

MCS-377 Intra-term Exam 2

Serial #:

This exam is closed-book and mostly closed-notes. You may, however, use a single 8 1/2 by 11 sheet of paper with *hand-written* notes for reference. (Both sides of the sheet are OK.)

Please write your name only on this page. Be sure to look at all problems before deciding which one to do first. Some problems are easier than others, so plan your time accordingly. You have 90 minutes to work.

Write the answer to each problem on the page on which that problem appears. You may also attach additional paper, which should be labeled with your test number and the problem number.

You must sign the honor pledge below and abide by it. This includes limiting yourself to 90 minutes.

Printed name: _____

On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work.

Signature for above honor pledge: _____

Problem	Page	Possible	Score
1	2	10	
2	2	8	
3	3	8	
4	3	14	
5	4	10	
6	4	10	
7	5	10	
8	5	10	
9	6	10	
10	7	10	
Total		100	

1. [10 Points]

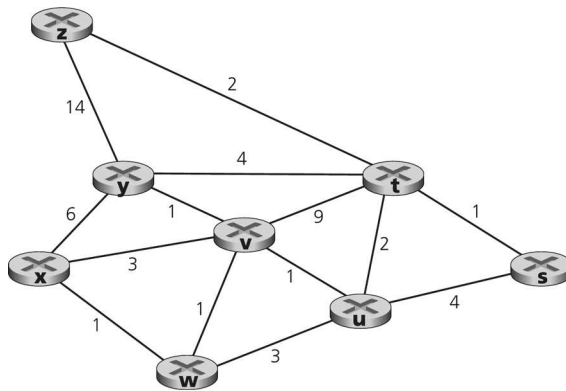
- (a) Why is it important that the Internet uses routers rather than only link-layer switches?
- (b) Why might it be easier to relocate computers if link-layer switches are used to divide up a campus rather than routers being used?
- (c) What is an advantage of using link-layer switches rather than only hubs?
- (d) What is another advantage of using link-layer switches rather than only hubs?

2. [8 Points] Translate between notations as indicated:

- (a) Express the IP address 10001001 01010100 01100000 00000111 in dotted decimal.
- (b) Express the IP address 70.13.59.34 in binary.
- (c) Express the subnet mask 255.240.0.0 in the $/x$ form (i.e., as a number of prefix bits).
- (d) Express the subnet mask $/14$ in dotted decimal form (producing a result akin to 255.240.0.0, but for a different number of prefix bits).

3. [8 Points] An organization has been assigned the prefix 107.205.0.0/20. It wishes to subdivide this address range, establishing four subnets within the organization. Subnet A must be able to accommodate at least 2000 interfaces, subnet B at least 1000, and subnets C and D at least 500 each. What would suitable prefixes, expressed in a.b.c.d/x form, be for the four subnets?

4. [14 Points] The following network is similar to the one you used for problem 4.p22. Once again you are to use Dijkstra's shortest-path algorithm to compute the shortest path to all network nodes, showing your work in a table. However, this time, you are to compute the paths starting from w . If you need to break any tie, pick the node that comes earlier in the alphabet.



step	N'	$D(s),$ $p(s)$	$D(t),$ $p(t)$	$D(u),$ $p(u)$	$D(v),$ $p(v)$	$D(x),$ $p(x)$	$D(y),$ $p(y)$	$D(z),$ $p(z)$
0	w							
1								
2								
3								
4								
5								
6								
7								

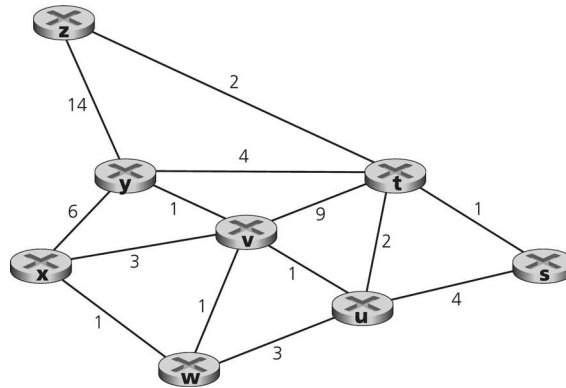
5. [10 Points]

- (a) In distance vector routing, “split horizon” and its “poisoned reverse” variant are sometimes used. You don’t need to distinguish between them, but what is the basic idea?
- (b) How does traceroute arrange to receive responses from intermediate routers, rather than only from the final destination?
- (c) How does traceroute arrange to receive responses from the final destination, rather than only from the intermediate routers? (There are two legitimate answers, depending on the version of traceroute. You may give either answer.)
- (d) What kind of ICMP message does traceroute receive from each intermediate router?
- (e) What kind of ICMP message does traceroute receive from the final destination? (Your answer to this will depend on which answer you chose in part 5c.)

6. [10 Points]

- (a) DHCP is an application protocol, layered on top of UDP which is in turn layered on top of IP. Yet one of the principal purposes of DHCP is to allow a computer to request an IP address. How is it possible for this process to be carried out using IP, when the client’s IP address is not assigned until the end of the process? There are two possible answers; for full credit, you should give both.
- (b) In addition to an IP address, DHCP allows other information to be transmitted to a machine that is booting up. Among the most important are a router address and subnet mask. What are these used for?

7. [10 Points] Let's return to the network from problem 4:



However, now assume that all the routers are multicast capable, and that a source-independent multicast distribution tree is centered at w . Suppose two routers other than w join the multicast group: t and y .

- Mark the routers and links that would be used for the multicast tree.
 - If the link between t and y were decreased in cost from 4 to 3, would that change the source-independent multicast tree centered at w and containing t and y ? Why or why not?
8. [10 Points] Suppose the propagation delay between Ethernet hosts A and B is 225 bit times. Suppose that host A starts transmitting a frame at time 0, and host B starts transmitting a frame at time 100 bit times. The two will collide. Suppose each picks $K = 0$. What is the earliest time at which A will start retransmission? What is the earliest time at which B will start retransmission? Show your work.

9. [10 Points]

- (a) How does an Ethernet switch learn that frames with a particular destination address should be sent out through one specific switch port?
- (b) Once a switch learns an address in this way, will it forever afterward send frames destined for that address only through the learned port? Explain.
- (c) Are the destination addresses that are used by the Ethernet switches IP addresses? If not, how does the initiating computer know what address it should use to reach a particular destination?
- (d) When multiple Ethernet switches are hooked together, some ports are automatically disabled for forwarding so that the actively used connections do not form any cycles. Why would cycles be disastrous for switched Ethernet, more so than for IP routing?

10. [**10 Points**] A computer receives the eight data bits 10001010 followed by the three CRC bits 101; the generator is 1001. Does this indicate that one or more bits were corrupted in transmission? Show your work.