CS 421: Computer Networks **FALL 2015**

MIDTERM
November 12, 2015
120 minutes

Name: _____

Student No: _____

Show all your work very clearly. Partial credits will only be given if you carefully state your answer with a reasonable justification.

Q1	
Q2	
Q3	
TOT	

1)

a) You own a company named mydream. The following table gives the DNS records for mydream.

Name	Type	Value	TTL
mydream.com	A	178.198.17.118	86400
asi.mydream.com	A	178.198.11.98	86400
myns.mydream.com	A	178.198.1.101	86400
gediz.mydream.com	A	178.198.15.225	86400
mydream.com	NS	myns.mydream.com	86400
mydream.com	NS	myser.myorg.org	86400
mydream.com	MX	gediz.mydream.com	86400
www.mydream.com	CNAME	asi.mydream.com	86400

i) (2 pts) If you type http://www.mydream.com into your web browser, to which IP address does your browser connect?

ii) (2 pts) If you send an e-mail to ali@mydream.com, to which IP address does your e-mail get delivered?

iii) (2 pts) What is the IP address for the authoritative name server for mydream?

iv) (3 pts) The TTL field for all the records are chosen as 86400 seconds (1 day). What might be a possible disadvantage of choosing a much longer TTL value, e.g., 1 month?

v) (3 pts) What might be a possible disadvantage of choosing a much shorter TTL value, e.g., 1 minute?

vi) (5 pts) Suppose that you want to change the IP address of mydreams's web server. What actions should you take before implementing the IP address change in the DNS records contained in mydream's authoritative name server so that your customers will have no interruptions in reaching your web server at its new IP address?

b) (6 pts) Why does your e-mail client first contact with your local SMTP server when you send an e-mail instead of directly contacting with the SMTP server of your e-mail's recipient?

c) (6 pts) Suppose you want to implement a reliable transport protocol for a connection with a very low packet loss and error rate, e.g., 10^{-12}. Which one of the Go-Back-N and Selective Repeat protocols will you prefer? Why? Explain your reasoning.

d) (6 pts) Why does TCP not use the SampleRTT values for retransmitted segments in the computation of EstimatedRTT?

2)

a) (6 pts) Consider a connection with a transmission rate of 12 Mbps where the distance between the sender and the receiver is 1050 km. Assume that the delay for the connection is dominated by the propagation delay and the speed of propagation is $2x10^5$ km/s. We transfer a file of size 18,080 Bytes over this connection. Assume that each packet has a maximum size of 1500 Bytes including a 40 Byte header and no segments experience errors or losses. Assume that the processing time at the receiver is negligible and ignore the transmission delay of ACK segments. What is the minimum window size that should be used for this connection so that the throughput for this file transfer is maximized?

b) (12 pts) Consider the above file transfer. Assume that the communication between the sender and receiver is full duplex, i.e., sender can send data segments while receiving an ACK segment. We use the **Selective Repeat** protocol for the file transfer with a window size of **N = 8** segments. Assume that the **first transmissions** of the **data segments** with sequence numbers **5 and 11,** and **ACK segments** with acknowledgment numbers **3 and 10** are errored, whereas **all other data** and **ACK segments are received correctly**. The timeout for each data segment is set to **15 msec starting from the end of the transmission of the segment**. How much time is required to complete the transfer of the whole file and receive the **final ACK** at the sender?

c) (12 pts) Calculate the transfer time for the above file transfer when **Go-Back-N** protocol is used with a window size of **N = 8** segments. Each window of the sender has a timeout of **15 msec starting from the time when the window is set by the sender**.

3)

a) At time *t,* a TCP connection has CongWin=7500 Bytes, ssthresh=8000, nextSequenceNumber=4000 and there are no unacknowledged segments. The sender sends four more segments between *t* and *s* (*s* > *t*), the first three containing 1500 Bytes and the last containing 1000 Bytes. TCP sender receives three ACK segments between *t* and *s* with acknowledgement numbers 5500, 7000 and 7000. Assume that the maximum segment size (MSS) for the TCP connection is 1500 Bytes.

   i) (4 pts) What are the sequence numbers of the four segments transmitted by the sender?

   ii) (6 pts) Assume that the last ACK segment contains a Receive Window of 14,000 Bytes. How many more bytes is the TCP sender allowed to send at time *s*?

   iii) (6 pts) Answer the same question as in ii) if the last ACK segment contains a Receive Window of 6,000 Bytes.

b) Suppose that we remove the Slow Start phase in the congestion control algorithm of TCP. Instead, we start in the Congestion Avoidance phase with an initial window size of 4xMSS once the connection is established. Assume that the transmission times of data and ACK segments are negligible compared to the round-trip time (RTT).

   i) (4 pts) What will be the Congestion Window size 4xRTT after the connection is established?

   ii) (3 pts) What would be the Congestion Window size 4xRTT after the connection is established if the TCP congestion control algorithm was not modified?

c) (6 pts) Four TCP connections are sharing a link with capacity of 120 Mbps. Assume that the bandwidth bottleneck for all four connections is this shared link. The roundtrip times for the connections are 8 ms, 10 ms, 20 ms and 40 ms, respectively. Calculate the maximum throughputs achieved by each connection.

d) (6 pts) Suppose that a client is downloading a file from a server. The TCP code at the client is modified such that when the client receives a segment with a sequence number S and containing N Bytes, it sends 10 successive ACK messages with ACK numbers S+N/10, S+2N/10,…, S+N. Does the client get any advantage from this modification in terms of the download speed from the server? If yes, describe how. If no, describe why not.