

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

SUPPLEMENTARY EXAMINATION 2011

Title of paper: NETWORKS AND CODING THEORY – I

Course number: CS437

Time allowed: 3 hours

Total Marks: 100

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) Distinguish between a Protocol and an Interface. List 3 ways in which the OSI reference model differs from the TCP/IP model. State any three reasons for the layering? [8]
- ii) Name at least three standards organizations (in the area of networking) and briefly describe what they standardize and how they operate. [6]
- b) i) Explain the term Bandwidth as applied to communication channels. How does bandwidth and signal to noise ratio affect the maximum transmission speed for a particular transmission media. What is more desirable high or low signal to noise ratio? [6]
- ii) Is the Nyquist theorem true for Optical fiber or only for copper wire? [2]
- iii) What is different about the method used to boost a digital signal's strength, compared with the method of boosting an analog signal's strength? [3]

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? [6]
- b) Using the CRC method, what frame, $T(x)$, will be transmitted for the data message $M(x) = 11000111110101110$ and the generator polynomial $G(x) = x^5 + x^2 + 1$? Why is modulo-2 arithmetic used in calculating CRC's? [9]
- c) Describe 2 of the advantages of ISDN over normal analogue dial-up telephone lines. Explain the operating characteristics and cost differences between dial-up and private (leased) circuits. [10]

QUESTION 3

- a) Ethernet LAN uses Manchester encoding. With the aid of an appropriate example explain the difference between Manchester encoding and NRZ encoding. Why is Manchester encoding said to be well suited to synchronous framing? [6]
- b) Describe the CSMA/CD algorithm and the Pure ALOHA algorithm for managing a shared channel usage. [4]
- c) With the aid of clear diagrams, briefly describe two (2) LAN topologies that are commonly used for data transmission over short distances. [6]
- d) State any 3 factors that can be used to compare data encoding schemes/techniques. Briefly describe the following encoding techniques: [9]
- i. Frequency Shift Keying (FSK)
 - ii. Pulse code modulation (PCM)

QUESTION 4

- a) With the aid of clear diagrams, show the encoded signal if the bit stream 1100111010010110 is encoded using: [10]
- Manchester encoding
 - NRZ-I

- c) The following waveform has been received:



What binary value does this represent if you assume that the waveform represents Differential Manchester encoded output? [5]

- 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]

QUESTION 5

- a) A 7-bit ASCII character is encoded using the Hamming code and is transmitted to a receiver. If the bit pattern 11000010101 is received, show how the receiving station checks for an error. [12]
- Determine if there is any error, and show how the error can be corrected.
 - What was the original ASCII character?
- b) 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. [7]
- c) Briefly explain why in a 10Base Ethernet a station can be certain that a data frame is successfully transmitted without collision if no collision is detected during the transmission of the first 64 bytes of data. [6]

QUESTION 6

- a) Give three (4) characteristics that differentiate between LANs and WANs. [4]
- b) Suppose a noisy channel has a signal-to-noise ratio of 30dB, and a bandwidth of 4 kHz. What is the maximum data rate possible for this channel? [6]
- c) Explain how synchronization is accomplished at the Data link layer. [9]
- d) Two antennas at a height 200m are supposed to communicate. Assuming that there are no intervening obstacles, what is the maximum distance that can be between the 2 antennas? [6]

<<End of Question Paper >>