



Faculty of Arts & Sciences
Department of Computer Science
CMPS 284—Computer Networks
Fall 2004–2005
Monday, January 24, 2005

Final Exam
Version 3



Name: _____ Student Id: _____

Signature: _____ Section: _____

Duration: 120 minutes

Section I	MWF 8:00 – 8:50
Section II	MWF 9:00 - 9:50

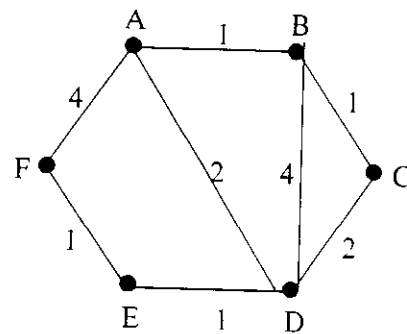
Instructions

- There are 6 problems and 12 pages. Make sure you have all of them.
- The exam is closed book, closed notes, closed calculators, and closed neighbors.
- Answer questions in the space provided.
- The questions **not sorted by difficulty**. Scan the whole exam before you start working.
- Your handwriting should be readable so it can be graded. Include all work or justification for partial credit.

Problem 1	7	
Problem 2	20	
Problem 3	30	
Problem 4	16	
Problem 5	7	
Problem 6	20	
Total	100	

Problem 1 [7 points]

Show how the routing table of F is formed by applying Dijkstra's routing algorithm to the following graph starting from node F.



6. In assignment 3, you had to develop a UDP client server application. The client had to successfully register with the server before getting access to the cash register. Sketch the flowchart for an UDP/IP client-server application (it is enough to just provide the main system calls). In this flowchart, illustrate when and how the client sends a register message to the server and how the server reacts to this message. **[6 points]**

SERVER

CLIENT

7. *traceroute* is a network tool that is used to construct a list of all routers along a path from a source computer to a given destination. Explain how traceroute uses ICMP messages to do so? **[4 points]**

Problem 3-[30 points]

Suppose that a corporate has a class C network with network ID 194.80.40.0. The corporate comprises three departments but expected to grow to 5 departments in a year. Currently each department has less than five employees but the number of employees in each department expected to rise to 20 in a year. The network administrator was asked to create a separate subnetwork for each department. To cope with the expected growth the administrator used 3 bits for the subnet id and 5 bits for the host id.

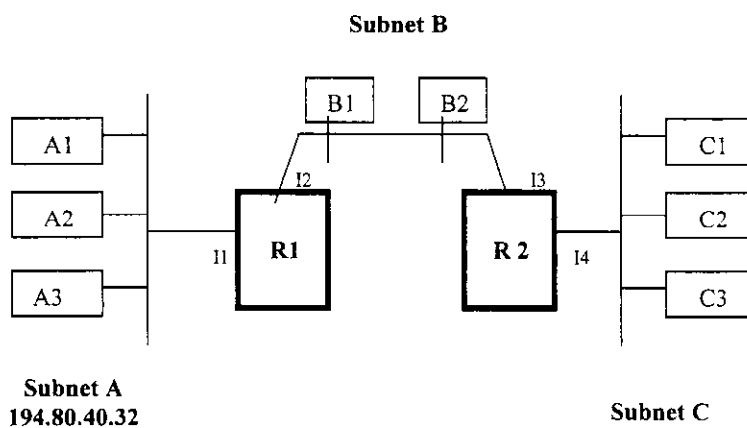
1. What is the dotted decimal representation of the mask address of class C networks? [1 point]

2. What is the dotted decimal representation of the subnet mask address in the network mentioned above? [1 point]

3. How many subnets can be supported in the network design mentioned above? [1 point]

4. What is the maximum number of hosts per subnet in the network design mentioned above? [1 point]

5. Assume that the network administrator created three different subnetworks to support the corporate three existing departments as shown in the diagram below. The subnet A was assigned the subnet id 194.80.40.32.



