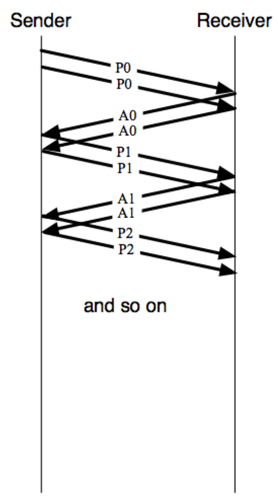
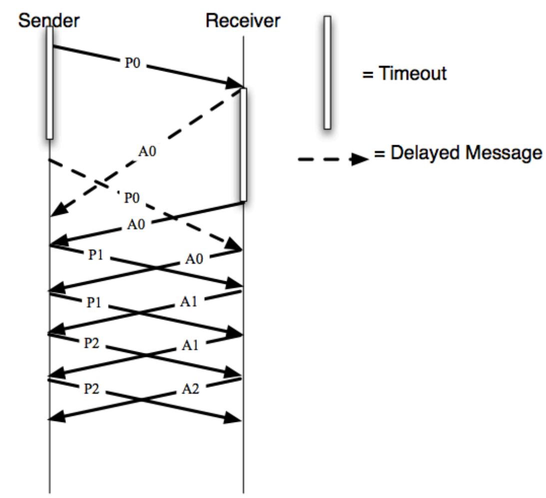
2.28

2.28a



High-level result: Each message will get transmitted **twice**.

2.28b



Sorcerer's Apprentice Bug from Here Onward

For 2.28b, other scenarios might be possible. Also, you didn't have to draw a space-time diagram for part b as long as you explained the conditions that would cause the bug to manifest.

Grading policy:
Part a:
* 2 points if you got that each message gets transmitted twice
* 1 point if you had a lot of arrows drawn but didn't really draw a conclusion about what was happening
* 0 points if you didn't do it.

Part b:
* 2 points if your solution involved delaying messages in such a way as to allow the Sorcerer's Apprentice bug to manifest
* 1 point if you caused the bug to manifest but based your reasoning on a faulty assumption about how the system was supposed to behave
* 0 points if you didn't do it.

2.42 A&B

a) There was some confusion about this problem, as it wasn't clear whether the jam signal was only required if the resulting minimum packet size was below 512 bits.

If you assume that you don't need a jam signal if the minimum packet size is longer than 512 bits, then you have to have a message whose minimum size is large enough to keep the line busy until a collision can be detected. Since you need 464 bits to do this at 10 Mbps, you need 4640 bits to do it at 100 Mbps (since the bandwidth-delay product of the link is ten times as large).

If you assumed that we needed a jam signal (I heard some reasonable justifications for this), then you added an additional 48 bits of jam signal and got 4688 bits.

We accepted either 4640 bits or 4688 bits as long as you gave at least some justification for your answer.

2 points for giving 4640 or 4688 bits and justifying your choice
1 point for giving something that was a little off due to some misunderstanding (wrong link speed, messed up the math, etc), or if you said "it gets larger" without specifying how much larger
0 points if you didn't do it.

b) The chief thing we were looking for here was that you might waste bandwidth sending packets that are smaller than 512 bits. Other answers that we accepted mentioned things like greater probability for retransmission assuming a constant probability for corruption, decreased queue capacity as a result of smaller packets, and a larger penalty for a packet that was dropped due to congestion.

2 points if you gave the above response or said something that we thought was a reasonable problem.
1 point if you said something sort of reasonable, but it revealed some fundamental misunderstanding of how these things are supposed to work
0 points if we couldn't understand your reasoning, you gave a nonsensical answer, or you didn't write anything

c) Some of you did part c. You didn't have to do it, and we didn't grade it, but you did anyway. Kudos on taking the initiative. :-)

3.21

a) If the bridge B1 simply forwards all messages, it is as though B1 doesn't exist. Furthermore, Ethernet segments E, F, G and H all logically appear to be a single Ethernet segment (since B1 serves as the broadcast mechanism between segments).

Because of this, all bridges in the topology (with the exception of B1 of course) can communicate, and so they will elect B2 as the root.

Kudos if you told us which links were turned on and off, but we didn't count that for or against you.

2 points if you said that B2 was elected root
1 point if you misunderstood what we meant by "forwards all messages", but your answer made sense given your misunderstanding of the problem
0 points if you fundamentally didn't understand the problem or you didn't write anything

b) If B1 drops all spanning tree messages, this effectively partitions the set of bridges into two disjoint sets, {B2, B3, B5, B7} and {B4, B6} (since spanning tree messages sent by a member of one set will never be received by any member of the other set).

As a result, each set of bridges will elect its own root - B2 for the first set, and B4 for the second.

2 points if you said that B2 and B4 would be elected roots.
1 point if you gave switches other than B2 and B4 as roots,misunderstood the behavior of B1 but gave a sensible answer given your misunderstanding, or if you said that the network would be partitioned but didn't say what would happen to the spanning trees as a result
0 points if your answer showed a fundamental misunderstanding of how the spanning tree protocol works, or if you didn't write anything

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3.46

Google Docs' table format is crappy, so I can't merge cells. Hence, the table format looks a little different from tables 3.10 and 3.13, but it should still be pretty clear.

inf = infinity

I'm putting next hop information in parentheses here for clarity, but you didn't have to provide it to get credit.

a) Initially, all nodes only know the distances to their immediate neighbors, and the distances to themselves.

