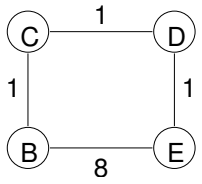
cmsc 417-F02 **Exam 2** **name:** _____

Total points 30. Total time 70 mins. 4 problems over 3 pages. No book, no notes, no calculator.

1. [10 pts]



The above network uses the distance-vector routing algorithm. Assume the following:

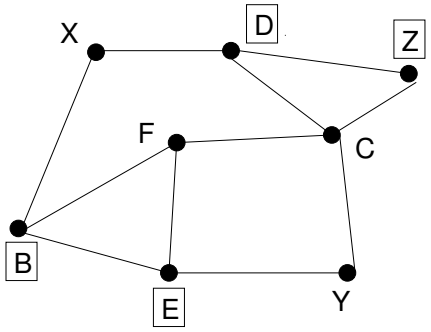
- Links are bidirectional, and a link has the same cost in each direction.
- If several neighbors of a node can serve as the node's next hop to a destination, the node chooses the neighbor with the smaller id (A<B<C< $\cdots$ <Z).
- Nodes exchange their routing info once every second, in perfect synchrony and with negligible transmission delays. Specifically, at every time i, $i = 0, 1, 2, 3, \cdots$, each node sends its routing info, then receives routing info and updates its routing table; the update is completed by time $i + 0.1$.
- At time 0, the link costs are as shown above and the routing tables are stable. At time 0.5, the cost of the link from C to D becomes 11. There is no further change in the link costs.

Give the evolution of the routing table entry at nodes B, C, and D for destination E, at times 0.1, 1.1, 2.1, $\cdots$, until they stabilize. Point out when they stabilize. **Present your final answer in the format given below, where the entry for time 0.1 has already been filled. Do your rough work elsewhere.**

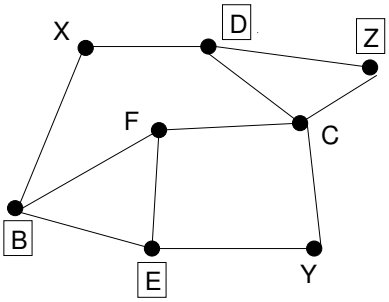
Time	At B, dist to E		At C, dist to E		At D, dist to E	
	via C	via E	via B	via D	via C	via E
0.1	3	8	4	2	3	1
1.1						
2.1						
.						
.						
.						

2. [10 pts] In this problem, every router is a multicast router; links are bidirectional; unicast routing is done on shortest-hop paths with ties resolved by choosing the next hop with smallest id (A<B<C< $\cdots$ <Z); nodes B, D, E, Z constitute a multicast group; each node in the group generates a flow of 1 packet/second to be delivered to all other nodes in the group. **Do your rough work elsewhere.**

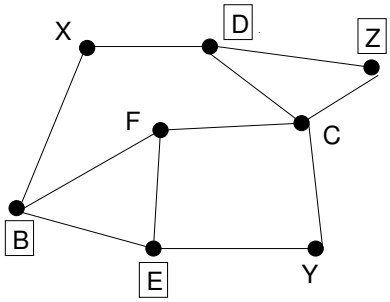
a. Assume a center-based shared multicast tree with center node E and join requests sent on unicast routes. Indicate on the figure the multicast tree and the aggregate flow on each link in each direction.



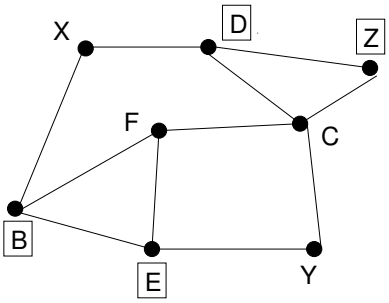
b. Assume that RPF (with pruning) is used to build source-specific routing trees. Indicate in the figures below the appropriate multicast trees.



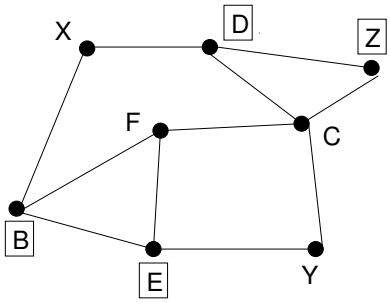
tree for B



tree for E

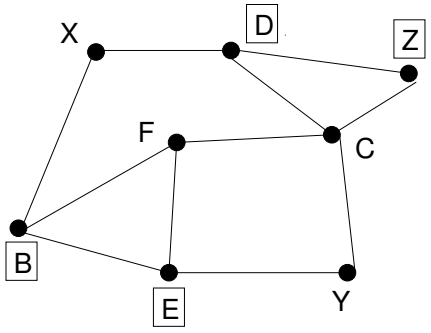


tree for D

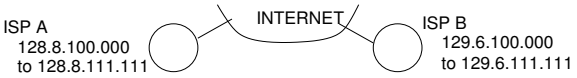


tree for Z

c. Indicate in the figure the aggregate flow on each link in each direction achieved in part b.



3. [5 pts]



a. Assuming that ISPs A and B have the addresses indicated above, what network id information does each ISP advertise to the Internet?

b. Assuming that the addresses 128.8.100.000 to 128.8.101.111 are transferred from ISP A to ISP B, what network id information does each ISP advertise to the Internet?

4. [5 pts]

a. Why are sequence numbers needed in link state routing messages?

b. Why are sequence numbers not needed in distance vector routing messages?