

PRIFYSGOL CYMRU; UNIVERSITY OF WALES

DEGREE EXAMINATIONS MAY/JUNE 2003

SWANSEA

Computer Science

CS 238 Data Communications and Computer Networks

Attempt 2 questions out of 3

Time allowed: 2 hours

Students are permitted to use the dictionaries provided by the University

Students are permitted to use the calculators provided by the University

CS_238 DATA COMMUNICATIONS AND COMPUTER NETWORKS

(Attempt 2 questions out of 3)

Question 1.

(a) Draw and carefully label a diagram which represents the ISO 7-layer model. Indicate on your diagram which layers would be found exclusively on a single machine and which would be distributed around a network. State in which layer you would expect to find the following :

1. Data Encryption
2. Wavelength Division Multiplexing
3. Starting and Ending Flags

[8 marks]

(b) Draw a Huffman tree which can efficiently represent the following string :

GHHHHHHIJJJKKKLHHHH

Show the binary code for each letter. (You do not need to show the resulting binary string). Assuming that the original string was represented as ASCII (7 bits / letter), what compression ratio would you have achieved?

[8 marks]

(c) The *non-return to zero level* scheme encodes 0 as a high level signal and 1 as a low level signal. The *differential Manchester encoding scheme* encodes a transition in the middle of each interval and also encodes a 0 with a transition at the beginning of an interval and a 1 without. Show, using a diagram, how each scheme encodes the following 8 bit string :

10010001

[4 marks]

(d) In the context of Asynchronous Transfer Mode (ATM) explain (using a road as an analogy) the difference between a *virtual circuit* and a *virtual channel*. Explain (using diagrams if necessary) the advantages that *Asynchronous transfer* has over *synchronous transfer*.

[5 marks]

Question 2.

(a) You have received the following 11 bit word which you know contains 7 data bits and 4 check bits, encoded using the Hamming single bit coding scheme.

10010100101

Compute, showing your calculations, the checksum. Explain how you can deduce from the checksum that an error has occurred. Explain which bit contains the error and deduce from this the original 7 bit data word.

Explain the difference between *bit errors* and *burst errors*. Describe how block encoding is used to allow Hamming single bit encoding to correct burst errors.

[9 marks]

(b) What kind of networks require a *medium access control* sub-layer. What are the three kinds of strategy for determining the order in which hosts can access the network. What are the main features of each of the three strategies?

[8 marks]

(c) Explain the following terms (One sentence each):-

1. Spectrum
2. Bandwidth
3. Data Rate
4. Baud Rate

[8 marks]

Question 3.

(a) Give three different types of communication media in order of their average data rates.

[3 marks]

(b) Draw a diagram showing how four hosts can send data along a high bandwidth channel using a multiplexer utilising *time division multiplexing*. Give reasonable data rates for typical connections.

[5 marks]

(c) Explain the following terms :-

1. Simplex
2. Half Duplex
3. Full duplex

[3 marks]

(d) Explain the difference between *circuit switching* and *packet switching*. Which type of switching would be used for a telephone call?

[4 marks]

(e) What is the main responsibility of the *session layer* in the ISO 7-layer model? Use an ATM as an example. What are the purposes of, and differences between, minor and major synchronisation points?

[5 marks]

(f) Explain, using diagrams, how the RSA public key crypto system can be used to provide:-

1. Authentication of a message.
2. Secrecy of a message.

[5 marks]