

Final Exam

*Open book and notes; In class**Friday, Dec 20th*

- ⊕ *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.

Name: _____

Problem	Points
1	
2	
3	
4	
5	
Total	

2. Network and Transport

(a) Construct an example where the MED attribute is used for BGP best path selection. (3 points)

(b) In TCP Fast Recovery, after the retransmission upon the third duplicate ACK, $cwnd \leftarrow ssthresh + 3 * MSS$. What is (a) the value of `ssthresh` at this point, and (b) why the extra 3 MSS? (3 points)

a)

b)

(c) Construct an example (with two space-time diagrams) where Selective Acks are more efficient than Cumulative Acks. You may use variables to represent sequence numbers if helpful. Smaller (correct) examples get more points. (4 points)

MAC Protocols

3. (a) What is the minimum amount of payload in an Ethernet packet? Why? (4 points)
- (b) How does 802.11 ensure that a transmitter does not *starve*, i.e., each packet is eventually transmitted, regardless of the state of other transmitters? (3 points)
- (c) Why does a 802.11 node that joins the network have to wait DIFS time before transmitting even if the medium is free? Describe in terms of the states other nodes may be in. (3 points)

5. General

- (a) What divisor polynomial degenerates CRC codes to parity codes? How? (3 points)
- (b) The *Hamming Distance* between two bit strings A and B is the number of bits that have to be changed in A to obtain B. The CRC-32 polynomial $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$ is used in Ethernet. Prove the following statement or disprove it with a counter example: “The minimum Hamming distance between two valid messages using the CRC-32 ethernet polynomial is 16”. (3 points)
- (c) BitCoins require continuous energy expenditure from an honest majority for the block chain to remain valid. Describe an alternative that does not. You will be graded on the inventiveness of your design along with how well you analyze both its pros and the cons. (4 points + Bonus)

Bonus What was Galois' first name? (1 point)