

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Electronic Engineering

MAIN EXAMINATION MAY/JUNE 2010

**Title of Paper: COMPUTER NETWORKS & OPEN SYSTEMS
INTERCONNECTIONS**

Course Code: ECO 520

Time Allowed: 3 hours

Instructions to candidates:

*This question paper consists of **FIVE(5)** questions. Answer any **FOUR (4)** questions.
Marks are indicated in 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) Explain the concepts of “open systems” and ‘protocol layering’. [4]
- ii) By means of a protocol layer diagram based on the ISO’s OSI seven layer reference model, show how data is transmitted from one computer to another over a network and clearly indicate on the diagram what is meant by a ‘peer to peer protocol’. [5]
- iii) What functions are performed by the Data Link and Transport layers within the ISO seven layer model? [4]
- b) i) Define the term baud rate and show how bandwidth and signal to noise ratio affect the maximum transmission speed for a particular transmission media. [8]
- ii) 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? [4]

QUESTION 2

- a) The network level can establish either a connection oriented or a connectionless route between a source and a destination. What are the differences between these 2 types of connection? What advantages and disadvantages does each have? [8]
- b) In a data communication network, a sender encodes all 7-bit ASCII characters using an even parity Hamming code before transmission to a receiver. Assuming that a receiver in the network receives the bit pattern **10111001001**. Show all your working.
- i) Use the Hamming code scheme to check if the bit pattern has any error, if in error which bit position(s) that is in error? [8]
- ii) Indicate the **ASCII** character that was transmitted. [4]
- c) Explain the difference between error detection and error correction. Which approach requires more information to be sent, in addition to the original data? [5]

QUESTION 3

- a) i) With the aid of appropriate examples explain the operation of NRZ-I encoding and Manchester encoding. [6]

ii) The following waveform has been received:



What binary value does this represent if you assume that the waveform represents:

- Manchester encoding output
 - Differential Manchester encoded output [6]
- b) Explain the difference between flow control and congestion control. [3]
- 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 4

- a) i) Compare parity check with CRC in terms of computation complexity and error detection rate. [4]

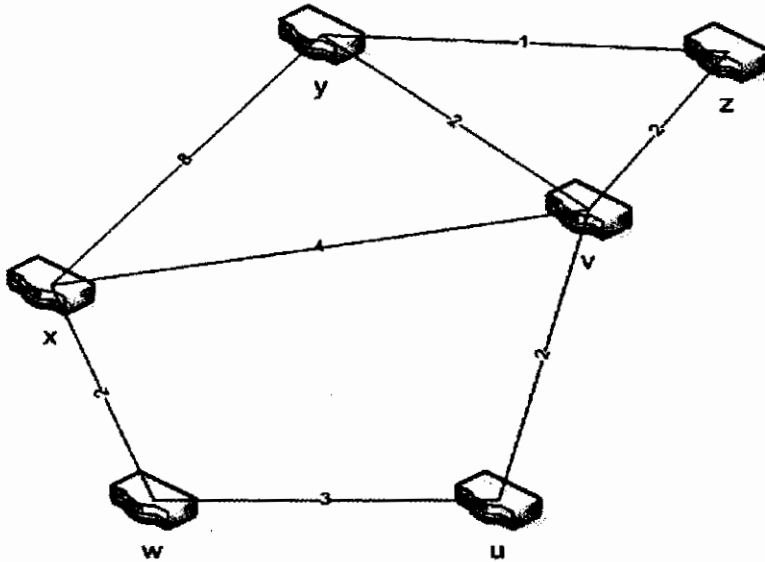
ii) Compute the CRC for the following data frame, $M(x)$, given the generator polynomial, $G(x)$. Find $R(x)$ and hence find the complete transmitted frame bit pattern:

$$\text{Data, } M(x) = 11001011011$$

$$\text{Generator polynomial, } G(x) = x^4 + x + 1 \quad [5]$$

- b) What happens in CSMA/CD when a node detects that its data has suffered a collision? [3]
- c) i) What functions are performed by a router? Why is it important for routers to know about all of the possible routes through a network topology? [5]
- ii) State one main difference between the Link state and Distance Vector routing algorithms. [1]

iii) Consider the following network.



With the indicated link costs, use Dijkstra's shortest-path routing algorithm to compute the shortest path from node u to all network nodes. Hence create the routing table for node u . [7]

QUESTION 5

- a) Give a detailed account of the following congestion control techniques for virtual circuit and datagram networks:
- Leaky bucket
 - Jitter control
 - Load shedding [3 marks each]
- b) Explain the process through which a device gets an IP address using DHCP. [5]
- c) State 2 ways in which IPv4 and IPv6 addresses differ. What are the two key portions of an IPv4 address? Use examples in your answer. Give an example of a Class B IP address. How many class B subnets can there be? [9]
- d) The IPv4 address space is considered to be too small to accommodate future Internet growth. Explain any 2 reasons for this. [2]