

Name: _____

*This exam carries 10% of course grade. (**SHOW ALL WORK**)*

1. (1 points, 0.25 point each) For the four classes of services (listed below), indicate **under the column TCP/UDP** write **UDP or TCP** depending on which transport service is used; **under the column APPLICATION PROTOCOL** write **the name of common application protocol used by internet** and **under the column DATA-LOSS TOLERANT** write **'tolerant' or 'not tolerant'** depending on if the application is data-loss or not.

	TCP/UDP	APPLICATION PROTOCOL	DATA-LOSS TOLERANT
e-mail	TCP	SMTP	Not-tolerant
Web	TCP	HTTP	Not-tolerant
Domain Name Service(DNS)	UDP	DNS	tolerant
Internet Telephones (VoIP)	UDP	proprietary	tolerant

2. (0.5 point) Which of the following statement is true (select the correct choice):
- TCP segment is a payload for IP datagram
 - IP datagram is a payload for TCP segment
 - Neither of the above
3. (0.5 points) Consider the following reply from the server to the HTTP GET message.
- When the document was last modified?
 - How many bytes are in the document being returned?
 - Did the server agree to a persistent connection?

```

HTTP/1.1 200 OK\r\n
Date: Sun, 26 Sep 2010 20:09:20 GMT\r\n
Server: Apache/2.0.52 (CentOS)\r\n
Last-Modified: Tue, 30 Oct 2007 17:00:02 GMT\r\n
ETag: "17dc6-a5c-bf716880"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 2652\r\n
Keep-Alive: timeout=10, max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n
\r\n
data data data data data ...

```

4. (0.5 point) If the distance between end systems is 2500 km. Assuming the signal is propagated at speed of light (2.5×10^8 m/s), the **propagation delay would be** (select the correct choice):
- a. 0.01 sec
 - b. 0.001 sec
 - c. 0.0001 sec
 - d. None of the above
5. (0.5 point) The **transmission delay** in a network depends on (select correct choice):
- a. Bandwidth of the network medium
 - b. Distance between communicating hosts
 - c. Both the bandwidth and the distance
 - d. Traffic condition
6. (0.5 points) **DNS** (Domain Name Service) is provided to:
- a. Translate host name to IP address.
 - b. Translate IP address to host name.
 - c. Translate MAC address to IP address.
 - d. Both to translate host name to IP address and translate IP address to host name.
7. (0.5 points) A '**socket**' is an application programming interface:
- a. Between the Application layer and Transport layer
 - b. Between the Transport layer and (IP) Network layer
 - c. Between Network layer and data link layer
8. (0.5 points) **When a HTTP server is communicating with 10 web browsers** (client processes), how many sockets are open on the server:
- a. 10
 - b. 20
 - c. 11
9. (0.5 point) **When a HTTP server is not communicating** with any web browsers (clients), how many sockets are open on the server:
- d. 0
 - e. 1
10. (0.5 point) To **transfer mail from a mail server to receiving mail server**, which Application protocol is used:
- a. POP
 - b. HTTP
 - c. SMTP

11. (0.5 point) **What information is used by a server process to communicate** with a client process:
- IP address of the device where client process is running
 - Port number of the device where client process is running
 - Both the IP address and the port number of the device where client process is running.

12. (1.5points) Consider a round trip time between a web client and a web server to be 5 ms. Also consider **a web page contains a base html file and 8 other small graphic objects (ignore transmission time)**. Assume that the client already has the IP address of the server (so no DNS look-up is necessary). How much time it takes to download the web page when:

- a. HTTP 1.0 (non-persistent) protocol is used- with no parallel connection.

$$2RTT + 2 \cdot 8 \cdot RTT = 18RTT = 18 \cdot 5 = 90ms$$

- b. HTTP 1.0 (non-persistent) protocol –with 10 parallel connections.

$$2RTT + 2 \cdot RTT = 4RTT = 4 \cdot 5 = 20ms$$

- c. HTTP 1.1 (persistent) protocol – with pipelining.

$$2RTT + 1RTT = 3RTT = 3 \cdot 5 = 15ms$$

13. (0.5 points) In HTTP the server **does not keep the state** of the communication. To overcome this limitation of the HTTP which of the following mechanism is used:

- Web caching
- Cookies
- Both we b caching and cookies

14. (2 points) Consider the following Network. Suppose the **average object size is 1Mbits**, and the average request rate from the institution browsers to the origin servers is **15 requests per second**. Suppose the HTTP request messages are small and thus create no traffic in the network. Also suppose that the amount of time that it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is 2 seconds.

- a. What is the ‘traffic intensity’ on the access link (from internet router to institution router)?

$$\text{Traffic intensity} = (1 \text{ Mbits} \cdot 15 \text{ requests/second}) / 15 \text{ Mbps} = 1$$

- b. Suppose the access link is upgraded from 15 Mbps to **100 Mbps**, then what would be the ‘traffic intensity’ on the access link (from internet router to institution router)?

$$\text{Traffic intensity} = (1 \text{ Mbits} \cdot 15 \text{ requests/second}) / 100 \text{ Mbps} = 0.15$$

- c. Suppose that the access link is left as is, at 15Mbps and instead a Web Cache is provided with the institution network that has a hit rate of 0.4, then **what is the average delay in getting a web page**.

(see page 113 of textbook)

