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THE BRITISH COMPUTER SOCIETY
THE BCS PROFESSIONAL EXAMINATION
Diploma

COMPUTER NETWORKS

28th April 2000 - 10:00a.m. - 1:00p.m.
Answer FOUR questions out of SIX. All questions carry equal marks.
Time: TWO hours.

*The marks in brackets are **indicative** of the weight given to each part of the question.*

1. a) Describe **TWO** methods of Media Access Control. **(7 marks)**
- b) Since the refurbishment of the building where I work, I have noticed deterioration in the performance of the UTP connection to my office. I have used a digital scope meter and a pulse generator to test the line. The waveform, measured at the driver, was as shown in **Figure 1** below.

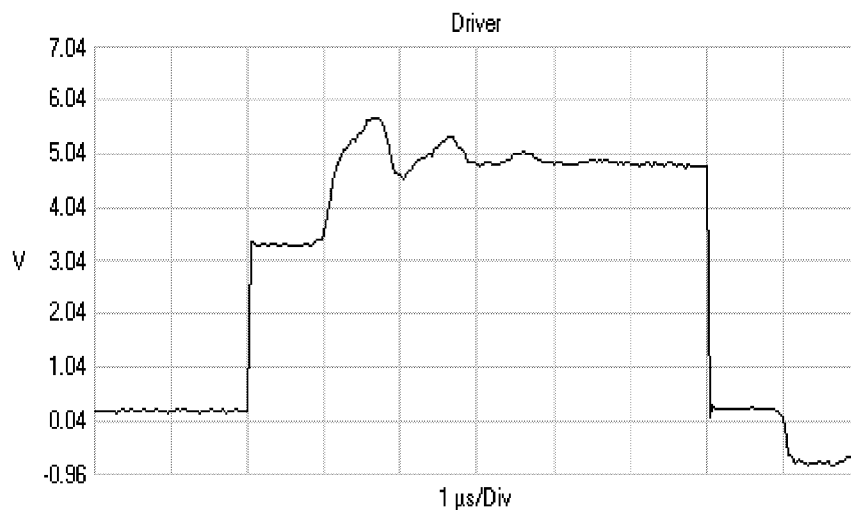


Figure 1

- Explain why this plot helps me determine what has happened to the cable and where the fault lies. You may assume that the propagation speed of the signal in the cable is $2 \times 10^8 \text{ ms}^{-1}$. **(9 marks)**
- c) Having fixed the problem with my UTP connection I have gone on to determine the maximum bit rate I can reliably use. Transmitting the pattern 01110101 at a bit rate of 3000 bits per second generates the waveform shown in **Figure 2** on the next page.

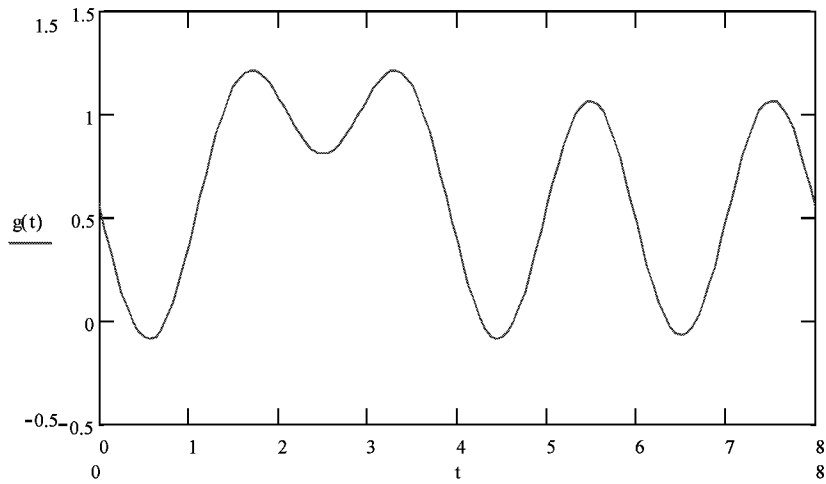


Figure 2

Doubling the speed to 6000 bps generates the waveform shown in **Figure 3** below.

