

*Ollscoil na hÉireann, Gaillimh*  
*National University of Ireland, Galway*

GX 1491

**Spring Examinations, 2003/2004**

Exam Code(s)	<u>3IF1, 3BI1, 3BI2, 3BJ1</u>
Exam(s)	<u>Third Year Information Technology</u> <u>Third Year Industrial Engineering &amp; 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?
- Dividing the transmitted bit stream into frames.
  - Providing error free end-end communications across the network.
  - Determining which route through the subnet to use.
- 6 MARKS
- b) What is modulation? Describe at least three types of modulation giving practical examples.
- 9 MARKS
- c) Describe the terms *bandwidth*, *data rate* and *signal-to-noise ratio*. Outline briefly the definition and implications of both Nyquist's theorem and Shannon's limit. If a binary signal is sent over a 3KHz channel whose signal to noise ratio is 20dB, what is the maximum achievable data rate?

10 MARKS

### Question 2

- a) What is framing? Describe at least two framing methods that are possible at the datalink layer, highlighting possible problems that could occur.
- 7 MARKS
- b) Explain round trip time in the context of Ethernet (IEEE 802.3). The standard minimum frame size allowed on Ethernet (IEEE 802.3) is 64 bytes (from destination address to checksum, including both). Explain the reason behind this limitation.
- 8 MARKS
- c) 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.
- 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 (at the IP level).  
5 MARKS
- b) What problem of IPv4 is NAT (Network Address Translation) solving? Describe briefly the principle of operation and what problems are associated with this solution.  
8 MARKS
- c) In the context of CIDR (Classless Inter-Domain Routing), consider that the ICANN (Internet Corporation for Assigned Names and Numbers) has millions of addresses available starting at 194.32.0.0. Suppose that three companies (company A, B and C) request in the listed order (A first, B second and C the last) 1024, 2000 and 1000 host addresses.
- List for each company the first assigned host address (base address) and last assigned host address
  - List for each company the assigned network mask
  - Describe the routing algorithm for an incoming IP packet with destination address: 194.32.4.17, assuming that the router is updated with information from above.

12 MARKS

### **Question 4**

- a) Describe TCP transmission policy (sliding window protocol) using a simple example.  
5 MARKS
- b)
- What are the performance issues and solutions to those issues (Nagle's algorithm vs. Clark's algorithm).
  - Describe how TCP deals with congestion control.
- 10 MARKS
- c)
- Describe the services that the transport layer has to provide to the upper layer. What is the key function of the transport layer?
  - Describe the problems and solutions associated with transport layer connection establishment and connection release.

10 MARKS

### **Question 5**

- a) Not all machines in the Internet are online all the time. How does the E-mail architecture deal with this fact? Describe briefly POP3 and IMAP.  
7 MARKS
- b) What is a URL? How many parts does a URL have and what are those?  
8 MARKS
- c)
- What is happening when an user clicks <http://www.nuigalway.ie> link?
  - Why dynamic web page generation is important?

- Describe how dynamic web page generation can take place at both client and server side.

10 MARKS

**Question 6**

Suppose that you are working for a large corporation that has been assigned the IP network address 140.203.0.0. The company management wants to be able to accommodate a number of 32 departments and you are requested to design the network layout.

- a) What is the maximum number of hosts per department? Explain the logic of your answer. What subnet mask needs to be used?

8 MARKS

- b) What are the valid host addresses on the first subnet?

9 MARKS

- c) What are the valid broadcast addresses for the first subnet?

8 MARKS