Examples of CS 356 exam questions S. S. Lam

EXAM 0 Name_____ EID_____

This is a closed-book exam. You are allowed one page of notes on 8.5"x11" paper, written or printed on one side only. Check to be sure that there are 6 problems on 6 pages. Do all. The number of points allocated to each problem is shown. Use your time wisely. For analytical problems, show all your steps.

Be specific in your answers. Do not give several answers hoping that one of them is the right answer; if you give *n* alternative answers to a question, you will get at most 1/*n* of the credit for the question. Write legibly. I will give you credit only if I can read your handwriting and understand your sentences. You have one hour and 15 minutes.

Note: This document is not a complete exam. It is intended to give you a flavor of different types of exam questions at various levels of difficulty.

Problem 1

(a) Name the five layers of the Internet protocol stack. Which layers are needed in a typical router? [4 pts]

(b) Associate each of the following with either packet switching (PS) or circuit switching (CS): [4 pts]

statistical multiplexing
time division multiplexing
queuing
wavelength division multiplexing

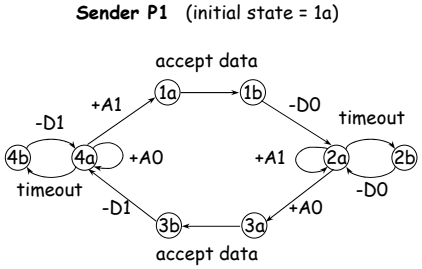
(c) ATM networks were designed with accommodating voice traffic in mind. Each ATM cell is only 53 bytes long (a relatively short packet length). Explain why a short packet length is good for voice traffic. [4 pts]

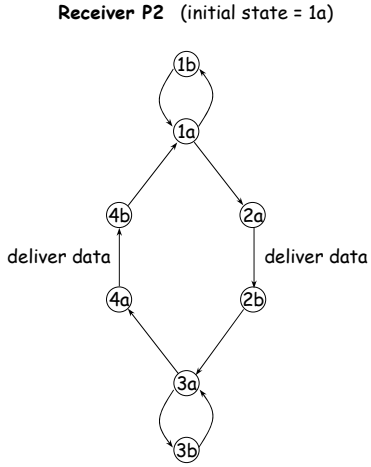
(d) For a server to support *n* simultaneous TCP connections to different clients, how many sockets does it need? How many port numbers does it need? [4 pts]

(e) In Gnutella, describe the technique used to prevent query flooding from inundating the network with too many query messages. [4 pts]

Problem 2

(a) Consider the following specification of the alternating-bit protocol, where the label –m denotes a state transition associated with the sending of message m and the label +m denotes a state transition associated with the reception of message m. Show labels that are missing from the transitions of receiver P2. [4 pts]





(b) Compute the Internet checksum of the following 16-bit integers: [5 pts]

1 1 0 1 0 1 1 1 0 1 0 1 0 0 1 1
1 1 0 0 1 0 0 1 0 1 0 1 0 1 1 1

(c) Draw a diagram illustrating the three messages of the three-way handshake protocol for establishing a TCP connection. Show the name of each message, as well as each message's sequence and/or acknowledgement number(s). Explain why the third message is needed. [6 pts]

Problem 3

Suppose a stream of 0.8-megabit long packets arrive to a FIFO queue at a rate of 1 packet/second. Another stream of 0.1-megabit long packets arrive to the same FIFO queue at a rate of 9 packets/second. The queue is served by a channel with a transmission rate of 2 megabits/second. (Note: 1 megabit is 10^6 bits.)

(a) What is the service (i.e. transmission) time of a 0.8-megabit packet? What is the service time of a 0.1-megabit packet? [2 pts]

(b) What is the average service time over all packets? (**Hint**: Of all packet arrivals, 1/10 of packets are 0.8 megabit long and 9/10 of packets are 0.1 megabit long.) [2 pts]

(c) What is the second moment of service time over all packets? [2 pts]

(d) Given that all packets arrive according to Poisson process, what is the average queueing delay (W) over all packets? [Hint: Use M/G/1 formula to calculate W.] [6 pts]

(e) What is the average delay (queueing + service) of a 0.8-megabit packet? [2 pts]