

# CS 5480: Sample Midterm Exam Questions

Print Name: \_\_\_\_\_

This is an open book, open note exam. Answer the problems in the space provided. The total number of points allocated to each problem is indicated; the entire exam will be graded out of a maximum of 100 points. Write all of your answers directly on this paper. Make your answers as concise as possible. **You needn't cover every available nano-acre with writing.**

You have **75 minutes** in which to complete the exam. Pay attention to the time remaining. If you get stuck on a particular problem, I suggest that you skip it and come back to it.

Good luck!

1. Explain how a single router can employ line cards that support ethernet, token ring, and a SONET point-to-point connection, despite their very different link-level protocols. **(5 points)**

2. XXX

3. What is the difference between time division multiplexing and statistical multiplexing. Give an example network protocol that employs each multiplexing mechanism. **(5 points)**

4. XXX

5. Considering the normal IP address convention for indicating a network, how many hosts can be addresses on the following networks? **(6 points)**

(a) 128.110.0.0

(b) 155.99.108.0

(c) 166.70.89.48, netmask 255.255.255.248?

6. Although uncommon, bit errors occur on physical connections. As a result, link layer protocols typically employ various forms of error correction. **(16 points)**

(a) Explain the principle of operation of a CRC error detection mechanism. **(5 points)**

(b) Using the 3-bit CRC  $x^3 + x^2 + 1$ , derive the three check bits for the message 0000. **(6 points)**

(c) For the 7-bit CRC-protected message your derived for 0000, give an example of a message with an error that will *not* be detected. **(5 points)**

7. Token rings and ethernetets are two common forms of LAN technology. (20 points)

(a) The media access control (MAC) mechanism for token rings, where a station must remove the token from the network before it is allowed to transmit, ensures that under periods of high network load, the network is utilized efficiently. What mechanism(s) do ethernetets employ to attempt to achieve high performance even under heavy load? How does this mechanism work (*in reasonable detail*)? **(7 points)**

(b) XXX

(c) XXX

8. Suppose a 100-Mbps point-to-point link is being set up between the Earth and a new lunar colony. The distance from the earth to moon is approximately 385,000 km, and data travels over that link at the speed of light,  $3 * 10^8$  m/second. Suppose you are designing a sliding window protocol for this link. Further assume that the maximum packet size for this networking technology is 1-kilobyte. **(20 points)**

(a) Calculate the minimum roundtrip time for this link. **(2 points)**

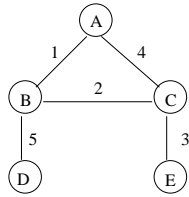
(b) Using the RTT as the delay, calculate the delay \* bandwidth product for this link. **(3 points)**

(c) What is the significance of the delay \* bandwidth product, in general? In other words, how do network architects use it, what are the implications of a large or small product, etc.? **(5 points)**

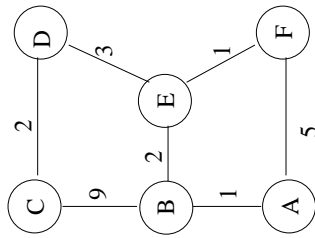
(d) XXX

(e) XXX

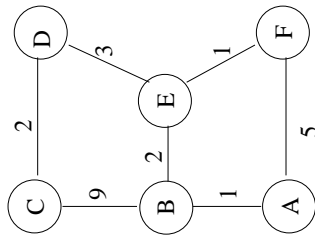
9. Forwarding, routing, and bridges. (22 points)



- (a) For the small network shown in Figure 9, give the datagram forwarding table for each node. The links are labelled with their relative costs; your tables should forward each packet via the lower cost path to its destination. (6 points)
- (b) Suppose this network represented a collection of ATM switches, describe how a virtual circuit is established between node *A* and node *E*, assuming the forwarding table that you calculated in the previous sub-problem. (8 points)
- (c) Describe, compare, and contrast the mechanisms used to build forwarding tables for bridges and routers. (8 points)



10. **Link-State Routing:** For the network given in the figure above, show how the link-state algorithm builds the routing table for node A. **(15 points)**



11. **Distance-vector routing:** For the same network as the previous problem, show the sequence of global routing tables – one for each update cycle – that would be created by the distance-vector algorithm. **(15 points)**