

National University of Computer & Emerging Sciences,
Islamabad, Pakistan

Name: _____ Roll No: _____

EE-311 Data Communication & Networks

Summer 2007

Final

Thursday, 2nd August 2007

Total Time: 3 Hours

Total Marks: 100

Course Instructor: Engr. Waleed Ejaz

You are advised to READ these notes:

1. Make sure that you have 20 pages and 10 questions.
2. The marks for each sub part of question are written in brackets []
3. Exam is closed books, closed notes. Please see that the area in your threshold is clean. You will be charged for any material which can be classified as 'helping in the paper' found near you.
4. Calculator sharing is strictly prohibited.
5. The invigilator present is not supposed to answer any questions. If you have any queries please wait for the appropriate person who may visit your exam room once in the initial half an hour or so.
6. If there is any missing parameter, write down your assumption and continue.
7. Write all the answers in the allocated space.

Question Number	1	2	3	4	5	6	7	8	9	10	Total
Marks	10	10	10	10	10	10	10	10	10	10	100
Marks Obtained											

Question 1**[6+4]**

Draw timing diagram for Virtual circuit switching, Circuit switching and Datagram Network (Connection less Packet Switching) for the following network. Assume three packets flow from source to destination and there are two intermediate nodes.

Virtual Circuit Switching:

Circuit Switching:

Datagram Network (Connectionless Packet Switching):

PART B

List three categories of multiple access protocols and also list at least three protocols in each category.

PART A

A cable company uses one of the cable TV channels (with a bandwidth of 6MHz) to provide digital communication for each resident. What is the available data rate for each resident if company uses a 128-QAM technique?

PART B

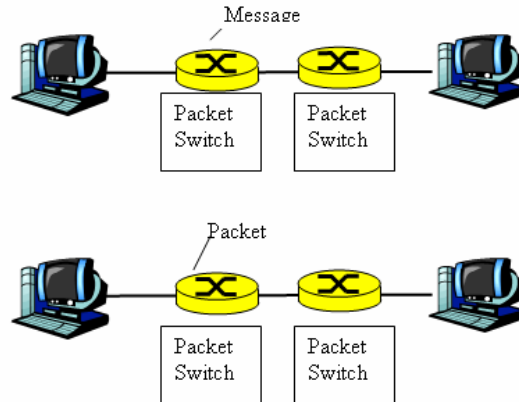
Four data channels (digital), each transmitting at 1 Mbps, use a satellite channel of 1 MHz. Design an appropriate configuration, using FDM.

PART C

Given a 10 bit sequence 1010011110 and a divisor of 1011, find CRC. Check your answer.

PART A

In modern packet-switched networks, the source host segment long, application layer messages (for example, an image or a music file) into smaller packets and sends the packet into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation. Figure below illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 7.5×10^6 bits long that is to be sent from source to destination in figure below. Suppose each link in the figure is 1.5Mbps. Ignore propagation, queuing and processing delays?



- Consider sending the message from source to destination without message segmentation. How long does it take to move the message from source host to first packet switch? Keeping in mind that each uses store-and-forward packet switching, what is the total time to move the message from source host to destination host?

- b. Now suppose that the message segmented into 5,000 packets, with each packet being 1,500 bits long. How long does it take to move the first packet from source host to first switch? When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the second switch. At what time will the second packet fully received at the first switch?
- c. How long does it take to move the file from source host to destination host when message segmentation is used? Compare this result with your answer in part (a) and comment.

PART B

What is the capacity of a 4KHz QAM-8 channel with SNR of 30dB?

PART A

Suppose a router receives an IP packet containing 600 bytes and has to forward the packet to a network with maximum transmission unit of 200 bytes. Assume that the IP header is 20 byte long. Show the fragments that router creates and specify the values in fragment header. Use the pattern shown below.

	Total length	ID	MF	Fragment Offset
Original Packet				
Fragment 1				

PART B

How many fragments will constitute the packet when a router tries to transmit an IP packet with 20 bytes IP header and 512 bytes IP payload over a link having 256 MTU?

PART C

A host has an IP address of 150.32.64.34 and a subnet mask 255.255.240.0. What is the address of this subnet? What is the range of IP addresses that a host can have on this subnet?