Information Stored at Node	Distance to Node A	Distance to Node B	Distance to Node C	Distance to Node D	Distance to Node E	Distance to Node F
A	0 (A)	inf	3 (C)	8 (D)	inf	inf
B	inf	0 (B)	inf	inf	2 (E)	inf
C	3 (A)	inf	0 (C)	inf	1 (E)	6 (F)
D	8 (A)	inf	inf	0 (D)	2 (E)	inf
E	inf	2 (B)	1 (C)	2 (D)	0 (E)	inf
F	inf	inf	6	inf	inf	0 (F)

b) After one round of communication, each node has shortest-path information to all nodes within two hops of them. For example, A receives messages from C and D. When A receives a message from C, it looks at C’s distance vector and discovers that it knows a shorter path to E and F (by routing through C) than it had before. In cases where it has multiple routes to choose from after receiving information from its neighbors, it chooses the route with the shorter total cost. For example, D has two paths to C at this step, one through E and one through A. It picks E’s path because it’s shorter (11 vs. 3)

Information Stored at Node	Distance to Node A	Distance to Node B	Distance to Node C	Distance to Node D	Distance to Node E	Distance to Node F
A	0 (A)	inf	3 (C)	8 (D)	4 (C)	9 (C)
B	inf	0 (B)	3 (E)	4 (E)	2 (E)	inf
C	3 (A)	3 (E)	0 (C)	3 (E)	1 (E)	6 (F)
D	8 (A)	4 (E)	3 (E)	0 (D)	2 (E)	inf
E	4 (C)	2 (B)	1 (C)	2 (D)	0 (E)	7 (C)
F	9 (C)	inf	6 (C)	inf	7 (C)	0 (F)

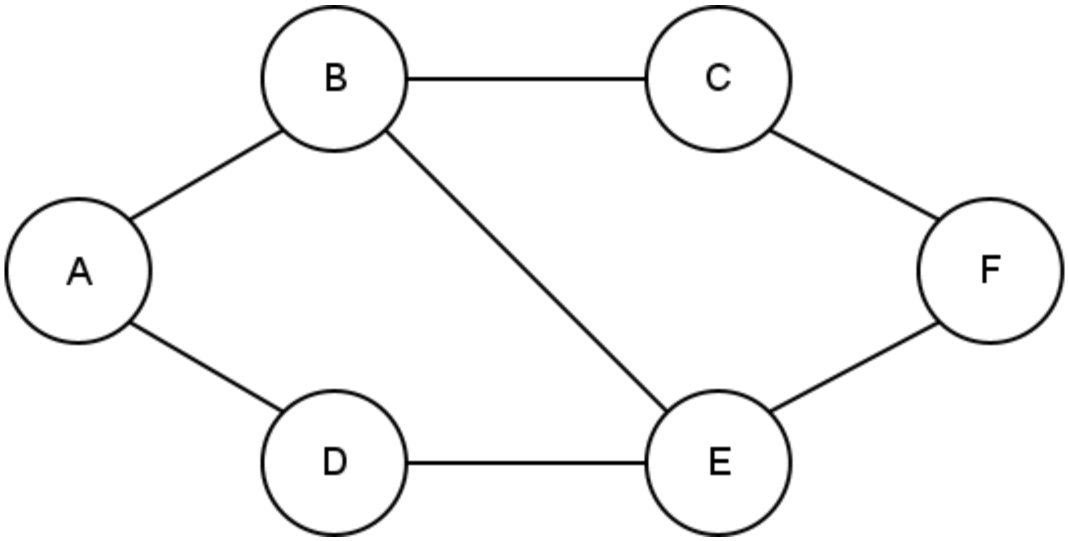
c) At this point, the shortest path information should be complete; the diameter of the graph is 3, and since at the end of this round each node has routing information from all nodes up to 3 hops away from it, each node has complete information. Note that at this point, A has discovered that it has a shorter path to D than its direct connection (6 through C rather than 8 via its direct link).

Information Stored at Node	Distance to Node A	Distance to Node B	Distance to Node C	Distance to Node D	Distance to Node E	Distance to Node F
A	0 (A)	6 (C)	3 (C)	6 (C)	4 (C)	9 (C)
B	6 (E)	0 (B)	3 (E)	4 (E)	2 (E)	9 (E)
C	3 (A)	3 (E)	0 (C)	3 (E)	1 (E)	6 (F)
D	6 (E)	4 (E)	3 (C)	0 (D)	2 (E)	9 (E)
E	4 (C)	2 (B)	1 (C)	2 (D)	0 (E)	7 (C)
F	9 (C)	9 (C)	6 (C)	9 (C)	7 (C)	0 (F)

2 points max. for each part

2 points if you got the table right
1 point if you missed a few of cells
0 points if you missed most of the cells or didn’t write anything down.

3.52



2 points if you gave the graph we expected, or a different graph with diameter 3 that met the criterion.
1 point if you gave a graph that agreed with the provided forwarding table, but was not minimal, or if you were missing an edge or two
0 points if your graph didn't agree with the forwarding table at all, or you didn't write anything