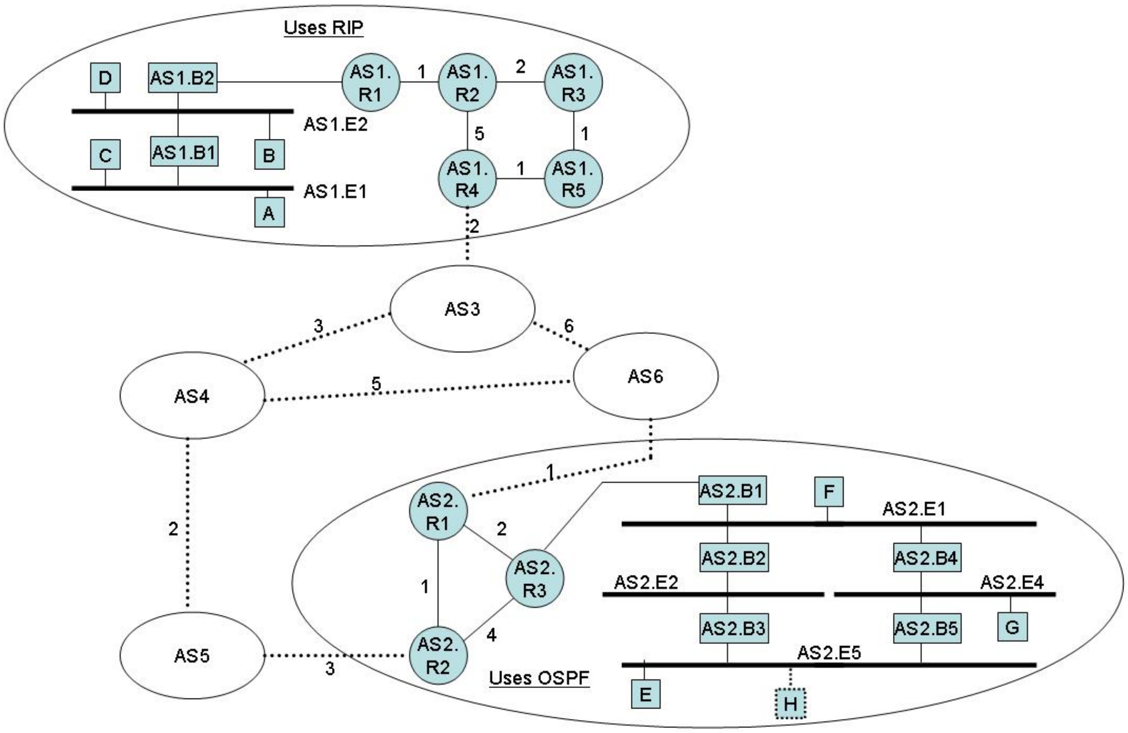
Problem 3:



- Assume that the network addresses of nodes are given by <AS>.<Network>.0.<node> e.g., node A has the address AS1.E1.0.A.
- Assume that for the bridge IDs, B1 < B2 < B3 …
- Assume H is not connected to AS2.E5 for part (a).
- Assume the BGP Speakers use the least-next-hop-cost policy for routing (i.e., among alternative paths to the destination AS, choose the one that has the least cost on the first hop)

Suppose that the network topology shown has been stable for a long enough time to allow all the routing algorithms to converge and all the bridges to learn where to forward each packet.

(a) What route, specified as a series of bridges and routers, would be used if G wanted to send a packet to A? **(12 points)**

(b) Now if node H was added to AS2.E5, and D tried to send a packet to it as soon as H was added, what would happen? Specifically, will the packet reach its destination and which all links and/or networks would the packet be sent on? [Describe in at most 5 lines] **(14 points)**

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Problem 3 (Continued)

(c) Starting from the network in (b), suppose AS2.R2 goes down. Outline in 2-3 lines the routing changes that would occur as a consequence of this failure. [Hint: Think about how the change affects packets sent from AS1 to AS2, and packets sent from AS2 to AS1.] **(14 points)**