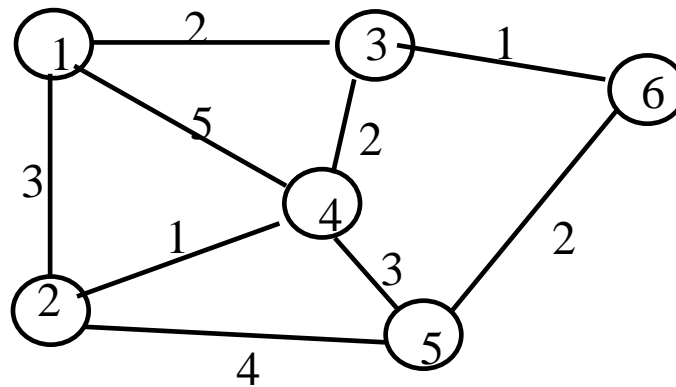
PART D

A university has 100 LANs with 200 hosts in each LAN. Suppose the university has one class B address.

- (i) Design an appropriate subnet addressing scheme.
- (ii) Design an appropriate CIDR addressing scheme.

PART A

For a network shown in Figure below:



- (i) Use the Dijkstra's algorithm to find the set of shortest path from node 2 to other nodes.

(ii) Draw the corresponding shortest path tree for node 2.

(iii) Find set of associated routing table entries at node 2.

PART B

Why is an ARP request broadcast? Why is an ARP reply Unicast?

PART A

Suppose a router has built up the routing table shown in the table below:

Subnet Number	Subnet Mask	Next Hop
128.96.39.0	255.255.255.128	Interface 0
128.96.39.128	255.255.255.128	Interface 1
128.96.40.0	255.255.255.128	R2
192.4.153.0	255.255.255.192	R3
Default		R4

The router can deliver packets directly over interfaces 0 and 1 or it can forward packets to routers R2, R3, R4. Describe what the router does with a packet address to each of the following destinations:

- (i) 128.96.39.10
- (ii) 128.96.40.12
- (iii) 128.96.10.151
- (iv) 192.4.153.17

PART B

When the time-to-live (TTL) field reaches zero, a time exceeds message notifies a source host about this. Which protocol is used to convey this message to the source host?

PART C

Consider the forwarding tables as shown below for nodes A and F in a network where all links have cost 1. Give a diagram of the smallest network consistent with these tables.

Node A			Node F		
Node	Cost	Next Hop	Node	Cost	Next Hop
B	1	B	A	3	E
C	2	B	B	2	C
D	1	D	C	1	C
E	2	B	D	2	E
F	3	D	E	1	E

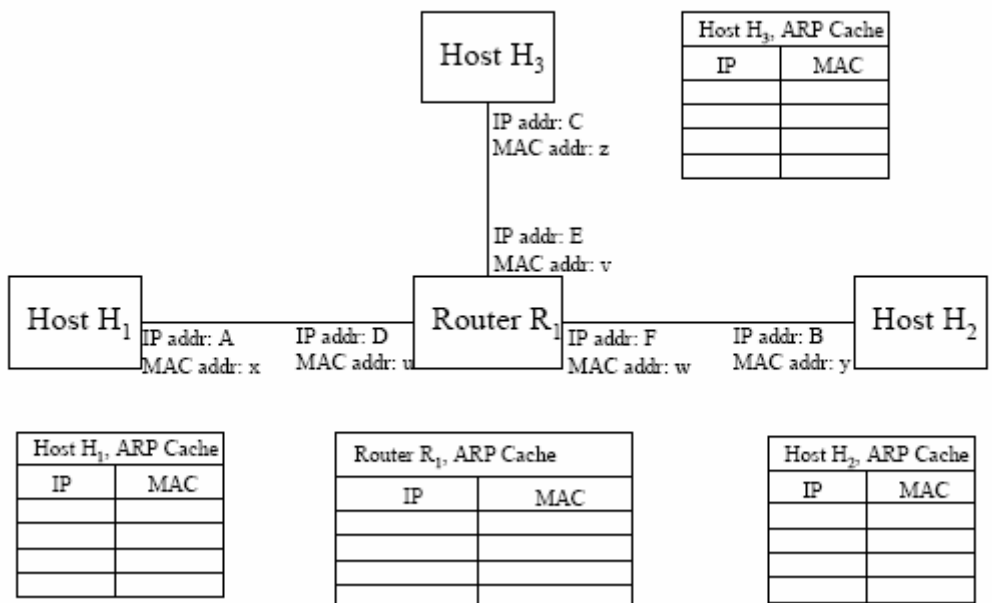
PART A

Following the OSI reference model (and the terminology used in the course), where would you place each of the following communication devices: Repeater, Bridge, Router, and Application Gateway?

