Northeastern Illinois University **Name: _____**
Department of Computer Science
CS 331

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	**Total**	**Midterm Points (Total / 4)**
___ 10	___ 10	___ 10	___ 10	___ 15	___ 15	___ 15	___ 15	___ **100**	___ **25**

Example Midterm Exam

Instructions:
Read carefully each question before you write your answer. The answer to the questions of the exam should ALL be written down in the exam in space provided. The answer to the question should be clearly written. Poorly written answers will be poorly graded.

Question 1: Select your answer by placing a circle over the letter and justify if necessary in the space provided. (2 points)

1. What does ping measure?

   a) end-to-end delay
   b) transmission delay
   c) round trip time
   d) propagation delay

2. What is the transmission delay of a packet with 40 **kilobits** (1 **kilobits** is 1000 **bits**) on a 1 Mbps link?

   a) 0.40 seconds
   b) 4000 milliseconds
   c) 0.04 seconds
   d) none of the above

   Show formula and calculations below:

3. Match the layers of the Internet Protocol Stack with the best fit description by writing the letter of the layer in the space provided.

LAYERS	*DESCRIPTION*
a. Network layer	___ best-effort end-to-end delivery
b. Data link layer	___ move bits
c. Physical layer	___ determines route between source and destination
d. Transport layer	___ point-to-point delivery

4. The Physical layer receives services from which layer?

   a) Transport layer
   b) Data Link Layer
   c) Network layer
   d) none of the above

5. The Transport layer receives services from which layer?

   a) Application layer
   b) Data Link Layer
   c) Network layer
   d) none of the above

Question 2: Write one sentence definition for each concept (2 points for each definition)

a) Computer Network:

(2 points)

b) Email:

(2 points)

c) Protocol:

(2 points)

d) Propagation delay:

(2 points)

e) Transmission delay:

(2 points)

Question 3: Write brief answer (be clear and concise)

a) Suppose all of the network sources (hosts) send data at a constant bit rate. Would packet-switching or circuit-switching be more desirable in this case? Why? First define packet-switching and circuit-switching then describe advantages and disadvantages.

Packet switching:

(1 point)

Circuit switching:

(1 point)

Which is desirable when hosts send data at a *constant bit rate*? Why?

(4 points)

b) Now suppose that all of the network sources are *bursty* – that they only occasionally have data to send. Would packet switching or circuit switching be more desirable in this case? Why?

(4 points)

Question 4: Consider the ping command layer

a) How does traceroute work and what are the statistics shown by traceroute?

(5 points)

b) Now look at result from a traceroute to www.ldc.usb.ve below:

traceroute www.ldc.usb.ve
traceroute to uxtal.ldc.usb.ve (159.90.10.9), 64 hops max, 52 byte packets
line 1 10.8.60.1 (10.8.60.1) **6.459 ms** 1.781 ms 1.146 ms
line 2 150.134.250.1 (150.134.250.1) **1.122 ms** 1.979 ms 1.174 ms
line 3 150.134.244.1 (150.134.244.1) 1.653 ms 1.507 ms 1.937 ms
line 4 192.55.234.1 (192.55.234.1) 2.618 ms 2.709 ms 2.491 ms
line 5 clevs-r0-ge-4-1-2s101.core.oar.net (192.153.38.225) 4.145 ms 3.853 ms 4.997 ms
line 6 192.88.192.138 (192.88.192.138) 11.757 ms 11.870 ms 12.838 ms
line 7 ae-8.10.rtr.atla.net.internet2.edu (64.57.28.6) 25.446 ms 25.052 ms 24.885 ms
line 8 198.32.252.237 (198.32.252.237) 38.521 ms 40.534 ms 39.255 ms
line 9 uxtal.ldc.usb.ve (159.90.10.9) 140.904 ms 140.236 ms 140.374 ms

What is the IP address of the destination host?

Explain why line 1 has a result of 6.458ms while line 2 has a much lower result of 1.122 ms?

