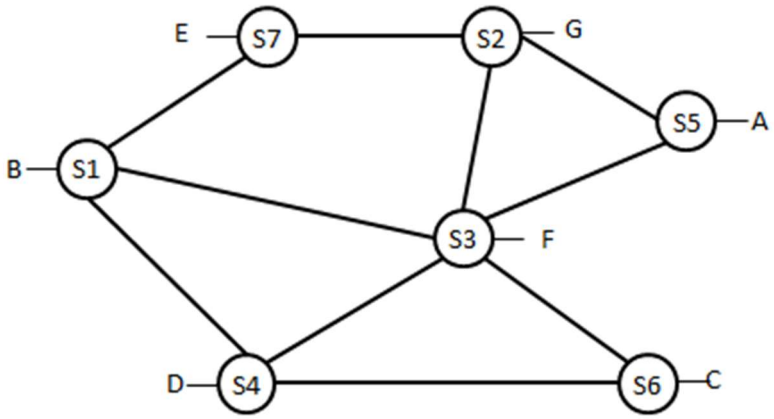
15-441/641 Homework #2
Due September 13, 2019 at 5PM to Gradescope
September 5, 2019

Part 1: Spanning Tree Protocol (14 pts total)

Given the Ethernet LAN shown in the figure below, hosts are labeled A-J and switches are labeled with S1-S7. The identifier "i" of switch Bi is used by the spanning tree protocol to identify the root and as a tie breaker for path selection (lowest identifier wins).



1. [7 pts] Please circle the root of the tree and highlight links that are part of the tree

2. [3 pts] Please list the path taken (as a sequence of switches/hosts) between the following pairs of hosts:
   a. B to G

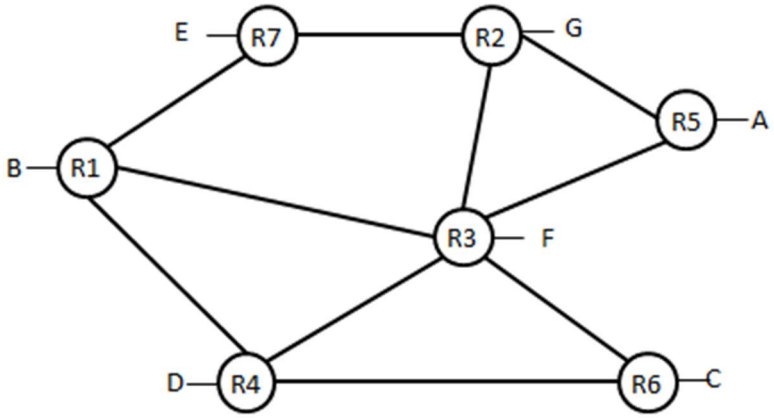
   b. E to A

   c. A to G.

3. [4 pts] Suppose each node sends one packet to every other node in the network without packet loss. Please list the number of packets traveling across the following bidirectional links:
   a. S1-S3

   b. S2-S5

Part 2: Link state routing (12 pts total)



The above figure shows the same topology, but we have upgraded the switches (layer 2 devices) to routers (layer 3 devices). We are running the OSPF protocol to identify paths through the network. OSPF is based on Dijkstra's shortest path algorithm.

1. [6 pts] Please identify the path used for communication between the following nodes pairs. If multiple paths are possible (since we did not provide a tie breaker), list them all:
   a) B to G

   b) E to A

   c) A to G

2. [3 pts] Provide one benefit of Spanning Tree Protocol (STP) over OSPF

3. [3 pts] Provide one benefit of OSPF over STP

Part 3: Protocol stacks (9 pts total)

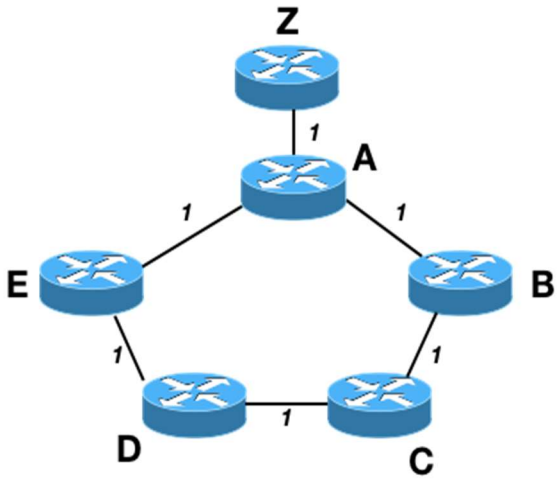
Router Steenkiste sends a packet to Router Sherry. Unfortunately, he drops it on the floor and it is all scrambled as you can see in the above figure.

1. [6 pts] Can you put all the pieces in the right order in the figure below?

2. [3 pts]Can you describe in one sentence why you picked this ordering. “Because that is what the slides show” is not a good answer!

Part 4: Distance Vector Routing Warmup (14 pts total)

Consider the following network where each router uses a Distance Vector Algorithm to manage routing. All routers implement Split Horizon/Poison Reverse. Each router releases a Distance Vector to its neighbors every 10 seconds, in lock step -- all at the same time.



1. [5 pts] Fill in the DV table for A node after all routes have stabilized :

	Via B	Via E	Via Z
To B			
To C			
To D			
To E			
To Z			

2. [5 pts] Fill in the DV table for D after all routes have stabilized.

	Via C	Via E
To A		
To B		
To C		
To E		
To Z		

3. [2 pts] How many seconds does it take for all nodes in the network to discover their best routes?

4. [2 pts] How many seconds does it take for all routes to stabilize (both best and backup paths)?

Part 4: Distance Vector Routing Challenge (2 pts total)

You are managing the above network, when node Z goes down entirely. You find that your network enters a “count to infinity” pattern. You read about hold down timers as a potential solution (combined with Split Horizon/Poison Reverse). When a node hears any announcement that a path to a node has gone down, it sets a “hold down timer”. First, it voids all routes to the downed node. Then*, it ignores any DV updates to the network that claim that the route is reachable until the timer expires.* After the timer expires, it accepts new updates normally.

What is the minimum duration you should set your hold-down timer for in this network in order to avoid Count-to-Infinity? Please explain why.