PRIFYSGOL CYMRU; UNIVERSITY OF WALES

M.Sc. AND DIPLOMA EXAMINATIONS

May/June 2002

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 COOMUNICATIONS

(Attempt 2 questions out of 3)

Question 1

a. What is the difference between the logical and physical network topology? Name two types of network topology and illustrate them with appropriate diagrams. Describe the typical physical and logical topology of a LAN using Ethernet and Token Ring.

[5 marks]

b. Name two static routing techniques, explain their functionality and state one advantage and disadvantage for each technique. Explain what is meant by an Isolated Routing technique. Name and describe two Isolated Routing techniques, and discuss their advantages and disadvantages (you need to give one advantage and one disadvantage for each technique).

[7 marks]

c. Name the two main network access methods and explain the way they work. Which of the two main techniques is deterministic and which is probabilistic and why? Discuss the benefits and drawbacks of both methods and compare qualitatively their performance.

[10 marks]

d. Explain and differentiate the concepts of Circuit Switching, Packet Switching and Virtual Calls.

[3 marks]

Question 2

a. Explain the difference between the Transport Service Provider and Transport Service User Layers in the ISO OSI model. Describe the main difference between End-to-End and Chained Layers in the ISO OSI Reference Model**.** Name three Transport Service provider and one Transport Service user layer and explain briefly their function (name at least two "responsibilities" per layer).

[7 marks]

b. Explain the term Hamming Distance in the context of two codewords and a selection of codewords. What is the minimum Hamming distance required in forward and backward error correction to protect against *d* bit inversions? Assume that we transmit the 8 data bits 11010110. Show how Hamming's original method (for detecting and correcting single bit errors) can be used to correct an error in the fourth data bit (7th 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 5 when codewords (including redundant data) have a length of 11 bits? How many checkbits are transmitted if each codeword (including check bits) consists of 11 bits?

[11 marks]

c. Explain the difference between secret and public key encryption. Explain a secret key and a public key digital signature procedure and point out the differences. What are the main difficulties with the two methods presented here when they are implemented?

[7 marks]

Question 3

a. Explain the term Client-Server Model. Illustrate how this model can be used to describe the use of an Internet Browser application.

[3 marks]

b. Explain briefly the significance of data compression in networks. Explain the difference between source and entropy encoding and give one example in each category. What type is Huffman encoding? Assume that a message contains the probability distribution and characters as follows:
Characters R, S, T, U, V with the probabilities of
P(R) = 0.31, P(S) = 0.27, P(T) = 0.22, P(U) = 0.14, P(V) = 0.06.

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 per character does this represent over transmitting the message without the Huffman encoding?

[10 marks]

c. What are the four central areas of data encryption? What are the main forms of intruders?

[5 marks]

d. Given the Network ID below, calculate the custom subnet mask to accommodate 5 additional networks. Show the result in binary and decimal representation for the Octets.
Internic network ID: 207.27.211.0 (Note: This is a class C network ID).

[7 marks]