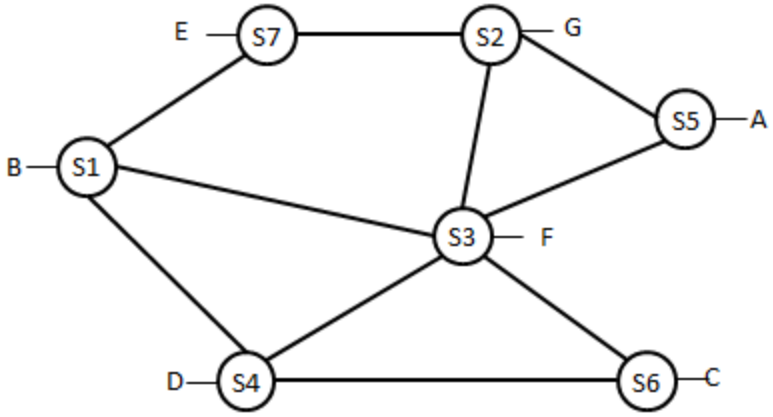
15-441/641 Homework #2
Due February 1, 2019 at 5PM to Gradescope
V 1.1 1/26/2019

Part 1: Spanning Tree Protocol

Given the Ethernet LAN shown in the figure above, 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).

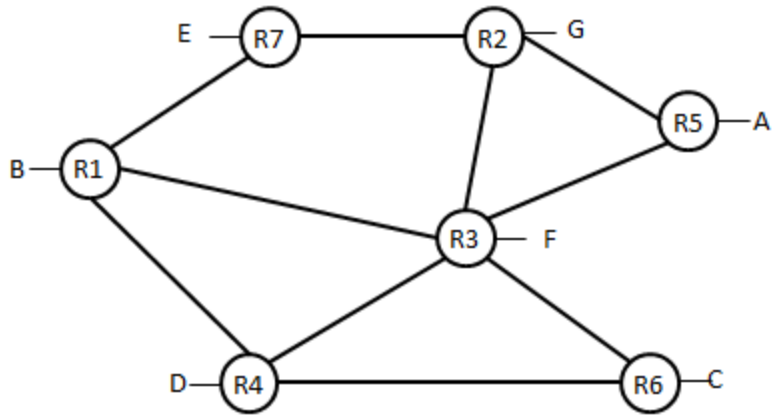


1. [4 pts] Please circle the root of the tree and highlight links that are part of the tree

2. Please identify the path (as a sequence of switches/hosts) between the following pairs of hosts:
    a. B to G,
    b. E to A, and
    c. A to F.

3. Support each node sends one packet to every other node in the network. There is no packet loss. Please list the number of packets traveling across the following (bidirectional) links:
    a. S1-S3,
    b. S2-S5, and
    c. S6-S4

Part 2: Link state routing



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. 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:

- B to G,
- E to A, and
- A to F

2. Provide one benefit of Spanning Tree Protocol (STP) over OSPF

3. Provide one benefit of OSPF over STP

Part 3: Protocol stacks

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.

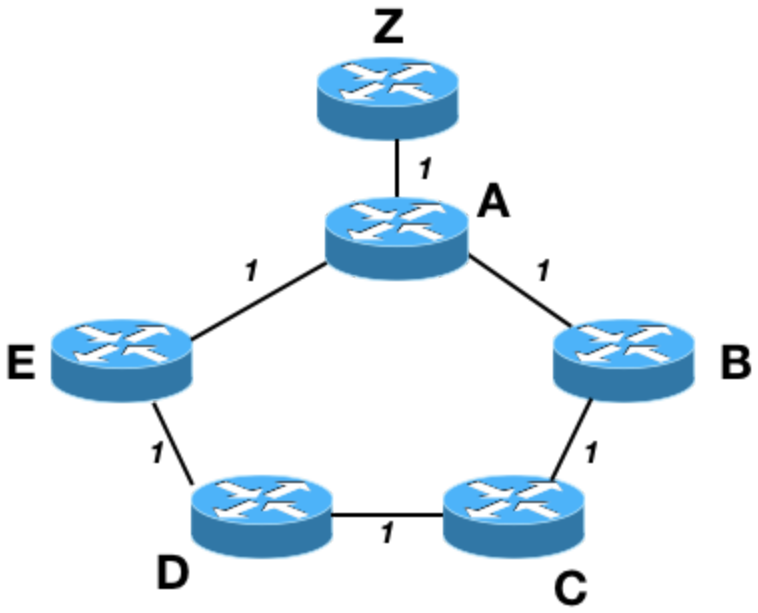
Fiber	TCP	HTTP	Session	Ethernet	IP	User Data

1. Can you put all the pieces in the right order in the figure below?

2. 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

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 points) 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 points) 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 points) How many seconds does it take for all nodes in the network to discover their best routes?

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

Part 4: Distance Vector Routing Challenge

1. (1 point) 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.