Second Third-Term Exam

Closed book and notes; In class   *Tuesday, November 19th*

$\oplus$ *Do not forget to write your name on the first page. Initial each subsequent page.*
$\oplus$ *Be* **neat** *and* **precise**. **I will not grade answers I cannot read.**
$\oplus$ *You should draw simple figures if you think it will make your answers clearer.*
$\oplus$ *Good luck and remember, brevity is the soul of wit*

- All problems are mandatory

- I cannot stress this point enough: **Be precise**. If you have written something incorrect along with the correct answer, you should **not** expect to get all the points. I will grade based upon what you **wrote**, not what you **meant**.

- Maximum possible points: 50.

Name: _____

Problem	Points
1	
2	
3	
4	
5	
Total	

1. Nomenclature

   (a) Describe the following terms: (2 points each)
       - DNS Zone

       - SACK

       - Multi-Exit Discriminator

       - Finger Table

       - Authoritative Answer

2. Name Resolution/Reliable Transfer

   (a) What entity(ies) host the DNS PTR record corresponding to the name `8.128.in-addr.arpa.`
       Explain. (1+2 points)

   (b) You need to send mail to `president@whitehouse.gov`. What DNS query(ies) will you need to
       issue? (2 points)

   (c) Upper bound (within 10%) the fraction of a 1Gbps 250ms RTT link that a Stop-and-Wait sender
       that sends 1000 byte packets can occupy. Show your work. (2 points)

   (d) Give an example where a sliding window transfer protocol that uses 8 sequence numbers fails
       when RWS = SWS=5 but only one packet is lost. (3 points)

TCP Details

3. (a) When might you disable Nagle's algorithm? (2 points)

   (b) What is Fast Retransmit? Why is it useful? (4 points)

   (c) Explain TCP simultaneous close with a space-time diagram. Identify the sequence of segment exchanges that causes simultaneous close and the state maintained by each end point. (4 points)

4. DNS/Application-Layer

   (a) Suppose the `umd.edu` nameserver administrator wants to delegate a new domain `cs.umd.edu`. Describe the steps required to enable this new domain. (2 points)

   (b) Assume a DHT over Chord that stores replicas at k successors. Consider an alternate in which if a lookup fails, a different hash function (up to k) is used to look for an item's replica. What are the benefits/drawbacks of each? (1+3 points) **OR**
   What is the *average* number of hops that a lookup traverses in a Chord ring with n nodes, where IDs have N bits? Why? (1+3 points)

   (c) How would BitTorrent transfers be affected if the `tracker` is terminated? Consider seeders, leechers, and new (yet unjoined) peers. (1+2+1 points)

5. Design (Choices)

   (a) Your server at home is behind a NAT. The NAT is connected to a router which receives an IP address via DHCP. What are the problems you must address before you can connect to your server? (2 points)

   (b) Design a protocol that will allow you to connect to your server from the Internet using a name. The NAT does not allow UPnP. State the protocol components (what software/hardware is required, and what protocol messages need to be exchanged.) (4 points)

   (c) Consider a BitTorrent client c that, for each peer p_i, counts received bits b_i over 30 seconds. Over the next 30 seconds, c sends b_i bits to p_i (while counting bits received from p_i). What properties does this protocol have? (4 points)