Homework 3 assignment for ECE374

Posted: 03/13/15

Due: 03/27/15

Note: *In all written assignments, please show as much of your work as you can. Even if you get a wrong answer, you can get partial credit if you show your work.* If you make a mistake, it will also help the grader show you where you made a mistake.

Problem 1 (10 Points):

Assume a datagram of size 5000 bytes crosses 5 different networks segments on its way from sender to receiver. The smallest MTU of all network segments is 820 bytes.

a. In how many datagrams does the original datagram have to be fragmented in?
b. At which point in the network does the fragmentation occur?
c. Show the length, ID, fragflag, and offset fields of the IP header of each fragment.
d. At which location are the IP fragments reassembled? Explain your answer.

Solution:

a. 7
b. The fragmentation occurs at the router directly ahead of the link with the MTU of 800 bytes.
c. Here are the header field for the fragments:
    1. Length = 820, ID = x, fragflag = 1, offset = 0;
    2. Length = 820, ID = x, fragflag = 1, offset = 100;
    3. Length = 820, ID = x, fragflag = 1, offset = 200;
    4. Length = 820, ID = x, fragflag = 1, offset = 300;
    5. Length = 820, ID = x, fragflag = 1, offset = 400;
    6. Length = 820, ID = x, fragflag = 1, offset = 500;
    7. Length = 220, ID = x, fragflag = 0, offset = 600;
d. All fragments are reassembled at the receiving host. Reassembling at one of the intermediate hosts could result in further fragmentation on other segments towards the destination. Routers have no knowledge of the MTU size other than the one directly connected to them.

Problem 2 IP (20 Points):

In the figure below, assign an IP address to each of the hosts and routers interfaces and specify the number of subnest.

