

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

MAIN EXAMINATION 2007

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

Course number: **CS437**

Time allowed: **3 hours**

Instructions: **Answer any 5 of the 6 questions.**

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Question 1

- a) Give an overview of the problems solved by each layer of the OSI Reference Model. [15]
- b) Contrast *dedicated circuits* and *virtual circuits*. [2]
- c) Distinguish between *simplex*, *duplex* and *half-duplex* communication. [3]

Question 2

- a) Describe the main problems preventing signals from being accurately transmitted through a medium. [12]
- b) Draw diagrams showing the encoding of the bit string 10000111 by:
i. Bipolar encoding
ii. Manchester encoding
iii. Differential Manchester encoding

State all assumptions. [6]
- c) Briefly explain any two advantages of digital signals over analogue signals. [2]

Question 3

- a) Consider the linear feedback shift register represented by the string 1101001. Draw a series of diagrams showing the step-by-step operation of this device as it computes the cyclic redundancy check for the message 10010110. [10]
- b) Give an overview of the telephone network, mentioning the role of local loops, trunks, switching methods and modems. [10]

Question 4

- a) Explain how synchronization may be accomplished at the data link layer by *asynchronous* and *synchronous* means. [6]
- b) Explain the method of *framing* employed at the data link layer in *character-oriented* synchronous data lines. [8]
- c) What is the goal of *flow control*? In addition, explain the X-On/X-Off flow control method. [6]

Question 5

- a) Explain in detail the Idle RQ method of feedback error control. In particular, how are lost and duplicated frames handled?

[9]

- b) Define link efficiency. Hence derive the following formula for the efficiency of a link over which Idle RQ is used, stating all assumptions:

$$U = \frac{1}{1+2a}$$

[6]

- c) Assuming frame size to be 100 bits, calculate the efficiency of a 1 km link having bit rate of 10 Mbps and propagation velocity of 2×10^8 m/s.

[5]

Question 6

- a) Describe how Ethernet avoids, detects and recovers from collisions.

[12]

- b) Describe how the Ethernet MAC unit responds to an incoming signal.

[4]

- c) List any four responsibilities of the token ring monitor.

[4]