

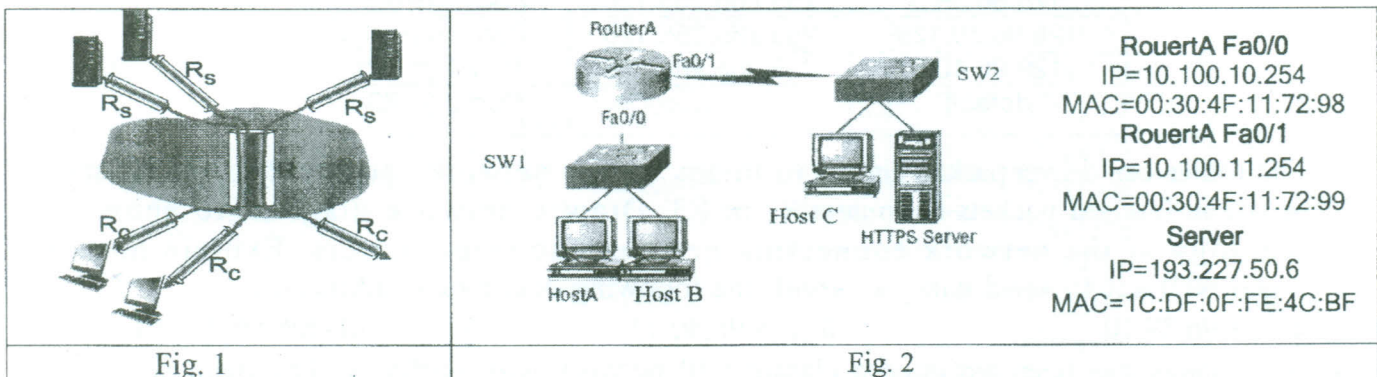
Faculty of Engineering	First Term 2012/2013	4th year ECE Final Exam
Electronics&Communications Eng. Dept.	Time: 3 Hours	Communications Networks

Attempt ALL questions. Assume any missing data. (Total 110 Marks=5 x 22 Marks)

Q.1.a) Millions of users are connected to the Internet through thousands of access ISPs. Discuss in short notes using neat sketches, how the Internet is structured to connect access ISPs together to offer a large virtual Network of Networks.

b) In the TCP/IP suite there are 2 transport protocols above the IP protocol, namely, User Datagram Protocol (UDP), and Transmission Control Protocol (TCP). Contrast their operation and the types of application for which each is more suitable.

c) In Internet, different parameters affect the average throughput of a given connection. If N virtual connections between servers and clients are established as shown in Fig. 1. Calculate the average throughput between each client-server pair when $R=10$ Mbps, $R_s=1$ Mbps and, $R_c=512$ Kbps; if $N=5$ and $N=20$. Are there any throughput bottlenecks? Where and why?



Q.2.a) The figure below shows a frame sent over a TCP/IP network that uses Ethernet LAN in the local area. The fields A, B, and C represent headers added at respective layers.



- i. Identify which of these headers correspond to each of the following layers: IP, TCP, DataLink.
- ii. If a bridge forwards this frame, which header(s) would the bridge examine and/or possibly change?
- iii. Which header(s) would a router in the Internet examine and/or possibly change?
- iv. To uniquely identify the process and host that this packet originated from, which header(s) should be examined?

b) In the network shown in Fig. 2, Host A and Host C send echo request messages to the https server and read the MAC and IP addresses in the replayed packets. What will be the IP and MAC addresses found in the replayed packets at both hosts? Is there any difference? If yes; discuss why?

c) Describe the Domain Name Service (DNS) structure and illustrate a typical message exchange between a host "myncl.mans.edu.eg" and DNS servers in order to resolve a translation from a host name "www.gmail.com" to an IP address.

