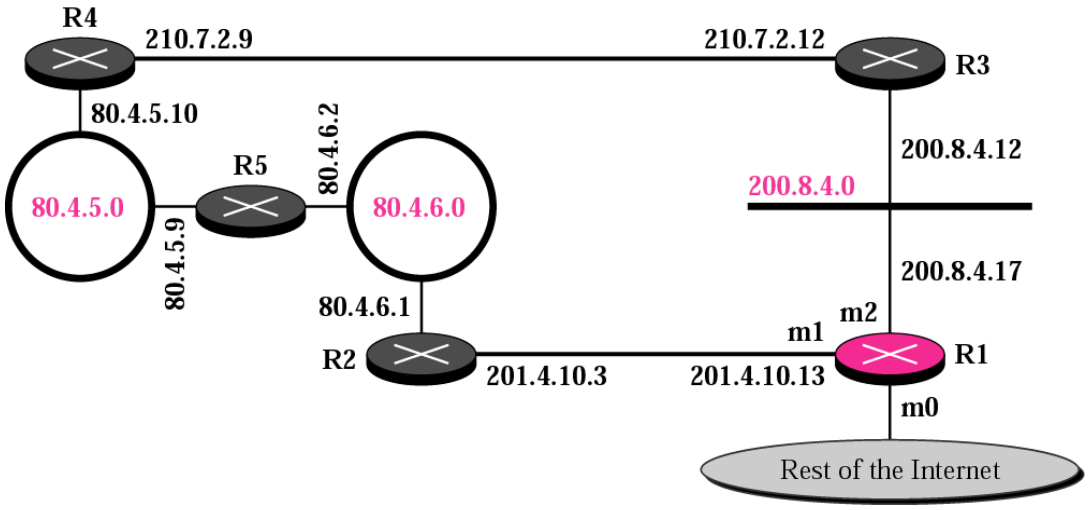
CSC 465 Computer Networks – Spring 2004 – Dr. J. Harrison

MIDTERM 2 SOLUTION

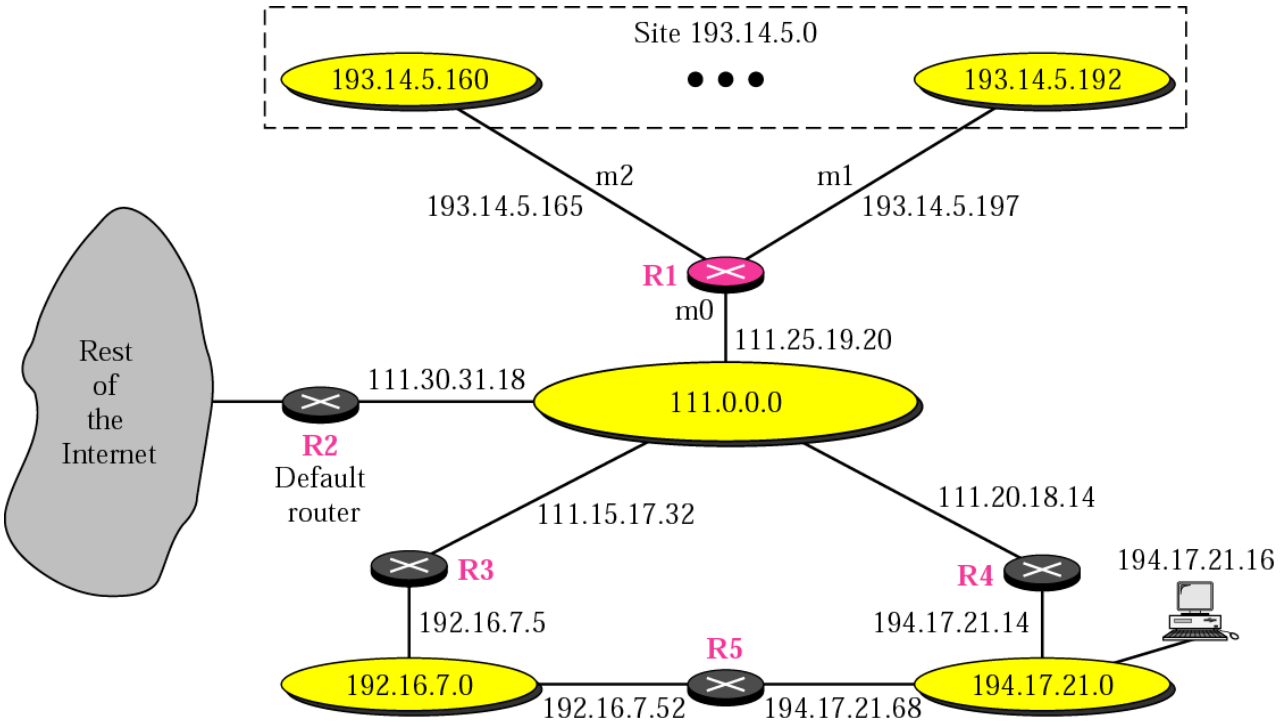
Question 1. (8 points) Given the routing table for Router R5 below, draw as much of the network topology as can be determined.