PART B

The figure below illustrates three hosts H1, H2 and H3 running IPv4 over a routed network, connected by router R1. The IP and MAC addresses of the hosts and the router's interfaces are given in the figure. The ARP cache of each host and the router are shown. Assume the ARP caches are initially empty, and that no packets have been sent yet. Now, host H1 wants to send an IPv4 Unicast datagram to host H3.

Fill in the state of the four ARP caches as they will appear after the IPv4 Unicast datagram has been delivered to host H3, that is, after dynamic ARP resolution has been made.



PART C

Which fields of the IP header change when a packet passes through a router? Assume that there are no IP options and that no fragmentation occurs.

PART D

Why is there need for a header length field in the IP header?

PART A

Suppose client A initiates an HTTP session with the server S. At about the same time, client B initiates an HTTP session with the server S. Provide possible source and destination port numbers for:

- (i) The Segments from A to S
- (ii) The Segments from B to S
- (iii) The Segments from S to A
- (iv) The Segments from S to B
- (v) If A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S?
- (vi) How about if they are the same host?

PART B

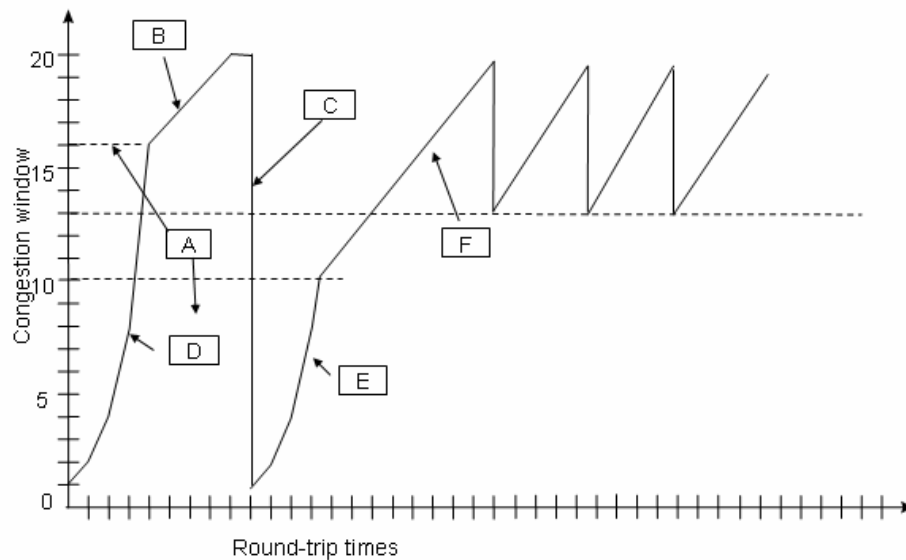
In a leaky bucket, what should be the capacity of the bucket if the output rate is 5 gal/min, and there is an input burst of 100 gal/min for 12 s and there is no input for 48 s?

PART A

Consider an email message being sent from a host to another host on the Internet. What transport and application protocols could be required in this message delivery?

PART B

Consider the TCP trace shown in the Figure below which depicts the congestion control behavior.



Identify various congestion related situations and associated mechanism/parameters in the Figure as indicated by the labels A to F.

PART C

Suppose Bilal, with a Web-based e-mail account (such as Hotmail), sends a message to Afan, who accesses his mail from his mail server using POP3. Discuss how the message gets from Bilal's host to Afan's host. Be sure to list the series of application-layer protocols that are used to move the message between the hosts.

PART A

What is difference between open-loop congestion control and closed-loop congestion control?

PART B

Why do OSPF message propagate faster than RIP messages?

PART C

List three transition strategies to move from IPv4 to IPv6.

PART D

What is NAT? How can NAT help in address depletion?

PART E

What is an autonomous system and which protocol is used for inter autonomous communication?