**CMSC 417-0201 Computer Networks** **Spring 2000**

# Final Exam

*Closed book and notes* *Tuesday, May 23*

⊕ *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.*
⊕ *When constructing examples, try to construct the simplest example that gets your point across.*
⊕ *Make sure you answer all sub-parts of each question for complete credit.*
⊕ *Good luck and remember, brevity is the soul of wit (i.e. the punt box counts).*

- Maximum possible points: 80.

Name: _____

| Problem | Points |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| Total | |

1. Network layer, routing

   (a) What is the abstraction provided by the Internet Protocol. (3 points)

   (b) How can distance vector routing cause routing *black-holes*? (3 points)

   (c) (Why) does the IP header need to be updated at each router? (4 points)

2. Transport layer, congestion control.

   (a) Assume $A$ wants to transfer 10,000 bytes to $B$ using TCP. The maximum segment size can hold 1000 bytes of data. $A$ and $B$ are connected by a direct link with latency 5ms and bandwidth 10KBps (10,000 BYTES per second). Assume $A$ opens a direct TCP connection to $B$ and transfers the file without any packet errors or losses.

   How long did it take to complete the transfer? (The transfer is completed when all data has been sent and the TCP connection has been closed by both sides). Ignore the *size* of the SYN, ACK, FIN packets, the effect of packet headers on transfer time, and any window size limitations. (6 points)

   (b) What is the difference between congestion aviodance versus congestion control? (2 points)

   (c) Give an example of an *in-network* congestion control scheme. (2 points)

3. Medium Access Control Protocols

(a) Under heavy loads where every end-station has some data to send, is it better to implement time-division multiplexing or a token passing protocol on a shared link? (2 points)

(b) What is the vulnerability period of *slotted-Aloha*? Why? (4 points)

(c) Give one advantage and one disadvantage each of the Token Ring (IEEE 802.5) and CSMA-CD Ethernet (IEEE 802.3) protocols. (4 points)

4. Error checking codes

   (a) What is a two-dimensional parity code? What kind of errors can it detect and correct? How? (3 points)

   (b) Consider the CRC generator polynomial $x^3 + x^2 + 1$. Suppose you want to transmit the bitstring 1010. What would be the CRC remainder? Show your work. (3 points)

(c) Derive the same remainder for the same message (1010) using the shift register implementation of the (same) polynomial $x^3 + x^2 + 1$. (4 points)

5. Security

(a) What is IP address spoofing? List three protocols affected by IP address spoofing. (3 points)

(b) How does the S/Key (Lamport's Hash) protocol work? Why are the captured passphrases not useful? (4 points)

(c) How are digital signatures generated using public key crytography? (3 points)

6. Mobile IP Wireless MAC

(a) What is the best way to send messages to a mobile IP terminal if the corresponding host (CH) is mobile-aware? (4 points)

(b) Describe the hidden terminal problem. (3 points)

(c) How is the hidden terminal solved in the 802.11 wireless-MAC protocol. (3 points)

7. Protocols - DNS, HTTP

(a) What is a DNS *zone*? (3 points)

(b) What is an authoritiative answer to a DNS query? (2 points)

(c) What is the major inefficiency of HTTP 1.0? (5 points)

8. General Suppose your IP address is 128.8.128.147 and you want to open a HTTP connection to *www.acm.org* (199.222.69.150). Your local first-hop router has address 128.8.128.1 and your local DNS server is 128.8.128.10. Your local name service does not know anything about the *www.acm.org* server. Assume your ARP cache is empty.

   List the packets that traverse your local LAN from the time you type in *www.acm.org* in (say) `netscape` and the time the *www.acm.org* page is displayed by your browser. You should at least be able to identity the source and destination and protocol and purpose for each packet. You do *not* have to be specific about particular fields inside the packets. (10 points)