Mask	Destination	Next Hop	F	R.C.	U.	I
255.255.255.0	80.4.6.0	-	U	?	?	?
255.255.255.0	80.4.5.0	-	U	?	?	?
255.255.255.0	200.8.4.0	80.4.6.1	UG	?	?	?
0.0.0.0	0.0.0.0	80.4.6.1	UG	?	?	?

The diagram below is from the text and contains more information than can be obtained from the table above. Note that the existence of routers R1, R3 and R4 cannot be derived from the information given so students need not have included them. The answer is a subset of this diagram including R5, networks 80.4.5.0 and 80.4.6.0.



Question 2. Consider the network diagram below:



Part A: (6 points) Produce the routing table for router R4 . (Use the same table structure and notation as provided in Question 1.)

Mask	Destination	Next Hop	F	R.C.	U.	I
255.0.0.0	111.0.0.0	-	U	?	?	?
255.255.255.0	194.17.21.0	-	U	?	?	?
255.255.255.0	192.16.7.0	194.17.21.68	UG	?	?	?
255.255.255.0	193.14.5.0	111.25.19.20	UG	?	?	?
0.0.0.0	0.0.0.0	111.30.31.18	UG	?	?	?

Part B: (6 points) Assume a packet traveled successfully from host 193.14.5.193 (host not shown - attached to network 193.14.5.192) to host 194.17.21.16, without passing through router R2 and with a strict source routing option. When received by 194.17.21.16, what addresses would appear in the options field of the IP datagram. (There may be more than one answer.)

There are (at least) two answers depending on path taken.

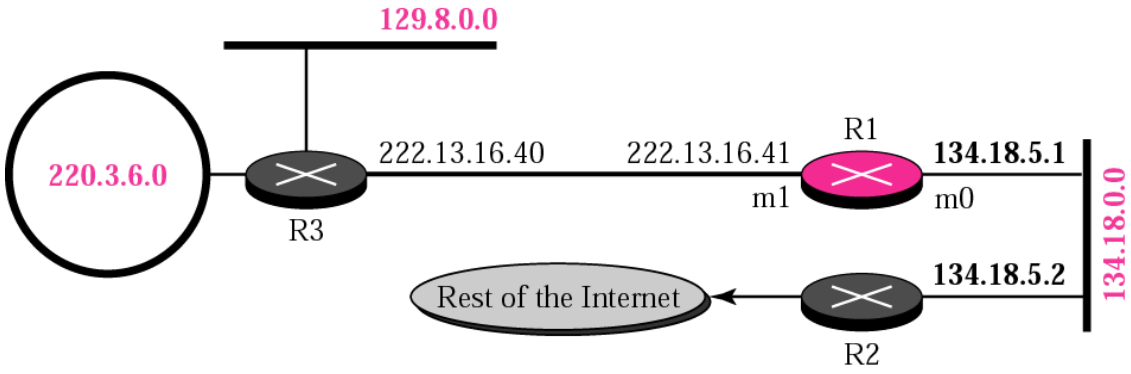
Answer 1:

Address 1: 111.25.19.20 Address 2: 194.17.21.14

Answer 2:

Address 1: 111.25.19.20 Address 2: 192.16.7.5 Address 3: 194.17.21.68

Question 3. (6 points) Produce the routing table for router R3 given the network diagram below. Use the same table structure and notation as given in question 1.



Draw the table here:

Mask	Destination	Next Hop	F	R.C.	U.	I
255.0.0.0	111.0.0.0	-	U	?	?	?
255.255.255.0	194.17.21.0	-	U	?	?	?
255.255.255.0	192.16.7.0	194.17.21.68	UG	?	?	?
255.255.255.0	193.14.5.0	111.25.19.20	UG	?	?	?
0.0.0.0	0.0.0.0	111.30.31.18	UG	?	?	?

Question 4. (6 points) State all the steps involved during the operation of an ARP process, as described in your text. In other words, assume a sender has data to send to a destination host and the sender knows the destination host's IP address. State what actions are necessary to complete the ARP request.

Note: During the exam I instructed the students to make sure they stated what addresses were in the ARP request and reply messages.

Sender constructs and **broadcasts** an ARP **request message**.

The request message contains the senders physical address and IP address. It also contains the destination IP address. The destination physical address is all zeros.

