15-441: Computer Networks
Homework 2

Assigned: Feburary 19th
Due: Feburary 28th

1. Frank Fandango runs a 10Mbit/s Ethernet between the CMU campus and the homes of his friends. All of these hosts are in a single broadcast domain. Fortunately, they are located *just* within the maximum distance of an Ethernet. The total size of an Ethernet can be about 2.5 kilometers, , and an Ethernet has a minimum packet size of 512 bits.

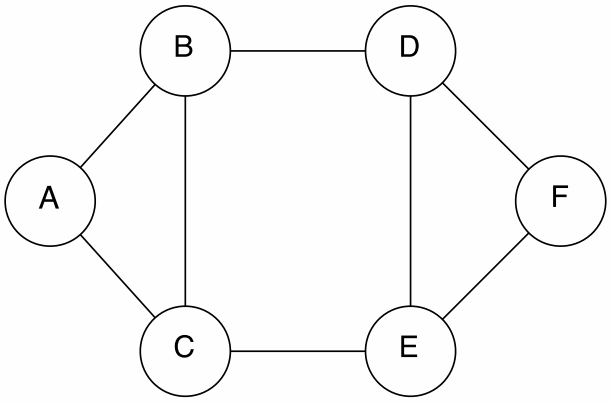
   Frank upgrades his network to 100Mbit/s Ethernet, and notices that when only one person sends at a time, or when he sends very large packets, his network works. But when many people send very small packets, things don't work at all.

   (a) Explain how a minimum packet size can help to detect collisions in Ethernet:

   (b) Help Frank out. Compute the threshold of how big packets must be in order for things to work:

   (c) One solution that Frank came up with is to raise the minimum packet size to the answer from part (a). Suppose that Frank cannot modify the minimum packet size, move the endpoints, lay new cable, or change the software or configuration on the endpoints. You may add new devices to the network. How could Frank change the topology to fix his problems anyway?

2. For this question, assume that the routers use RIP to calculate their forwarding tables.



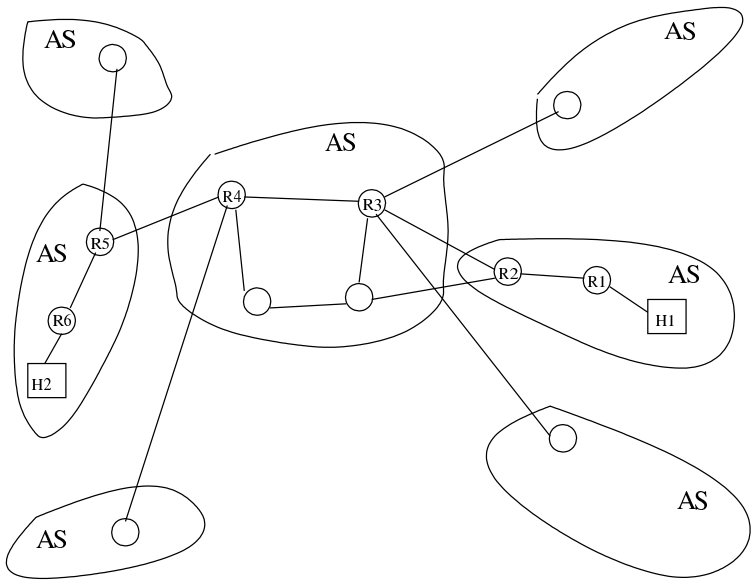
   (a) Fill in the routing table for node A, after convergence.

A		
B		
C		
D		
E		
F		

(b) After convergence, node E goes down. Fill in the final routing table for B, after re-convergence.

A		
B		
C		
D		
E		
F		

3. Imagine the Internet is divided into the Autonomous Systems shows below. In this problem we assume *NO subnetting* and *NO supernetting* and *NO CIDR* is used. A packet is being sent from Host H1 to Host H2. The packets takes the following route: H1 $\longrightarrow$ R1 $\longrightarrow$ R2 $\longrightarrow$ R3 $\longrightarrow$ R4 $\longrightarrow$ R5 $\longrightarrow$ R6 $\longrightarrow$ H2



Some information: R2, R3, R4, and R5 are gateway routers. **Assume that there are many routers and networks within each AS that are not shown. Assume also that there are NO default entries in routers. Please answer the questions below in 10 words or less. We are NOT looking for numerical answers.**

(a) Which of the *labeled* routers above likely use the BGP routing algorithm to create their forwarding tables?

(b) How many entries does R1's forwarding table have?

(c) Assume that host H1's IP address is 205.96.17.172, What can we say about the IP address of R1

(d) Give an example of an entry in R1's forwarding table (don't leave out any fields).

(e) How many entries are there in R2's forwarding table?

(f) Suppose AS X thinks that AS Y drops too many packets. Using only BGP, is it possible for AS X to implement a policy stating that "traffic outbound from my AS should not cross Y?" Why or why not?

(g) Now suppose AS X thinks that AS Y generates a lot of illegal file sharing traffic. Using only BGP, is it possible for AS X to implement a policy stating that, "I don't want to carry traffic from Y to my customers?" Why or why not? Assume that AS X does not want to deny transit to traffic from any other AS.

4. Maggie decides to start a small company. She asks her ISP, Acme Networks, to give her enough addresses for 1200 hosts. ACME allocates a subblock from the 192.1.* address range that they own and tells Maggie to use the following addresses:

192.1.0.*
192.1.1.*
192.1.2.*
192.1.3.*
192.1.4.*

(a) Maggie has heard that the size of the Internet routing table has grown to huge proportions, and that to be a good citizen, she should announce the fewest number of routes possible to exactly cover her IP addresses.

Under CIDR, what is the smallest *set* of network numbers that the rest of the world would use to describe Maggie's networks (please use address & prefix format - e.g. 128.2/16)?

(b) Maggie has a second ISP that she uses, RoadRunner Networks. She announces some of her network addresses to both Acme and RoadRunner. (Maggie hadn't talked to you yet—these announcements do not correspond to the answers you provided to the previous question). As a result, some router far away in the network produces a forwarding table with the following entries:

Destination	Next Hop
192.1/16	1.2.3.4
192.1.0/23	1.2.3.5
192.1.4/24	1.2.3.6
192.1.1/24	1.2.3.7

Which next hop should the router use for a packet destined to 192.1.0.1?