Systems and Networks	**Homework 9: TCP**
CS3600 Fall 2014	**July 28, 2014**

This homework is due at the beginning of class on November 24, 2014 and is worth 1.5% of your grade.

Name: _____

CCIS Username: _____

Problem	Possible	Score
1	35	
2	10	
3	20	
4	20	
5	15	
Total	100	

1a. Suppose an IP router has the following initial routing table entries:

#	Address	Subnet Mask	Next Hop
1	129.10.112.0	255.255.255.0	R1
2	129.10.80.0	255.255.255.0	R1
3	129.10.0.0	255.255.0.0	R2
4	129.10.62.0	255.255.255.0	R4
5	129.10.63.0	255.255.255.0	R4
6	129.10.64.0	255.255.192.0	R3
7	129.10.65.0	255.255.255.0	R4
8	129.10.66.0	255.255.255.0	R4

Identify the set(s) of table entries that can be aggregated to reduce the table size. (15 pts)

1b. Show the final routing table entries after aggregation has been performed. (10 pts)

1c. What are the next hops that are used if the router is asked to forward a packet to (a) 129.10.7.3, (b) 129.10.97.4, (c) 129.10.80.2, and (d) 129.11.112.4? (10 pts)

2. You are a router, and one of your outgoing links has an MTU of 1000 bytes (ignore layer 2 headers). You receive the following packets that all need to be sent out over this link:

#	ID	Flags	Offset	Total Length
0	0x1930	-	0	1000
1	0x92ad	-	0	3000
2	0x944f	DF	0	1000
3	0xaa22	-	185	1001
4	0x78a1	MF	370	1500
5	0x3ac8	DF	0	1500

Fill in the table below with the header fields of the packets that you send out (you may not need all of the rows). The first packet has been completed for you. (10 pts)

#	ID	Flags	Offset	Total Length
1	0x1930	-	0	1000
2				
3				
4				
5				
6				
7				
8				
9				
10				

3a. TCP packets are being sent from a client to a server. The MSS is equal to 1460 bytes, and each TCP packet is sent with the maximum capacity. How many TCP packets can be sent before the sequence number field in the TCP header will wrap around? (10 pts)

3b. How much time (in seconds) will this take on a 1 Mbit/s link? (5 pts)

3c. How much time (in seconds) will this take on a 1 Gbit/s link? (5 pts)

4a. In the stop-and-wait protocol (i.e., the simple reliable transport protocol where the sliding window size is always one packet), what is the minimum number of bits required to encode the sequence number for the protocol to work correctly? (10 pts)

4b. If sequence number is not used, the resulting “broken" stop and go protocol may fail to transfer data correctly. Describe a specific scenario where not using a sequence number in the stop-and-go protocol would result in incorrect data transmission. (10 pts)

5a. If we generalize from the stop-and-wait protocol to a sliding window protocol, where k packets can be sent but unacknowledged, what is the minimum number of distinct sequence numbers that we would need for this protocol to work correctly? Why? (10 pts)

5b. Suppose we are using a sliding window protocol with a window size of 128 KB and a round-trip time of 100 milliseconds. What is the expected sending rate of this protocol? (5 pts)