UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

SUPPLEMENTARY EXAMINATION 2010

Title of paper: **NETWORKS AND CODING THEORY – I**

Course number: **CS437**

Time allowed: **3 hours**

Instructions to candidates:

This question paper consists of **SIX (6)** Questions. Answer any **FOUR (4)** questions. Marks are indicated in the square brackets.

All questions carry equal marks.

THIS EXAMINATION PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

QUESTION 1

a) i) List 2 similarities between the OSI reference model and the TCP/IP reference model. List 3 ways in which they differ. State any three reasons for the layering? [8]

b) i) Explain the term Bandwidth as applies to communication channels and how it limits the baud rate. [4]

ii) Is the Nyquist theorem true for Optical fiber or only for copper wire? [5]

c) Using the CRC method, what frame, $T(x)$, will be transmitted for the data message $M(x) = 1100011111010111 0$ and the generator polynomial $G(x) = x^5 + x^2 + 1$? Why is modulo-2 arithmetic used in calculating CRC's? [8]

QUESTION 2

a) An 8-bit byte with binary value **10011001** is to be encoded using an even-parity Hamming code. How many check bits are needed to ensure that the receiver can detect and correct single bit errors? What is the binary value, **codeword**, after encoding? [5]

b) What are transmission impairments? State and briefly describe the different types of noise. [7]

c) Ethernet LAN uses Manchester encoding. With the aid of an appropriate example explain the difference between Manchester encoding and Differential Manchester encoding. Why are they said to be well suited to synchronous framing? [7]

d) Describe the CSMA/CD algorithm and the Pure ALOHA algorithm for managing a shared channel usage. [4]

e) State 2 causes and or sources of transmission errors. [2]

QUESTION 3

a) List three (3) data communications standards bodies. [3]

b) Distinguish between single and multimode fiber. Sate 2 advantages of using multimode fiber? [5]

c) Briefly describe the operation of the following carrier sense multiple access protocols:
   i) 1- persistent CSMA
   ii) CSMA/CD [4 marks each]

d) i) Define the Hamming Distance between two codewords. [3]

ii) Assume the message to be sent is the word "LAN" and the ASCII coding scheme is used. Complete the table below to show the byte representation for each character as well as the Longitudinal Redundancy Check (LRC)/ (BCC) for the frame. Consider even parity. ***Show all your working*** [6]

Character	**Byte (8 bit representation)**	**Parity bit (Even parity)**
L		
A		
N		
LRC (BCC)		

QUESTION 4

a) Two Ethernets can be interconnected using a bridge, which forwards packets between the networks at the OSI Datalink layer. Describe the operation of an Ethernet bridge. [7]

b) Describe circuit switching. Describe the two "flavors" (or fundamental methods) of packet switching. Describe the overheads present in packet switching and in circuit switching. In the context of circuit switching, what is "blocking"? [10]

c) With the aid of clear diagrams, briefly describe two (2) LAN topologies that are commonly used for data transmission over short distances. [8]

QUESTION 5

a) Explain the principle of operation of an ADSL modem. Include in your answer a discussion of the impact of ADSL modems on web access levels. [6]

b) Briefly explain how CSMA/CD handles medium access on a multipoint link. [5]

c) Distinguish between X-ON / X-OFF flow control with credit based flow control. [4]

d) Compare the following transmission media of twisted pair cable, coaxial cable and fiber optic cables. [10]

QUESTION 6

a) Compare parity check with CRC in terms of computation complexity and error detection rate. [7]

b) The serial ports on two computers which use binary signaling are connected by a twisted pair cable. The cable has a flat frequency response up to 12 kHz, with negligible group delay distortion. [10]

   i. What is the maximum information transfer rate that can be accommodated by the cable, assuming a noise-free environment?
   ii. If the noise introduced by the cable is -40 dB with respect to the signal power, what is the resulting maximum information transfer rate?

c) Give three (3) characteristics that differentiate between LANs and WANs. [3]

d) Two antennas at a height 150m are supposed to communicate. Assuming that there are no intervening obstacles, what is the maximum distance that can be between the 2 antennas? [5]