Q.3.a) Using neat sketches explain the concept of 3-way TCP hand-shake and TCP sliding window and explain why UDP does not use these mechanisms.

b) The probability of collisions occurring in a shared media network is proportional to many factors. Discuss these factors and show how they affect the network performance parameters such as delay, loss and throughput.

c) A local area network (LAN) uses 10 Mbps Ethernet Standard with CSMA/CD mechanism. A connected host transmits fixed-sized frames on the LAN repeatedly with waiting total time (IGP) of 60 μ S between frames. If the average bandwidth monitored was 8 Mbps, what is the size of a single frame sent?

Q.4.a) List the device(s) in which fragmentation may take place, explaining at what protocol layer fragmentation is performed and explaining the reason why fragmentation is needed.

b) Suppose a router in the Internet has a routing table shown below

Subnet number	Subnet mask	Next hop
128.96.39.0	255.255.255.128	Port 1 (direct)
128.96.39.128	255.255.255.128	Port 2 (direct)
128.96.40.0	255.255.255.128	Port 1 (toR2)
default		Port 2 (toR3)

The router can deliver packets directly to nodes on the networks attached to ports 1 and 2 or it can forward packets to routers R2 or R3. Draw a network diagram to show the topology of the network connecting between the three routers. Explain how the router will act to send datagrams with the following destination addresses:

- i. 128.96.39.10 ii. 128.96.40.12 iii. 128.96.40.151

c) A company has been assigned a classless IP network with prefix /x. The main site of the company has a LAN with 50 Users. The router of the main site is connected, by WAN links; to 6 branch offices each of them has a LAN of 20 hosts.

- i. Draw a network diagram to show the network topology used.
- ii. Determine an appropriate value of x when using either fixed-size subnetting or VLSM subnetting.
- iii. In case of VLSM, assume appropriate network Id. and redraw the network diagram with the complete network Id.'s information on it.

Q.5.a) Compare between Ethernet and ATM network technologies based on: traffic services support, type of connection technology and packet/cell structure and size.

b) Banyan ATM Switches belong to the class of blocking switches. Draw a diagram to illustrate the internal structure of 8x8 port Banyan Switch and to determine is there blocking will occur if the switch receives three packets, at the same time, at input ports 1, 4, and 5 and they aim the out ports 6, 7, and 8 respectively.

c) Suppose you have two 8x8 Banyan ATM switches. Determine the required number of 2x2 switching elements to be added to build a 16x16 switch and draw its complete diagram.

Good luck Prof. Hassan Soliman

Useful relations and tables

Tabulation of the Q -function

z	$Q(z)$	z	$Q(z)$
0.0	0.50000	2.0	0.02275
0.1	0.46017	2.1	0.01786
0.2	0.42074	2.2	0.01390
0.3	0.38209	2.3	0.01072
0.4	0.34458	2.4	0.00820
0.5	0.30854	2.5	0.00621
0.6	0.27425	2.6	0.00466
0.7	0.24196	2.7	0.00347
0.8	0.21186	2.8	0.00256
0.9	0.18406	2.9	0.00187
1.0	0.15866	3.0	0.00135
1.1	0.13567	3.1	0.00097
1.2	0.11507	3.2	0.00069
1.3	0.09680	3.3	0.00048
1.4	0.08076	3.4	0.00034
1.5	0.06681	3.5	0.00023
1.6	0.05480	3.6	0.00016
1.7	0.04457	3.7	0.00011
1.8	0.03593	3.8	0.00007
1.9	0.02872	3.9	0.00005

The definition of Q function is:

$$Q(z) = \int_z^{\infty} \frac{1}{\sqrt{2\pi}} e^{-y^2/2} dy$$

Two important properties of $Q(z)$ are

$$Q(-z) = 1 - Q(z)$$

Assume the symbol error rate for QPSK $\approx 2Q(\sqrt{\gamma_s})$

$$\sum_{n=0}^{\infty} (a)^n = \frac{1}{1-a} \quad \text{for } a < 1$$