The destination receives the request message and **unicasts** an ARP **reply** message back ot the (original) sender.

The reply message contains the senders physical address and IP address. It also contains the destination physical and IP addresses.

See page 174 of the text.

Question 5. (6 points) Briefly describe Proxy ARP, according to your text?

Proxy ARP is used to create a subnetting effect. A Proxy ARP is an ARP that acts on behalf of a set of hosts. Whenever a router running a proxy ARP receives an ARP request looking for the IP address of one of these hosts, the router sends an ARP reply announcing its own hardware (physical) address.

See page 176 of the text.

Question 6. (12 points) Assume a router receives an IP datagram with the following fields:

Total Length: 4020
Identification: 1234
Fragmentation Offset (in units of 8-bytes): 0
"Do not Fragment" Flag = Clear
"More Fragments" Flag = Clear

Assume the router must now transmit this datagram across an Ethernet (MTU: 1500 bytes). Show the values of the fields above for each fragment constructed if the router attempts to send the largest datagrams permissible. Assume that there are no options specified in the IP header.

Similar to example in Figure 8.9, Fragments 1,2 & 3 on page 202

Maximum Ethernet frame data size is 1500. IP header with no options is 20 bytes.

Total Length: 1500 (1480 is data, 20 is IP header)
Identification: 1234
Fragmentation Offset (in units of 8-bytes): 0
"Do not Fragment" Flag = Clear
"More Fragments" Flag = Set

Total Length: 1500 (1480 is data, 20 is IP header)
Identification: 1234
Fragmentation Offset (in units of 8-bytes): 185 (1480 bytes)
"Do not Fragment" Flag = Clear
"More Fragments" Flag = Set

Finally, 4000 – 2960 = 1040 (+ 20 for header) so:

Total Length: 1060 (1040 is data, 20 is IP header)
Identification: 1234
Fragmentation Offset (in units of 8-bytes): 370 (2960 bytes)
"Do not Fragment" Flag = Clear
"More Fragments" Flag = Clear

Question 7. (6 points) Briefly describe the two cases when an ICMP "Time Exceeded" message is generated?

1) When time-to-live field becomes 0 after decrementing, router discards the datagram. ICMP Time Exceeded message is then generated. Can be caused by errors in routing tables

2) When all fragments that comprise a message are not received by the designated host within a designated time limit

See page 234 for more details.

Question 8. (6 points) Briefly describe what steps a multicast router performs when it receives a leave report from a host for the group 224.5.6.7?

When a multicast router receives a leave report, it sends a "special query message" which will include the group id and multicast address 224.5.6.7. The router allows a specific response time for any host or router to respond.

If during this time, no interest (membership report) is received, the router assumes that there are no loyal members in the network for the group and it purges the group from its list.

See page 257 of the text.

Question 9. (6 points) What tasks must a host UDP package perform, according to your text, when a UDP datagram is received by a client for which there is no receiving (listening) host process?

1. Drops the packet
2. Sends ICMP Port Unreachable message to server

Question 10. (10 points) Suppose a sender wants to transmit three (3) 8-bit sections and a checksum to protect against corruption. Show the checksum computations performed at the source and destination to confirm correct transmission, given the sample data below:

01010000
00001010
00111101

Computation at sender:

D1: 01010000
D2: 00001010
D3: 00111101

Psum: 10010111

Invert to obtain checksum: Csum: 01101000

Send D1, D2, D3 and Csum to receiver.

Computation at receiver:

D1: 01010000
D2: 00001010
D3: 00111101
Csum: 01101000

Psum: 11111111

Invert to obtain: 00000000

Since result is all zeros, no transmission error detected

Question 11. (6 points) A supernet has a first address of 205.16.32.0 and a supernet mask of 255.255.248.0. How many blocks are in this supernet and what is the range of the addresses in each block?

8 blocks
205.16.32.0 – 205.16.32.255
205.16.33.0 – 205.16.33.255
205.16.34.0 – 205.16.34.255
205.16.35.0 – 205.16.35.255
205.16.36.0 – 205.16.36.255
205.16.37.0 – 205.16.37.255
205.16.38.0 – 205.16.38.255
205.16.39.0 – 205.16.39.255

See Example 8, page 131 of the text for more information.

Question 12. (6 points) Assume an organization is granted the site address 201.70.64.0/24 (CIDR notation). The company needs 8 subnets (with the addresses evenly distributed). What would their network addresses be? (Use CIDR notation.)

The CIDR notation specifies a class C address.

201.70.64.0/27
201.70.64.32/27
201.70.64.64/27
201.70.64.98/27
201.70.64.128/27
201.70.64.160/27
201.70.64.192/27
201.70.64.224/27

See Example 3, Page 125 of the text for more information.