UNIVERSITY OF LONDON

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1999

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 M 2.10

NETWORKS AND COMMUNICATIONS
Tuesday, May 4th 1999, 2.00 – 4.00

Answer THREE questions

For admin. only:
paper contains 4 questions

1 a   All TCP/IP networks that are connected to the Internet must use network numbers assigned by the Network Information Center.

    i   How are Class A, B and C networks differentiated?

    ii   What range of addresses is available for each?

    iii   What special addresses are reserved and what are their functions?

  b   i   Outline three techniques for resolving a protocol address to a physical address on a local area network.

    ii   How does an IP host on an Ethernet communicate with another IP host on the same subnet when it doesn't know the destination's physical address?

    iii   What happens if the destination host is on a different subnet, on the other side of a router?

The two parts carry equal marks.

2 a   Three types of impairment can affect an analog signal transmitted in copper cable; *Attenuation*, *Delay distortion* and *Noise*. Briefly describe each of these impairments and show (by means of a diagram) their effect on the analog signal. Why are impairments to analog signals of significance when transmitting baseband binary data?

  b   Rather than use baseband signalling which is subject to the problems described, we can use broadband (or AC) signalling.

    i   Describe three ways in which an AC signal can be modulated to represent a 1 and a 0.

    ii   How can more than one bit be carried on a single change in the AC signal?

  c   State the principle advantages and disadvantages of the following Local Area Networks.

    i   IEEE 802.3 CSMA/CD

    ii   IEEE 802.5 Token Ring

  How is access to the medium controlled in each case?

The three parts carry, respectively, 30%, 30%, 40% of the marks.

3 a   Typical Local Area Networks use a variety of transmission media, Twisted pairs, Coaxial cable and Fibre optics are common examples. For two of these types of media provide a brief physical description and outline the advantages and disadvantages of each. Clearly describe the topology of the network where each would most likely be found.

b   Describe the functions of a repeater and a bridge in Local Area Networks. At which layer of the OSI reference model does each operate?

c   i   How is the source to destination route determined for networks connected via transparent bridges?

ii   How is the source to destination route determined for networks connected via source routing bridges?

iii   Which technique results in the optimal route from source to destination?

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

4 a   All transmission media are susceptible to interference and as a consequence the transmitted bit patterns may be corrupted. By adding redundant bits to a pattern it is possible to implement error detection and error correction codes. In general though, to provide error correction as well as detection requires more redundant bits to be added to the original bit pattern.

i   Give one example of a single bit error detecting code and an example of a single bit error correcting code. Show how the following sequence of binary digits would be protected with each of your codes and illustrate how a single bit error would be detected in both and corrected in the second.

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10110100
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ii   Under what circumstances would the extra redundancy of an error correcting code be worthwhile? When would an error detection code be more preferable?

b   One of the major types of errors that affect Local Area Networks (LANs) are burst errors due interference. This is when a number of, not necessarily consecutive, bits are corrupted. These corrupted bits are surrounded by good bits as the source of the interference is often impulse based. Cyclic Redundancy Codes (CRCs or polynomial codes) are able to detect such burst errors

i   Outline the process of protecting and checking a bit stream using CRC.

ii   Using the Generator polynomial x^3+x+1 calculate the frame to be transmitted after a CRC has been added to

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10110100
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The two parts carry equal marks.

End of Paper