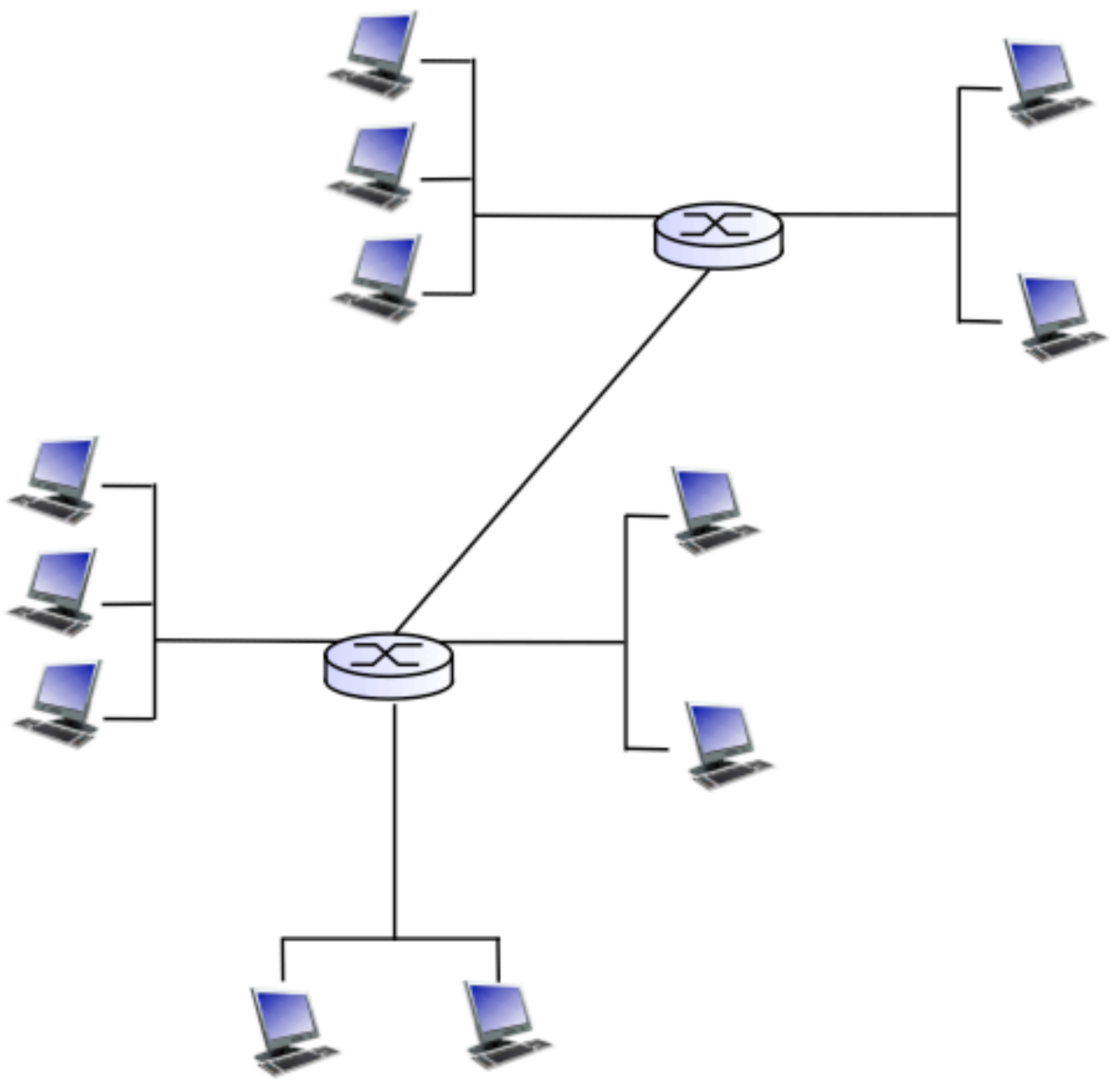


Figure 1

Problem 3 (16 Points):
Consider the network setup shown in Figure 2. Suppose that the ISP instead assigns the router the address 24.34.112.235 and that the network address of the home network is 192.168.1/24.

a. Assign addresses to all interfaces in the home network.
b. Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.186. Provide the six corresponding entries in the NAT translation table.

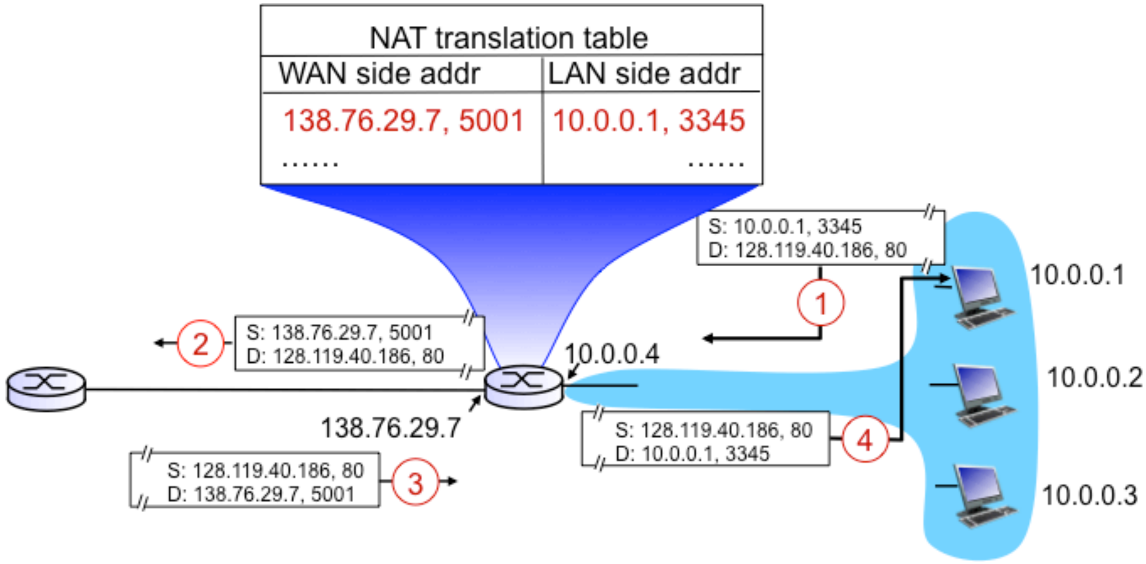


Figure 2

Solution:

a) Home addresses: 192.168.1.1, 192.168.1.2, 192.168.1.3 with the router interface being 192.168.1.4

b) NAT Translation Table

WAN Side	LAN Side
24.34.112.235, 4000	192.168.1.1, 3345
24.34.112.235, 4001	192.168.1.1, 3346
24.34.112.235, 4002	192.168.1.2, 3445
24.34.112.235, 4003	192.168.1.2, 3446
24.34.112.235, 4004	192.168.1.3, 3545
24.34.112.235, 4005	192.168.1.3, 3546

Problem 4 (20 Points):

To calculate the timeout value the TCP sender uses to trigger a retransmission (if an acknowledgement is not received) an exponential weighted moving average is uses. For this problem you should familiarize yourself with how TCP calculates Estimated RTT.

a. Capture 20 individual RTTs from your host to www.umass.edu and store them in an Excel table. SUBMIT the resulting Excel file as additional material with your homework!
b. For each of these RTTs calculate EstimatedRTT ($\alpha = 0.125$) and enter these values also in the table.
c. Plot the values for RTT and EstimatedRTT.
d. Repeat steps b. and c. for $\alpha = 0.25$ and $\alpha = 0.5$.

