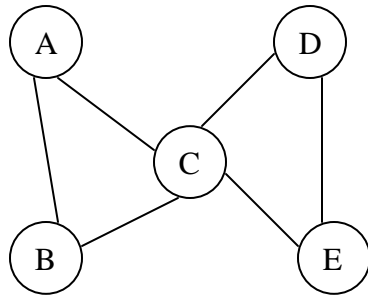


ECE/CS 438 -- Fall 2008
Homework 8
Assigned December 1, 2008
Due by class time on December 8, 2008

(1) Consider flows 1 and 2 that share a link with rate 10 Mbps. Thus, the rates of the two flows, R_1 and R_2 , are constrained as $R_1 + R_2 \leq 10$ Mbps. Let the utility functions for the two flows be $U_1(R_1) = \log R_1$ and $U_2(R_2) = 10 \log R_2$. Determine the optimal choice of rates R_1 and R_2 such that the network utility (that is, sum of utility of the two flows) is maximized.

(2) Consider the wireless network shown below. In this network, at any time, only one node may transmit a packet reliably. Assume that when a node transmits a packet (without any interfering transmissions) the packet is received by all the nodes connected to it by links in the figure below.



Suppose that node B needs to multicast data to nodes A and D both, and node E also needs to multicast data to A and D both. Suppose that all transmissions are performed at rate 1 Mbps.

Explain how network coding may be used to improve aggregate rate at which multicasts are performed by nodes B and E.

(3) Consider the following version of the token ring protocol: When a host receives the token, the host may transmit for at most 1 ms duration at the rate of 100 Mbps, and then pass the token to the next host. Suppose that the time required to pass the token between adjacent hosts is 0.05 ms. Assume that the token ring consists of 10 hosts.

(i) Estimate the maximum aggregate throughput (aggregate over all hosts) achievable using the above protocol.

(ii) Suppose that only one of the hosts on the token ring is backlogged, and no other host has any data to transmit. Determine the maximum throughput achieved by the backlogged host.

(4) Briefly describe a potential benefit of using *source routing*.