

**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**

**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 :

**GHHHHHHHIIJJJKKKLHHHH**

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]