CS 6390 HW I Spring 2016.

Question 1: Internet Basics

(a) Why do routers at the core of the Internet need to be aware of network numbers and not just autonomous system numbers?

(b) Why usually do all the routers within an AS at the core of the Internet speak BGP (i.e. all routers within a core AS must speak BGP)

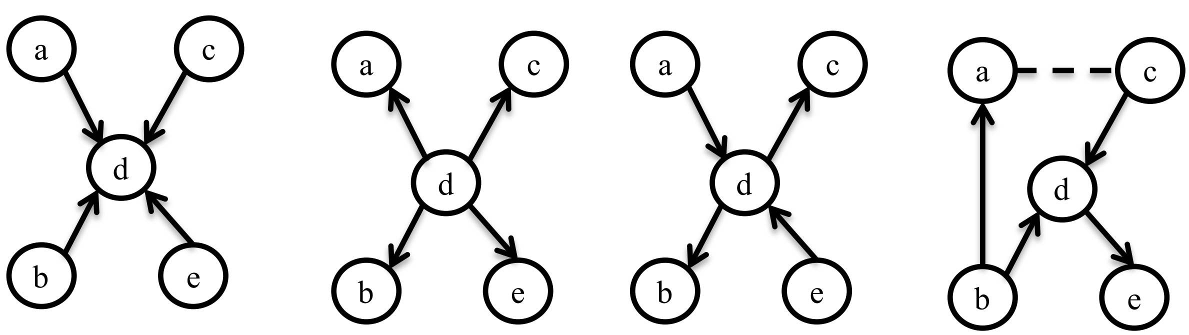
(c) Give me two reasons why BGP advertise the entire AS-path to the destination (as opposed to simply advertising the number of AS-hops to the destination).

(d) In a LAN (such as Ethernet) why is it necessary for the LAN to be able to do a broadcast if we are considering including the LAN into the Internet (i.e. run IP on the machines in the LAN).

Question 2: BGP abstract model – proof of convergence

In slide 30 of the proof of "no dispute wheel implies convergence", there are two "Why?" questions (why u_0 must exist, and why Q_0 is unique and the lowest ranked in values(C,u_0)). Answer these two questions (rigorously, remember, we are dealing with a proof).

Question 3: Hierarchical BGP



(i) (ii) (iii) (iv)

For each of the five autonomous systems (a, b, c, d, and e) in each of the four systems in the graph (system (i), (ii), (iii), and (iv)), tell me which other autonomous system they can reach, provided we follow the export policy restrictions that were discussed in class.

Question 4 (Ethernet Multicast)

Consider doing a multicast in an Extended Ethernet LAN (multiple Ethernet LAN segments connected via bridges). Assume that hosts do not send Ethernet membership reports (which we discussed in class). However, the bridges (not the hosts) can have their software configured as we please. Assume want to implement IPv4 multicasting on that LAN. How would you modify the bridges to allow efficient multicasting? I.e., bridges forward IP multicast packets only to the LAN segments where there are receivers, and it should involve the least amount of processing at the bridges.

Question 5 (Bridge Packet Forwarding)

Consider slide 11 in the DVMRPandMOSPF slides. Recall that by now I sent a message to J, J sent a message to I, and K sent a message to J. Consider the following sequence of events.

a) Host N sends a message to host K. Which bridges learn about the location (direction) of node N?
b) After a) above, host M sends a message to host N. Which bridges learn about the location (direction) of node M?
c) Assume host J is moved to the LAN segment where host K is located, and J does not send any new Ethernet frames (it is alive and running but at the moment it is not sending anything). Can host I send a message to host J, or is the communication from I to J totally lost?

Question 6: Internet Subnets

Assume that the following subnet numbers belong to a company.

i. 129.56.4.0
ii. 129.56.2.0
iii. 129.56.12.0
iv. 129.56.8.0
v. 129.56.3.0
vi. 129.56.1.0

Is it possible for all of these subnet numbers to exist concurrently in the company? If yes, then show me the minimum number of bits that must exist in the subnet mask of each of the six subnets. If no, then argue why not.

Question 7: Reverse Path Flooding

In the reverse-path flooding (RPF), we argued in class that the total number of messages is 2*E – (N-1) where E is the number of edges and N is the number of nodes. Assume that the nodes are using distance vector routing (any of its variations, I will let you choose which one). Can we use this to reduce the number of messages? Show how if so, or argue why not if no.

Question 8 Dispute Wheels

Consider a dispute graph with conflict arcs and transmission arcs. Argue that a cycle cannot be formed by using transmission arcs and a *single* conflict arc.

Question 9 DVMRP

Consider the collection of subnets below (the blue boxes are routers, the subnet "name" is along side of it i.e. (a) (b) etc). You can break ties in alphabetical order (i.e. A has a lower IP address than B, if both A and B have the same number of unicast hops your unicast algorithm favors A)

i. In Reverse Path Broadcasting (RPB), identify for each LAN, which router is the parent router of the LAN with respect to source S.
ii. In Truncated Reverse Path Broadcast, indicate which LANs are leaf LANs, and which leaf LANs will be truncated.
iii. In Reverse Path Multicasting (basically the full-blown DVMRP), identify which routers send Non-Membership Reports, and to whom do they send them.
iv. After pruning, identify the LANS over which multicast messages from S are sent to group