CMSC 417 Computer Networks **Fall 2009**

Final Exam

Open book and notes (your choice); In class *Thursday May 14th*

⊕ *Do not forget to write your name on the first page. Initial each subsequent page.*
⊕ *Be* **neat** *and* **precise**. **I will not grade answers I cannot read.**
⊕ *You should draw simple figures if you think it will make your answers clearer.*
⊕ *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 + bonus

Name: _____

Problem	Points
1	
2	
3	
4	
5	
Total	

1. Network

(a) Why does OSPF not need mechanisms such as Poison Reverse? (2 points)

(b) Discuss one advantage and one disadvantage of using Network Address Translation. (2 points)

(c) Why is the IP version number the very first field in the IP header? (1 points)

(d) Suppose two universities (with prefixes 128.8/16 and 131.207/16 respectively) have set up a link for exchanging local traffic only. How would you set up the various routing protocols to enable this? (5 points)

2. Transport

(a) When closing a TCP connection, why is a 2MSL timeout not necessary on the transition between `LAST_ACK` to `CLOSED`? (2 points)

(b) Suppose you have to transfer 1 gigabytes of data using UDP. You use the `sendto` call to send packets. (Recall that `sendto` sends `len` bytes at a time.) How would the end-to-end throughput change as you change the value of `len` from 1 to 1048576. State any assumptions you make. (3 points)

(c) A TCP option allows the advertised windows to be "scaled". For instance, if the scaling factor is k, each number in the advertised window advertises 2^k bytes. Derive a relationship between the scaling factor, advertised window, link speed and round trip time. (Show your work) (5 points)

3. Application/DNS

(a) What is the per byte overhead of using MIME? Describe (2 points)

(b) Why is the PASV FTP mode useful with a NAT? (3 points)

(c) What is a problem with caching negative DNS responses? How do current DNS protocols address this problem? (5 points)

4. MAC protocols/checksums

(a) Assume signals propagate with speed $2*10^8$ m/s. Derive a relationship between maximum segment length (no repeaters) and minimum frame size. (Show your work) (4 points)

(b) Consider a modified CRC algorithm. M(x) is a message to be sent, and D(x) is the divisor polynomial of degree k. Define R(x) to be:

$$R(x) \equiv D(x) - (M(x) \mathrm{mod} D(x))$$

transmitted polynomial is T(x) defined as:

$$T(x) \equiv M(x) + R(x) \ll k + R(x)$$

- What useful property does M(x) + R(x) have? (2 points)

- Can the receiver recover M(x) if T(x) is received intact? (2 points)

- Describe one (fatal) problem with this scheme that usual CRC schemes does not suffer from. (4 points)

(c) Wireless/Design

- Why does 802.11 not have a jamming signal as in 802.3? What (if anything) is the substitute? (3 points)

- Consider an *ad-hoc* wireless network. An ad-hoc network does not have an access point. Design a leader election protocol for this network. After your protocol runs, there should be *only* one leader node nominated in the network and all nodes should identify this node as the leader. You may assume that the network is connected, but not every node is within range of every other node. (7 points)

  - State all of your assumptions.
  - Describe your protocol using with a picture and the messages that are sent with a short description of each message.
  - State the run time of your protocol.
  - Discuss the shortcomings of your protocol.