Final Exam

$\oplus$ *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 + bonus

Name: _____

Problem	Points
1	
2	
3	
4	
5	
Total	

1. Describe the following terms: (2 points each)

    (a) RTS threshold

    (b) Exposed Terminal Problem

    (c) Nagle's Algorithm

    (d) Beacon Frame

    (e) k-persistent protocol

2. MAC

   (a) How is a *repeater* different from a *router*? (1 point)

   (b) How is a 802.3 transmitter assured of a successful transmission? How does this procedure differ for a 802.11 transmitter? (3 points)

   (c) Prove that CRC checksums can detect all odd number bit errors. Be precise, and state all your assumptions. Use $G(x)$ as the generator, $T(x)$ as the transmitted polynomial, $R(x)$ as the received polynomial, and $E(x)$ as the error polynomial. (6 points)

3. Network

    (a) Explain with an example why CIDR requires longest common prefix lookups. (2 points)

    (b) Describe two scenarios where forwarding through a NAT is less robust than regular IP forwarding. (2 points)

    (c) Why is *pruning* required for some multicast protocols? (2 points)

    (d) In PIM, how does $(\star, G)$ state differ from (S, G) state? Explain with an example. (4 points)

4. Transport

   (a) How do TCP receivers impose flow control? (2 points)

   (b) Suppose you have to transfer 1 gigabyte of data using UDP on a single link network running 100Mbps Ethernet. 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 16 (bytes) to 128K (bytes). State any assumptions you make. (3 points)

   (c) Describe how a Bloom Filter can be used to implement selective acknowledgments for a reliable transmission protocol. Would this be more, less, or equally efficient as using a bitmask as used in TCP? (5 points)

(d) Applications

- List two advantages and two disadvantages of opening multiple simultaneous HTTP connections (to the same server)? (2 points)

- What is *Optimistic Unchoking*? Does BitTorrent *require* this mechanism for the protocol to operate correctly? (4 points)

- What (if any) is the advantage of replicating data on the $k - 1$ successors in Chord versus maintaining k separate Chord rings (with no replication)? (4 points)