King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering
Department of Computer Engineering

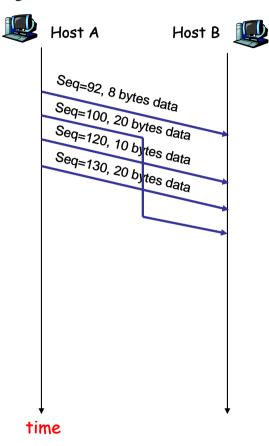**COE 344 – Computer Networks (T082)**

Major Exam # 02
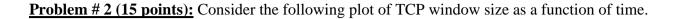
Date & Time: Sunday May 31, 2009 (08:30 AM – 09:45 AM)

- **This is a CLOSED books, CLOSED notes exam.**
- **Show all your work. NO credit will be given if work is not shown.**
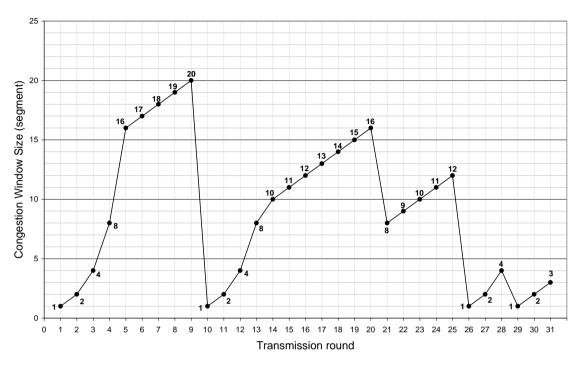- **Answer ALL problems.**

Problem #	Mark	Score
1	10	
2	15	
3	10	
4	15	
Total	**50**	

Problem # 1 (10 points):

For the following TCP Reno scenario, show the remainder of the traffic exchange (e.g. acknowledgements with sequence numbers, retransmissions with sequence numbers and size of data field, …). Assume that no timeout takes place, time between any two received TCP segments is larger than 500 milliseconds, and all segments are received before a retransmission is received.

Problem # 2 (15 points): Consider the following plot of TCP window size as a function of time.

1. **(1 point)** Identify the intervals of time when TCP *slow start* is operating.

2. **(2 points)** After what transmission round(s) is segment loss detected by a triple duplicate ACK?

3. **(2 points)** After what transmission round(s) is segment loss detected by a timeout?

4. **(2 points)** What is the value of `Threshold` at the 16th transmission round?

5. **(2 points)** What is the value of `Threshold` at the 31st transmission round?

6. **(2 points)** During what transmission round is the 50th segment sent?

7. **(4 points)** Assume that the data size of each segment is 1 byte. What is the sequence number of the segment transmitted at the 10th round?
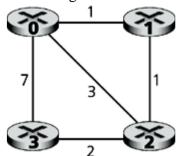
Problem # 3 (10 points):
Consider sending a 3000-byte datagram (inclusive of a minimum size header of 20 bytes) from a host connected to router to a host connected to a different router over a direct link. Assume that the link has an MTU of 500 bytes (inclusive of a minimum size header of 20 bytes).

1. **(6 points)** Find the number of fragments generated.

2. **(4 points)** Specify the ***offset value*** of each fragment that is generated.

Problem # 4 (15 points): Consider the following network.

Suppose that the link cost $c(0,3)$ has changed from 7 to 1, re-compute the distance tables for nodes 0, 1, 2, and 3 after each iteration of a synchronous version of the distance vector algorithm using as many of the following tables as needed. Note that the tables' values *prior* to the link cost change are as shown in the leftmost column of the tables.

cost to

D^0	0	1	2	3
0	0	1	2	4
1	1	0	1	3
2	2	1	0	2
3	4	3	2	0

D^0	0	1	2	3
0				
1				
2				
3				

D^0	0	1	2	3
0				
1				
2				
3				

D^0	0	1	2	3
0				
1				
2				
3				

D^0	0	1	2	3
0				
1				
2				
3				

cost to

D^1	0	1	2	3
0	0	1	2	4
1	1	0	1	3
2	2	1	0	2
3	∞	∞	∞	∞

D^1	0	1	2	3
0				
1				
2				
3				

D^1	0	1	2	3
0				
1				
2				
3				

D^1	0	1	2	3
0				
1				
2				
3				

D^1	0	1	2	3
0				
1				
2				
3				

cost to

D^2	0	1	2	3
0	0	1	2	4
1	1	0	1	3
2	2	1	0	2
3	4	3	2	0

D^2	0	1	2	3
0				
1				
2				
3				

D^2	0	1	2	3
0				
1				
2				
3				

D^2	0	1	2	3
0				
1				
2				
3				

D^2	0	1	2	3
0				
1				
2				
3				

cost to

D^3	0	1	2	3
0	0	1	2	4
1	∞	∞	∞	∞
2	2	1	0	2
3	4	3	2	0

D^3	0	1	2	3
0				
1				
2				
3				

D^3	0	1	2	3
0				
1				
2				
3				

D^3	0	1	2	3
0				
1				
2				
3				

D^3	0	1	2	3
0				
1				
2				
3				