

EE122 Midterm 2 Exam
Prof: Lai, Stoica
UC Berkeley, Fall 2001

Question 1 (20 pt)

- (a) (10 pt) What is RED? Explain briefly how it works. Use no more than five phrases for the explanation.
- (b) (10 pt) Name two goals of RED. Explain. Use no more than three phrases to describe each goal.

Note: For (a) you need to explain only the main ideas. You don't need to give the exact formula.

Question 2 (20 pt)

- (a) (5 pt) What is the goal of Fair Queueing?
- (b) (15 pt) Assume a link of capacity 10 Mbps that is traversed by four flows with arrival rates of 6, 4, 2, and 1 Mbps, respectively. Compute the fair rate along the congested link. What bandwidth will each flow get? (Show all work.)

Question 3 (20 pt)

Consider a TCP flow that sends 7 packets. Assume the TCP source experiences exactly one packet loss before finishing the transmission. Let d be the **one**-way propagation delay between the source and the receiver, and let RTO be the retransmission timeout. Let T denote the total time it takes the source to transmit all packets, i.e., the difference between the time when the source receives the knowledge for the last (7th) data packet and the time when the first data packet was sent.

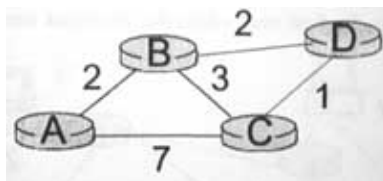
Determine which packet has to be dropped to result in maximum T , and which packet has to be dropped to result in minimum T (if there are more than one possibilities in each case, present only one of them). Compute T in both cases as a function of d and RTO . For both cases, draw the time diagram of the data packets and acknowledgements exchanged by the sender and the receiver. Upon each data packet arrival computer the congestion window size.

Note: The TCP implements both fast recovery and fast retransmission; fast recovery is triggered by 3 duplicate acknowledgements.

Question 4 (20 pt)

Consider the network below. Assume that the network implements the Distance Vector routing protocol.

- (a) (5 pt) Write down the routing table of each node.
- (b) (15 pt) Assume the cost of the link between nodes A and C decreases from 7 to 1. Write down the routing table of each node at every step until routing tables converge. Assume that both A and C see that the change of the link (A,C)'s cost at the same time, and that exchanges of routing information and routing table updates are synchronous (i.e. they happen at the same time for all nodes)



Question 5 (20 pt)

Consider a multicast group consisting of nodes Y, X, and T in the figure below. Assume Y is the source, and X and T are the receivers.

- (a) (5 pt) Draw the multicast tree in the case of DVRMP. What is the maximum path length from source to any of the receivers?
- (b) (15 pt) Explain how the multicast tree is constructed in the case of CBT. Assume the core/root can be any of the nodes Z, U, or V. Draw the best **and** the worst multicast trees amongst the three resulting multicast trees. (The metric used to compare two multicast trees is the length of the longest path from source to any of the destinations; the multicast tree with the smallest length is the best one, while the multicast tree with the longest length is the worst one.)