(5 points)

Question 5: Write an example of an application. You must write the advantages and disadvantages of selecting a transport layer protocol for the application selected.

a) Give an example of an application that requires low delay but tolerate loss. Also state the transport layer protocols you would use and briefly describe the application (what the application is used for).

(5 points)

b) What are the advantages and disadvantages of the application using the transport layer protocol you selected?

Advantages:

(5 points)

Disadvantages:

(5 points)

Question 6: Write a step by step solution to the following problem.

Consider the Internet in the picture below, in which zones are indicated with a dashed line. There is only one DNS server per zone and it happens to have the same name as the highest node in each zone: yale.edu, cs.yale.edu, rutgers.edu, cs.rutgers.edu, rdl.edu, tdl.gov, tld.net and root-servers.net. The only servers supporting recursive querying are cs.yale.edu and cs.rutgers.edu.

For each of the queries below, list in order all the DNS servers contacted by the resolver. Assume there is no caching performed at any level of the hierarchy.

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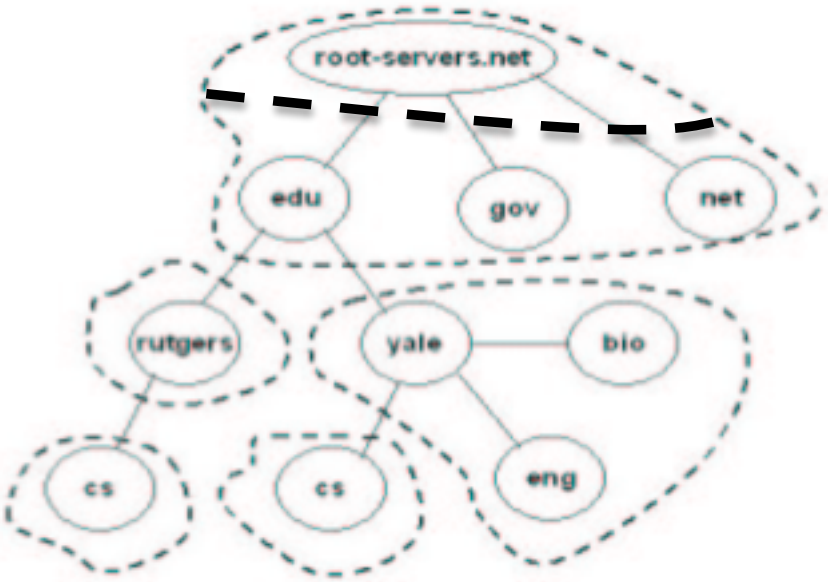

a) A machine called lab1.bio.yale.edu exists in the biology (bio) department at Yale, and a user on eden.rutgers.edu (rutgers) launches a query to resolve the name lab1.bio.yale.edu. List the steps and the names of the servers that will be contacted by DNS.

(5 points)

b) Draw a picture that illustrates the query resolution process you explained in the previous question. Make sure you label correctly so it is clear which step above correspond to the messages in the picture.

(10 points)

Question 7: Answer the following question by writing no more than one paragraph:

a) Compare all applications by drawing a chart with the application architecture, application layer protocol, and transport layer protocol for web, email, ftp, and DNS.

(5 points)

b) Draw a picture of all the email components, **ALL protocols,** and describe the steps required for Alice to send an email message to Bob.

(10 points)

Question 8: Answer the following question by writing clearly the formula used:

a) What is transmission delay required to send 800 byte packet across a 3000 kilometer link at 10 Mbps? Show your calculations.

(7 points)

What is the total time required to send 4000 bytes across a 3000 kilometers link at 1 Mbps? Use a signal propagation of 3 $x10^8$ meters/seconds. Show your calculations

(8 points)

EXTRA CREDIT: (10 points) - 5 points per question

Explain with a detailed example, what happens to the end-to-end delay of packet when:

a) The link speed is increase by a factor of two (i.e., doubled)

b) The packet length decreases by 50%