PRIFYSGOL CYMRU; UNIVERSITY OF WALES

M.Sc. AND DIPLOMA EXAMINATIONS

May/June 2003

SWANSEA

Computer Science

CS M28 Principles and Practice of Network Communications

Attempt 2 questions out of 3

Time allowed: 2 hours

Students are permitted to use the dictionaries provided by the University

Students are NOT permitted to use calculators

CS_M28

PRINCIPLES AND PRACTICE OF NETWORK COMMUNICATIONS

Attempt 2 questions out of 3

Question 1:

a) Calculate the custom subnet to create 9 additional networks to the Network ID 212.42.19.0 (Class C network ID). Show the result in binary and decimal representation for the Octets. How many hosts are available in each of the newly created networks? **[6 marks]**

b) Name the three different main data transfer types and explain briefly their characteristics and how they differ. **[6 marks]**

c) Name four of the many possible metrics used to measure congestion on networks. Name some of the policy decisions that affect congestion on networks when designing the Transport, Network and Datalink layers and explain briefly what needs to be considered in each (name four in each layer for full marks). Point out the difference between the Transport layer and Datalink layer policies. **[9 marks]**

d) Explain the term Hamming Distance and give an example with Hamming Distance 3 for a codeword pair and a codeword group. What minimum Hamming distance is required to (i) detect d single bit errors, and to (ii) correct d single bit errors? Explain this by using the definition of the Hamming Distance. **[4 marks]**

Question 2:

a) Describe the constituent parts of a Computer Network (list three for full marks). Explain briefly the difference between an internet and The Internet. Classify and define the words LAN, WAN, Intranet and Extranet. **[4 marks]**

b) Explain briefly the difference between static and adaptive routing algorithms and give two examples in each category. Explain the concept of isolated routing by giving one example. **[6 marks]**

c) Forward Error Correction. Assume that we transmit the 9 data bits 110011010. Show how Hamming's original method (for detecting and correcting single bit errors) can be used to correct an error in the second data bit (5th bit overall) from the right by the receiver by showing all the steps explicitly. How can the single Hamming bit code method be adapted to detect and correct burst errors of length 6 when codewords (including redundant data) have a length of 10 bits? How many checkbits are transmitted if each codeword (including check bits) consists of 10 bits? **[8 marks]**

d) Explain briefly the idea of Layers in the ISO OSI Computer Networks Model. Give three examples of layers (and name their main functions – minimum two per layer) and classify them using the terms "End-to-End", "Chained" and separately as "Transport Service Users" and "Transport Service Providers". Explain and differentiate the terms "Service" and "Protocol". **[7 marks]**

Question 3:

a) Explain briefly the difference between the terms Port and Socket. Give one example for each. Explain the two types of Ports in TCP/IP. Explain the use of Sockets. **[6 marks]**

b) Explain briefly the requirements for Public Key encryption and the way Public Encryption Key methods enable secure data exchange. What is the main drawback of public key encryption, but how can it still be used efficiently? Explain how public key digital signatures can protect against non-repudiation. Where do the main difficulties lie? **[7 marks]**

c) List, and explain briefly the meaning of, the four central areas of data encryption. What are the two main forms of intruders? **[5 marks]**

d) What type of data compression technique is Huffman encoding and why? Assume that a message contains the probability distribution and characters as follows: Characters K, P, Y, C, W with the probabilities of P(K) = 0.35, P(P) = 0.28, P(Y) = 0.20, P(C) = 0.10, P(W) = 0.07. Construct the corresponding Huffman tree, the codewords, and calculate how many bits on average are needed to transmit a character using the method that you have developed. What saving in terms of bits per character does this represent over transmitting the message without the Huffman encoding? **[7 marks]**