

UNIVERSITY OF LONDON  
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1997

MSc Degree in Computing Science  
for Internal Students of the Imperial College of Science, Technology and Medicine

*This paper is also taken for the relevant examinations for the  
Diploma of Membership of Imperial College*

PAPER M2.10

COMMUNICATIONS

Tuesday, May 6th 1997, 2.00 - 4.00

*Answer THREE questions*

For admin. only: paper contains 4  
questions

- 1 In "Internetworking with TCP/IP" Douglas Comer states:

"No single network can serve all users"  
"Users desire universal interconnection"

How does TCP/IP seek to address these requirements? Describe the TCP/IP protocol suite.

Include in your description:

MAC level addressing  
IP addressing  
IP, UDP and TCP protocols  
how local and remote machines are located  
how messages are addressed to different services at the same host  
the names of some services that use UDP and TCP  
the length of time that information should be held in tables  
when and why fragmentation occurs. Discuss the advantages and disadvantages of recombining fragments as soon as possible or at the destination

- 2a Why is error detection and correction necessary in a computer network? Briefly describe the use of parity, Cyclic Redundancy Check (CRC) and Hamming Code for error detection and correction. Under what circumstances might you use each of these methods rather than the others?
- b Given a 7-bit ASCII character describe how you would create a Hamming Codeword that would give 1 bit error correction using four code bits. Show how you would correct a one bit error after receiving a codeword.
- c Given that most errors are likely to be burst errors affecting a contiguous string of bits how could you minimise the possibility of a multibit error occurring within a Hamming Codeword?
- d Add a CRC to the message

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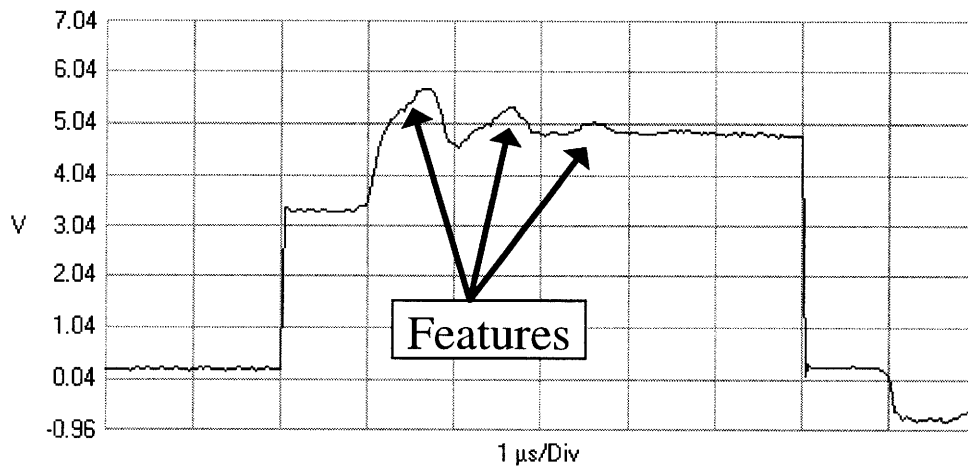
using the generator polynomial  $x^3 + x^2 + x^0$

*The four parts carry, respectively, 35%, 35%, 15%, 15% of the marks.*

- 3a Describe two different LAN technologies. Include a description of the media used and how a message is transmitted from one station to another.
- b What happens if two stations want to transmit at the same time? What type of error checking is performed on the LANs that you have chosen?

*The two parts carry, respectively, 60%, 40% of the marks.*

- 4 The following trace was taken from an unshielded, twisted pair cable that forms part of a computer network.



- a
- Was this trace taken at the receiver or the driver end of the cable and how do you know?
  - What does the trace tell you about the termination of the cable?
  - Carefully describe what has caused the three features indicated.
  - Assuming the propagation of electricity in this cable is  $2 \times 10^8$  m/s, what is the length of this cable?
- b What is the maximum bit rate that I can reliably use if I wish to send frames of data that contain 8 bits over a network that strongly attenuates frequencies above 3600Hz but is otherwise a perfect channel?
- c Briefly describe what is meant by signal propagation delay and transmission delay.
- d The network designers have now included a filter which strongly attenuates frequencies below 300Hz. and as a consequence I have introduced a modem that modulates the phase of an appropriate carrier signal. If the maximum baud rate of the channel is 2400 draw an appropriate constellation diagram for my modem that would give me a maximum bit rate of 19200 bits per second. Give reasons for your arrangement.

*The three parts carry, respectively, 40%, 20%, 40% of the marks.*

End of Paper