

OLLSCOIL Na hEIREANN  
THE NATIONAL UNIVERSITY OF IRELAND  
NATIONAL UNIVERSITY OF IRELAND, GALWAY.

**SPRING EXAMINATIONS 2000**

Third University Examination in Information Technology  
Third University Examination in Electronic and Computer Engineering

**CT303 / CT303B Networks and Data Communications**

Prof. D Bell  
Dr G. Lyons  
Mr. D.Chambers

Candidates taking CT303

Answer any 5 questions from either Section  
All questions carry equal weight  
Time allowed: **three hours**

Candidates taking CT303B

Answer any 4 questions from **Section A only**  
All questions carry equal weight  
Time allowed: **two and a half hours**

**Section A (Questions 1 to 5)**

- 1.a: What types of *Ethernet* LANs are commonly available (in terms of their cabling and wiring configuration) ?  
4 MARKS
- b: What is meant by the *Network Slot Time* in Ethernet (8802.3) ? What affect would **increasing** the data rate have on the packet size in Ethernet ?  
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.  
8 MARKS

2.a: Discuss the operation of a *Sliding Windows* protocol that could be used for data communications. In particular, show how such a protocol would recover from the typical error conditions that could occur e.g. lost or corrupted packets.

8 MARKS

b: What is the maximum possible *window size* for a sliding window protocol that uses an 8-bit sequence number ? What could happen if the window size was increased beyond this limit ?

4 MARKS

c: HDLC is an example of a *datalink* protocol. Discuss its operation and describe what kind of data frames are used.

8 MARKS

3.a: Outline briefly some of the main similarities and differences between the OSI reference model and the TCP/IP reference model.

4 MARKS

b: Explain how Asynchronous Transfer Mode (ATM) can be used to provide what looks like a "connection-less" Local Area Network service, using LAN emulation. Why is ATM a suitable technology for both traditional computer data and voice / video services ?

8 MARKS

c: Explain the main differences between the various classes of *IP* (Internet Protocol) addresses. If a Class B network on the Internet has a subnet mask of 255.255.240.0 then what is the maximum number of hosts per subnet ?

8 MARKS

4.a: Why does UDP exist ? Would it not have been enough to just let user processes send raw IP packets ?

4 MARKS

b: Discuss the operation of *TCP* (Transport Control Protocol) as used in the Internet. With reference to the packet format used, show it can provide for error free end-end communications.

8 MARKS

c: Outline the domain name hierarchy in use within the college. Explain how the local DNS server might process a request from the *gethostbyname()* system call to find the IP address of the system *www.qub.ac.uk* (use an appropriate diagram to show the steps involved).

8 MARKS

5.a: Discuss how the Sockets API typically handles the following tasks:

- Binding local names to sockets.
- Connection establishment.
- Data transfer.
- Broadcasting.

Explain the typical API flow for a network server using the Windows Sockets *WSAAsyncSelect()* function.

8 MARKS

b: Show how *STREAM* type sockets, in the Internet domain, could be utilised in the design and implementation of a reliable internet banking utility. Use *C* like pseudo-code to illustrate the operation of the Server.

12 MARKS

### **Section B (Questions 6 and 7)**

6.a: What is the typical bandwidth of a switched voice grade telephone channel ? Using high speed modern modems, what is the maximum data rate you might be able to achieve over such a channel ?

4 MARKS

b: Explain how a *MODEM* can transmit digital data over ordinary analog (e.g voice grade telephone) lines, using *Phase Shift Keying* as the means of modulation ? What are the main causes of signal degradation during the transmission of data ?

8 MARKS

c: 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 ?

8 MARKS

7.a: Why has the PCM sampling time, as used in digital speech encoding for the telephone network, been set at 125  $\mu$ S ?

4 MARKS

b: Television channels are generally 6MHz wide. How many bits/sec can be sent over one of these channels if four-level digital signals are used ? Assume a noiseless channel.

8 MARKS

c: What signal-to-noise ratio would be required to put a T1 (1.544 Mbps) carrier on a line with a bandwidth of 50KHz (use Shannons limit).

8 MARKS