Solution:

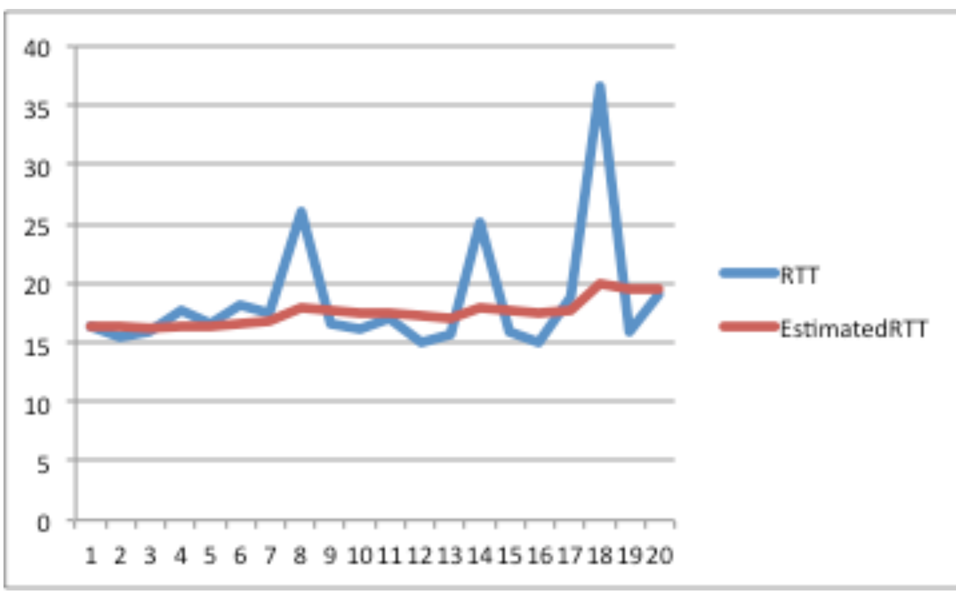
a. ping –c 20 www.umass.edu

```
ping -c 20 www.umass.edu | awk -F " " 
'{split($7,a,"="); print a[2]}'
```

b. One possible outcome is the one shown below.

RTT	EstimatedRTT
16.356	16.356
15.558	16.25625
15.87	16.20796875
17.599	16.38184766
16.693	16.4207417
18.229	16.64677399
17.454	16.74767724
25.973	17.90084258
16.636	17.74273726
16.113	17.5390201
17.002	17.47189259
14.911	17.15178102
15.785	16.98093339
25.249	18.01444172
15.928	17.7536365
15.029	17.41305694
18.942	17.60417482
36.735	19.99552797
16.019	19.49846197
19.101	19.44877923

c.



d.

Problem 5 (20 Points):

Consider the following network. With the indicated link costs, use Djikstra's shortest-path algorithm to compute the shortest path from *A* to all network nodes. Show how the algorithm works by computing a table below.

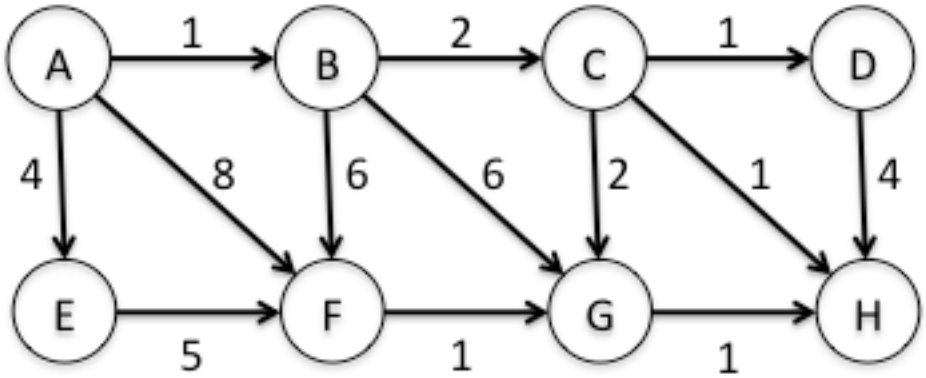
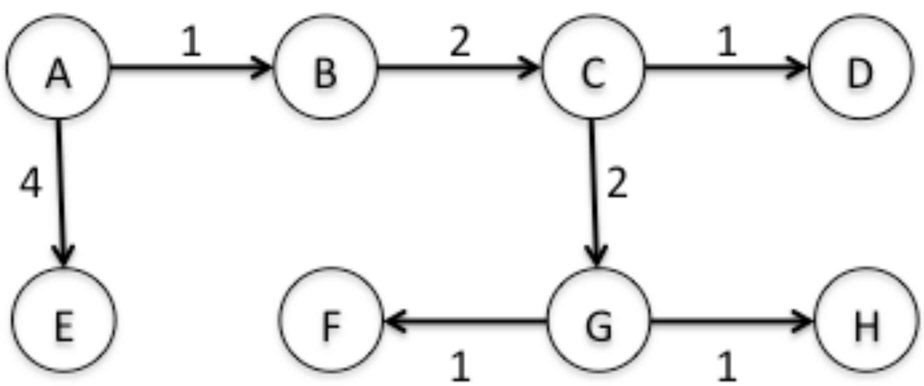