- 5.1. Looking at the subnet id of subnet A, assign the next available subnet ids to subnet B and subnet C. What are the values of these ids in dotted decimal? [2 points]

5.2. For each subnet provide the following:[4.5 points]

	Lowest IP address that can be assigned to a host	Lowest IP address that can be assigned to a host	Broadcast IP address
Subnet A			
Subnet B			
Subnet C			

5.3. Write down an IP address for each interface at all hosts and routers in the diagram. In each subnetwork, for hosts, start from the lowest possible address and up. For routers, use the highest possible IP address and down.[6 points]

Subnet A

Subnet B

Subnet C

A1	
A2	
A3	
R1-I1	

B1	
B2	
R1-I2	
R2-I3	

C1	
C2	
C3	
R2-I4	

5.4. Given your IP addresses from above, what are the contents of the routing table of router R1 (include Destination Network, Mask Address, and Next Hop).[4.5 points]

Destination Subnet	Subnet Mask	Next hop

- 5.5. Suppose that a1, a2 and a3 are the hardware addresses for hosts A1, A2, and A3 respectively; b1 and b2 are the hardware addresses for hosts B1 and B2 respectively; c1, c2 and c3 are the hardware addresses for hosts C1, C2, and C3 respectively; i1, i2, i3, i4 are the hardware addresses for the interfaces I1, I2, I3, I4 at routers R1 and R2. Give the ARP table for station A1 assuming that A1 has recently communicated with all other stations. **[3 points]**

IP Address	Hardware Address

- 5.6. If A1 sends B1 an IP packet, explain what takes place at Net A and Net B by sketching the headers (namely the address fields) for a packet as it flows from host A1 to host B1 **[2 points]**.

6. Consider sending an IP packet of 3000 bytes into a link that has an MTU size of 500 bytes. Suppose that the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values of the offset and identification fields of each fragment? **[4 points]**

Problem 4-[16 points]

Matching - choose (from among the choices listed below) the word/phrase that best matches each statement.

Physical Layer	TCP/IP	Relay Agent	UDP	ARP
Loopback address	RARP	FIN	LAN	WAN
Network Layer	End-to-End	Checksum	ACK	SYN
Packet Switches	ICMP	packet loss	Flow Control	Hop-by-Hop
Port number	IPv4Address	OSI	Dijkstra	DNS
Bridge	LinkState	Router	Transport Layer	Switch
Out of order delivery	Encapsulation	Resolver	Datalink Layer	Socket

1. Internet layer protocol that can be used by IP to send control information. _____
2. Application client that is used to translate a name to an IP address. _____
3. Programmer uses for testing and preliminary debugging network applications. _____
4. Interconnects networks that use different technologies, including different physical addressing and different frame formats. _____
5. Fundamental building blocks of a WAN include _____ and high-speed connections between them.
6. Provides communication between processes running on end-systems on possibly different networks.

7. Forwards DHCP messages between clients and servers. _____
8. In general, reliability protects against _____ and _____
9. 32 Bit identifier used to route IP datagrams. _____
10. 16 bit identifier used to deliver TCP segments and UDP datagrams to the correct process. _____
11. A widely used protocol suite. _____
12. Used to translate an Ethernet Address to IP address. _____
13. Often used for error detection. _____
14. A transport layer protocol. _____
15. One of the main routing schemes. _____

Problem # 6 [20 points]

Write T if you think that the answer is mostly correct and F if you think that the answer is mostly incorrect. Note that two wrong answers cancel a correct one.

1. www.mybank.com and www.mybank.co.lb can have the same IP address.
2. In TCP, the acknowledgement number that a host puts in a segment is the sequence number of the next byte the host is expecting from the sender.
3. Suppose that host A wants to send data over TCP to host B, and host B wants to send data to host A over TCP. Two separate TCP connections - one for each direction - are needed.
4. Local DNS name servers cache DNS responses, but discard them after a period of time that is on the order of a few days.
5. SMTP uses TCP connection to send and receive email messages.
6. DHCP supports three mechanisms for IP address allocation. They are: Automatic allocation, Dynamic allocation, Manual allocation.
7. MIME Allows the inclusion of only one type of data in a single mail message
8. Replay means packets are delivered as duplicate.
9. An Internet path with more hops always involves a greater delay than a path with fewer hops.
10. First router that receives packet fragments reassembles the fragments to reconstruct the packet.
11. SMTP is used to transfer messages from a mail server to a user agent.
12. BOOTP was invented to enhance DHCP and eliminate its weakness.
13. With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
14. Maximum transmission unit is defined as the maximum size of the frame.
15. If D_0 is the delay when the network is idle, and U is a value between 0 and 1 that denotes the current utilization, then $D_0/(1-U)$ gives a value for the *effective* throughput
16. Consider an HTTP Web server using persistent connections. Suppose the server spawns a separate process for each client that connects to the server. Then each of these spawned processes will have different server port numbers.
17. The ICMP protocol runs on top of UDP
18. Suppose a user requests a Web page that consists of some text and two images. For this page the client will send one request message and receive three response messages.
19. Domain names are hierarchical, with the most significant name on the extreme left.
20. The TCP Window Size never changes throughout the duration of the connection.