UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 5 Examination in Engineering: June 2015 (Old Curriculum)

Module Number: EE5315 **Module Name: Digital Communication and Computer Networking**

[Two Hours]

[Answer **all questions**, each question carries five marks]

Q1 a) Briefly explain the importance of using layered protocols architectures in data communication.

[1 Mark]

b) Which of the Open Systems Interconnection (OSI) layers handles each of the following functions?

i) Constructing a packet by encapsulating upper layer data.

[0.5 Marks]

ii) The task of the Address Resolution Protocol (ARP).

[0.5 Marks]

c) Why has the Transmission Control Protocol (TCP)/Internet Protocol (IP) model replaced the OSI reference model? Give at least three reasons.

[1 Mark]

d) Assume that you are trying to access the File Transfer Protocol (FTP) server in your Local Area Network (LAN) from your computer. Explain the procedure in which the information is flowing using the OSI layered model and their protocols.

[2 Marks]

Q2 a) A host on a LAN wishes to send the following bit stream: 111100110110.

i) Sketch the Manchester encoding for this bit stream.

[0.5 Marks]

ii) Sketch the differential Manchester encoding for this bit stream.

[0.5 Marks]

b) Determine the maximum bit rate and appropriate signal levels for a channel having bandwidth of 2400 Hz under the following signal to noise ratios.

i) Signal to noise ratio is 0dB.

[0.75 Marks]

ii) Signal to noise ratio is 10dB.

[0.75 Marks]

c) Explain the terms simplex-system, half-duplex system and full duplex system in the context of data communication.

[1.0 Mark]

d) Assume host A transmits data to host B using a bit-oriented data link protocol with frame tags. The starting and ending frame tags consist of the bit sequence 100000001. Host A performs bit stuffing by inserting a 1 bit whenever six 0 bits appear in sequence.

i) If the host A wants to send the binary data message 01101000001100000000001010000001 to host B, what does the message look like to host B after tagging and bit stuffing? (Assume there were no errors in transmission.)

[0.75 Marks]

ii) If host B receives the binary message 10000000101001100000010010000001 from host A, what was the original data message?

[0.75 Marks]

Q3. a) Consider the delay of pure ALOHA versus slotted ALOHA at low load (i.e. when there are very few stations trying to send). Which one is having lowest delay? Explain your answer.

[1 Mark]

b) Why Ethernet choose Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as its protocol instead of others. Please list its advantages and compare it with slotted ALOHA, pure ALOHA and CSMA.

[2 Marks]

c) What is the advantage of sliding-window flow control compared to stop-and-wait flow control?

[1 Mark]

d) Describe the selective repeat mechanism in sliding window protocol. Use relevant diagrams to show how NAK (Negative Acknowledgement) speed up this mechanism. Explain how this mechanism works in the situation where NAK get lost due to the noise in transmission.

[1 Mark]

Q4. a) Explain what is ARP and how does it work?

[1 Mark]

b) The following character encodings were used in data link layer protocol.
A : 11010010
B : 00111001
FLAG : 01111110
DLE (Data Link Escape) : 11110010

Show the bit sequences transmitted in binary for the following character frame "A DLE FLAG B" by using, character oriented framing and bit oriented framing.

[2 Marks]

c) What are the two basic error correction methods? Give at least one example for each case.

[1 Mark]

d) A channel has a data rate of 4kbps and a propagation delay 20ms. For what range of frame sizes does stop-and-wait give an efficiency of at least 50%.

Hint : 20% efficiency implies a utilization $U = 0.2$
For stop-and-wait,

$$U = \frac{1}{1+2a}, \quad a = \frac{\text{Propagation delay}}{\text{Transmission time}}, \quad \text{Transmission time} = \frac{\text{Distance}}{\text{Data rate}}$$

[1 Mark]