Figure 3

Step	N'	D(A),p(A)	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)	D(G),p(G)	D(H),p(H)
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									

Solution:



St	N'	D(A),p(A)	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)	D(G),p(G)	D(H),p(H)

ep									
0		0, -	∞	∞	∞	∞	∞	∞	∞
1	A	-	A, 1	∞	∞	A, 4	A, 8	∞	∞
2	AB	-	A, 1	B, 3	∞	A, 4	B, 7	B, 7	∞
3	ABC	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	∞
4	ABCD	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	D, 8
5	ABCDG	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	D, 8
6	ABCDGF	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	G, 6
7	ABCDGF E	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	G, 6
8	ABCDGF H	-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	G, 6
9		-	A, 1	B, 3	C, 4	A, 4	B, 7	C, 5	G, 6

Problem 6: (14 Points)
For this problem consider Figure 4 and answer the following questions. In all cases provide a short discussion justifying your answer.

a. For the *TCP 1* transmission, identify the time intervals when TCP slow start is operating.
b. For the *TCP 1* transmission, identify the time intervals when TCP slow start is operating.
c. For *TCP 1* transmission, identify the time intervals when congestion avoidance is operating.
d. For *TCP 2* transmission, is the segment loss detected by triple duplicate ACK or by timeout?
e. What is the initial value of ssthresh?
f. What TCP flavor is shown by the *TCP 1* transmission?
g. What TCP flavor is shown by the *TCP 1* transmission?

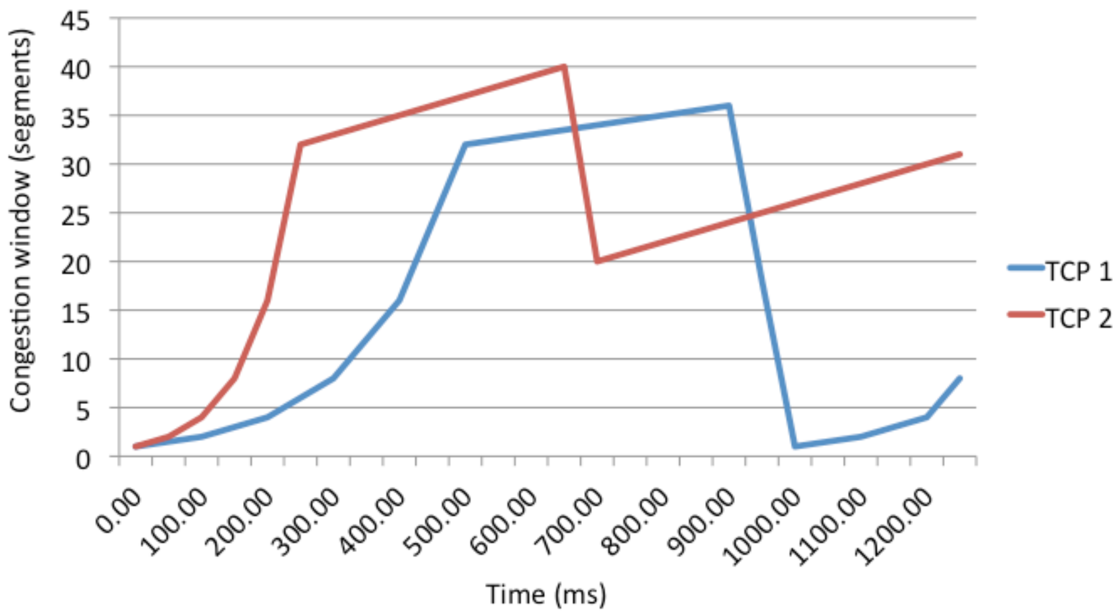


Figure 4

Solution:

a. 0-500 & 1000-1300
b. 0-200
c. 500-900
d. triple duplicate ACK
e. 32
f. Tahoe
g. Reno