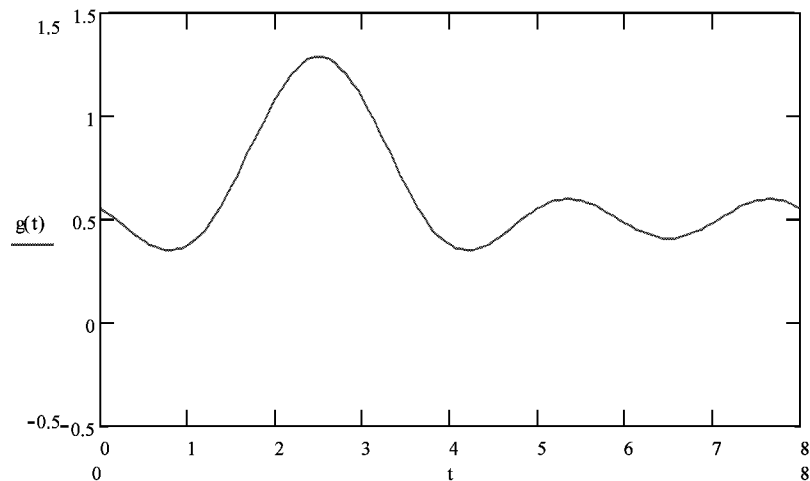


Figure 3

Explain the difference in the waveform in **Figure 3**. What additional information would you require to calculate the bandwidth of this channel? **(9 marks)**

2. a) What are the seven layers of the OSI reference model? Give a brief, one-line description of the aspects of communication covered by each layer. **(7 marks)**
- b) i) How does a router differ from a bridge? Your answer should state the layers of the OSI reference model at which each operates.
- ii) When might one use a bridge and when a router? **(8 marks)**
- c) i) Describe a *non-adaptive* and an *adaptive* routing protocol with which you are familiar.
- ii) If virtually all packet-switching networks use some form of adaptive routing strategy, suggest circumstances when a non-adaptive one may still be needed. **(10 marks)**

3. a) i) What is meant by the term *data transparency*?
 ii) Give an example of a bit-oriented and a character-oriented Data Link layer protocol and describe how data transparency is achieved in each. **(10 marks)**
- b) i) The following bit pattern has been received and decoded by you.
 011000100111
 The transmitter uses a standard Hamming code to provide single bit error detection and permits single bit error correction. Check this bit pattern, if necessary correct it and then extract the original data.
 ii) With what Code Efficiency was this bit pattern sent? **(8 marks)**
- c) Cyclic Redundancy Checks enable a receiver to detect burst errors in addition to single and double bit errors.
 i) What is the definition of an *n-bit burst error*?
 ii) What feature of the CRC generator polynomial ensures that all single bit errors are caught? What feature ensures that all double bit errors are caught?
 iii) Given an R bit generator polynomial, what is the probability of accepting a burst error less than or equal to R bits? What are the consequences of a burst error being exactly equal to R+1 bits? **(7 marks)**
4. a) The network level can establish either a *connection-oriented* or a *connectionless* route between a source and a destination. What are the essential differences between these two types of connection? What advantages and disadvantages do each have? **(8 marks)**
- b) According to RFC 1180, TCP offers a connection-oriented byte stream, instead of the connectionless datagram delivery service provided by UDP. Explain the differences between the two services and their implications. **(9 marks)**
- c) You are designing your own network application.
 i) Under what circumstances might you use TCP?
 ii) Under what circumstances might you use UDP? **(8 marks)**
5. a) Explain what is meant by the terms *circuit switching* and *packet switching*. Identify an application area where it would be appropriate to deploy each of these technologies. **(12 marks)**
- b) With reference to Wide Area Networks (WANs), discuss the relative merits of **TWO** routing algorithms with which you are familiar. **(13 marks)**
6. a) Explain, with the aid of appropriate diagrams, what is meant by the following terms:
 i) amplitude modulation
 ii) frequency modulation
 iii) phase modulation **(6 marks)**
- b) Define the term *baud rate* and show how *bandwidth* and *signal to noise* ratio affect the maximum transmission speed for a particular transmission media. **(10 marks)**
- c) Describe the operation of a data compression algorithm which may be used to transmit data which contains a high proportion of graphical images. **(9 marks)**