

**Midterm EXAM (Sample!)**

Name \_\_\_\_\_ ID \_\_\_\_\_

This is a closed book exam. You are allowed one page of notes on an 8.5"x11" paper, written or printed on one side only.

Check to be sure that there are 6 pages. Please try to complete 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. We will give you credit only if we can read your handwriting and understand your sentences.

You have 1 hour and 30 minutes, 90 minutes in total.

For instructor use only:

1.	2.	3.	4.	5.	6.	7.	8.	9.	Total

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**Problem 1**

(a) Name the five layers of the Internet protocol stack

[5 pts]

(b) List two types of access networks.

[5 pts]

(c) Associate each of the following concept with either packet switching (PS) or circuit switching (CS):

[6 pts]

Store and forward ---

Dedicated resource allocation ---

Queuing ---

(d) Consider a video streaming server with an upload capacity of 200 Mbps and a download capacity of 100 Mbps. It is serving 50 clients simultaneously by *fairly* multiplexing its upload capacity. Each of the clients streaming from the server has an upload capacity of 2 Mbps and a download capacity of 5 Mbps. The Internet is not congested. What is the maximum bit rate at which this client is receiving service? [4 pts]

**Problem 2**

(a) How long does it take a packet of length 1,000 bytes to propagate over a link of distance 2,500 km, propagation speed  $2.5 \cdot 10^8$  m/s, and transmission rate 2 Mbps?  
[5 pts]

(b) More generally, how long does it take a packet of length  $L$  to propagate over a link of distance  $d$ , propagation speed  $s$ , and transmission rate  $R$  bps? [5 pts]

**Problem 3**

(a) In class, we discussed different ways loss can occur as data is transferred over the network. List and provide a brief explanation of the two types of data loss we discussed.  
(5 points)

(b) What is the difference between virus and worm? When a malware is included in an Email attachment, is it a virus or worm? (5 pts)

#### Problem 4

(a) Let the round trip time be  $T_r$  and file transfer time be  $T_f$ , what is the time to use non-persistent HTTP to get a file? [4 pts]

(b) Consider an institution with a 1.5 Mbps incoming channel from the Internet. The average http request rate from all browsers in the institution is 30/second. Each request is for a single object with an average size of 7,000 bytes. Will the incoming channel congested by the http traffic? [6 pts]

#### Problem 5

(a) In BitTorrent, a peer sends chunks “tit-for-tat” to four neighbors currently sending chunks to it at the highest rates. And every 30 seconds it “optimistically unchokes” a randomly selected peer, i.e., sends chunks to it. Why is it *necessary* for the system to have chunks sent to randomly selected peer [5 pts]

(b) Compare DNS recursive query and iterative query. [5 pts]

**Problem 6**

(a) List the advantages and disadvantages by comparing client-server to peer-to-peer [5 pts]

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

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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

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1. *add*

2. *one's complement sum*

3. *Internet check sum*

**Problem 7**

(a) Given  $T_A = 0$ ,  $T_P = 0$  and  $P = 0$ , the maximum utilization formula for the sliding window protocol is

$$U = 1 \quad \text{for } W T_F > T_F + 2\tau$$

$$\text{and } U = W T_F / (T_F + 2\tau) \quad \text{otherwise}$$

where  $T_F$  denotes the transmission time of a frame,  $W$  the send window size, and  $\tau$  the one-way propagation time. Suppose the link transmission rate is 10 megabits/second, frame size = 10,000 bits, and  $\tau = 10$  msec. We would like to choose  $W$  such that  $U$  is at least 0.8. Determine  $W$ . Show your derivation steps. [10 pts]

**Problem 8**

(a) In design of the reliable data transfer protocol, what mechanism is used to handle the case that the receiver may receive a segment with errors? (3pts)

(b) Compare go-back-N and selective repeat. list their advantages and disadvantages. (7pts)

**Problem 9**

Host A and B are directly connected with a 100 Mbps link. There is one TCP connection between the two hosts, and Host A is sending to Host B an enormous file over this connection. Host A can send its application data into its TCP socket at a rate as high as 120 Mbps but Host B can read out of its TCP receive buffer at a maximum rate of 50 Mbps. Describe the effect of TCP flow control. [10 pts]