

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 1592

Spring Examinations, 2002/2003

Exam Code(s)	<u>3IF1, 3BI1, 3BI2, 3BJ1</u>
Exam(s)	<u>Third Year Information Technology</u> <u>Third Year Industrial Engineering & Information Systems</u> <u>Third Year Management Engineering with Language</u>
Module Code(s)	<u>CT303</u>
Module(s)	<u>Networks and Data Communications</u>
Paper No.	<u>1</u>
Repeat Paper	<u>Special Paper</u>
External Examiner(s)	<u>Professor Paddy Nixon</u>
Internal Examiner(s)	<u>Professor G. Lyons</u> <u>Dr. D. Chambers</u> <u>Mr. P. Bigioi</u>

Instructions:

Answer any 4 questions.
Use a separate answer book for each section.
All questions will be marked equally.

Duration	<u>3 hrs</u>
No. of Answer Books	<u>2</u>
No. of Pages	<u>4</u>
Department(s)	<u>Information Technology</u>

Section A (Questions 1 and 2)

Question 1

- a) Describe briefly the purpose and structure of the OSI Reference Model. Which of the OSI layers handles each of the following tasks?
- Providing error free end-end communications across the network.
 - Session recovery caused by network failures.
 - Determining which route through the network to use.

6 MARKS

- b) Explain the difference between *Asynchronous* and *Synchronous* transmission of data ? Illustrate, using a suitable example, how *Manchester Encoding* can be used to allow a data receiver to recover the clocking information from transitions in the arriving data ?

9 MARKS

- c) Which broadcast protocol is more efficient "Pure Aloha" or "Slotted Aloha"? Explain your answer and also describe how the basic Aloha scheme could be made even more efficient e.g. using Persistent or Non-Persistent CSMA.

10 MARKS

Question 2

- a) Describe what happens following a collision in Ethernet (802.3). Some LAN technologies e.g. Token Ring (802.5) provide a mechanism for priority access, is there a similar facility available in Ethernet (802.3)?

7 MARKS

- b) Describe the encoding techniques used in *Fast Ethernet* (802.3u) to achieve 100Mbps over both Cat-3 and Cat-5 Unshielded Twisted Pair (UTP) cabling.

8 MARKS

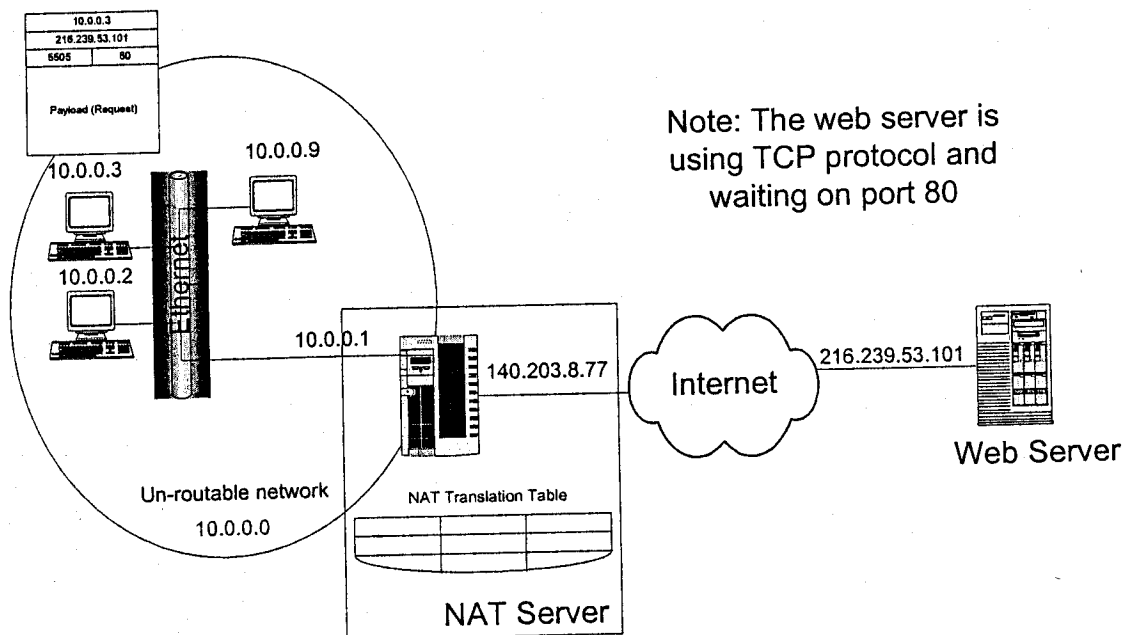
- c) Outline briefly the definition and implications of both Nyquist's Theorem and Shannon's Limit. If an eight level digital signal is sent over a 2MHz channel whose signal-to-noise ratio is 30dB, what is the maximum achievable data rate?

10 MARKS

Section B (Questions 3 to 6)

Question 3

- a) Explain briefly the difference between a connection-oriented and connectionless network. In this context, which type of network is the Internet itself (using the IP protocol).
5 MARKS
- b) It is known that IPv4 is running out of addresses. What are the two main solutions to cope with the shortage problem. Describe briefly each of them.
8 MARKS
- c) Consider the network topology in the figure below.
- Describe the operation of NAT assuming that the host 10.0.0.3 in the un-routable network 10.0.0.0 makes a web request to the server 216.239.53.101 (web server is waiting on port 80)
 - Show how the request TCP/IP packet is modified on its way from host 10.0.0.3 to the web server.
 - Show how the reply packet from the server 216.239.53.101 to host 10.0.0.3 is modified by NAT.
- 12 MARKS



Question 4

- a) Describe the main differences between UDP and TCP. Why UDP does exists? Would it have been sufficient to have hosts to send raw IP packets?
5 MARKS
- b) Describe TCP transmission policy using a simple example (how window management and flow control operate in TCP). What are the performance issues (Nagle's algorithm vs. Clark's solution)
10 MARKS
- c) What is the main problem of TCP implementation over wireless networks? What are the typical solutions to deal with this problem?

10 MARKS

Question 5

- a) How does the E-mail architecture deal with the fact that not all the machines can send and receive mail at all times? Describe briefly POP3 and IMAP.

7 MARKS

- b) Using a simple example, describe the architecture of WWW. What is happening on the client machine when the link <http://www.abcd.com/products.html> is selected?

8 MARKS

- c)
- What is the main role of the HTML forms?
 - Describe dynamic web page generation, at both client and server side.
 - In context of server side dynamic web page generation, describe the steps involved in processing a HTML form requesting user information stored in a database.

10 MARKS

Question 6

Suppose that you are working for a large corporation that has been assigned the IP network address 141.222.0.0 and you are requested to create subnets that can each support up to 1024 hosts per subnet.

- a) Explain how many departments (subnets) the corporation can accommodate and explain the logic. What subnet mask need to be used?

8 MARKS

- b) What are the valid host addresses on subnet #1

9 MARKS

- c) What are the valid broadcast addresses for subnet #1

8 MARKS