



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013**

COURSE NAME : DATA COMMUNICATION
COURSE CODE : BEX 43403 / BEP 4223
PROGRAMME : BEE
EXAMINATION DATE : JUNE 2013
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 Consider a telecommunication link that is to be set up for data communication services between earth station and moon base station. The data rate of 1 Mbps is being deployed in order to send color images from the moon. Each image consists of 8,000 x 8,000 pixels, and 16 bits are used for each of the three-color components of each pixel. The distance between earth and the moon is approximately 380,000 km.

- (i) What is the image transmission rate over the link in terms of “images per second”. The transmission of each image is done as a single block. Calculate the total time it takes to get an acknowledgment back from the earth? Assume that ACK time is much less than frame transmission time ($t_{ack} \ll t_f$) and the speed of light is 3×10^8 m/s.

(5 marks)

- (ii) Consider the following definitions as regards to Go-Back-N and Selective Repeat ARQ,

P_f - probability that a frame transmission has an error, assuming that it is

independent of other frames transmission, where $P_f = 1 - (1 - BER)^{n_f}$

n_o - the number of overhead bit in a frame.

n_f - number of bits in the frame.

W_s - size of the send window, given as $W_s = \frac{2 \cdot t_{prop} + t_{ack}}{t_f} + 1$.

Develop from first principle the expression for for the protocol efficiency, η of Go-Back-N ARQ and Selective-Repeat ARQ.

(12 marks)

- (iii) The efficiency of link transmission protocol is a measure of their ability to provide reliable transfer of these images from the moon to earth. Suppose that the BER is 10^{-5} , compare the efficiencies(η) of Go-Back-N ARQ protocol and Selective Repeat ARQ protocol for this transmission, given that $n_o = 20$ bytes, $n_f = 4080$ bits and $n_{ACK} = 64$ bits. Comment on the results.

(8 marks)

- Q2** A CRC codeword is to be generated using shift registers and Ex-OR circuits, that could produce a 4-bit FCS for a given 11 bit dataword. The generator polynomial is given as, X^4+X^3+1 .
- (i) Design and describe the circuit that can perform this task. (7 marks)
- (ii) The dataword is given as 1 0 0 1 1 0 1 1 1 0 0 , then generate the codeword using the circuit above. (8 marks)
- (iii) Show the outcome of the of the code generator by using polynomial division and binary division. (10 marks)
- Q3** One of the function of data link layer is multiple access protocols. It is classified into random access protocols and control access protocols.
- (i) Compare and contrast between CSMA/CD and Token Ring MAC protocol. (8 marks)
- (ii) FDDI uses Token Ring MAC protocol for packet transmission. Calculate the utilization of Token Ring protocol in terms of Token Holding Time, Ring Latency, number of nodes and data rate. (4 marks)
- (iii) Consider an FDDI LAN is to be used to transmit voice packets of a set of users, at a coding rate of 64 kbps and each voice packet contains 20 ms speech.
- (a) Assume that each station handles a single voice call and that stations are 100 meters apart. The FDDI ring is required to transfer each voice packet within 10 ms. Determine the number of nodes that the FDDI accommodate while meeting the transfer requirement? (7 marks)

- (b) Estimate the total number of simultaneous calls that it can manage if each station is allowed to handle up to 8 calls?

(6 marks)

- Q4** (i) In network layer, differentiate between classful addressing and classless addressing.
(7 marks)

- (ii) An ISP, is granted a block of addresses starting with 150.80.0.0/16. It needs to allocate these blocks to 2600 nodes according to the following division: Division A, consists of 200 medium size businesses, each is given 128 addresses. Division B, consists of 400 small businesses in which each one is given 16 addresses. Finally the Division C has 2000 homes, in which each home is allocated 4 addresses. Design the subblocks based on the slash notation for each subblock and evaluate the capacity of address allocation.

(18 marks)

- Q5** Switching system is a fundamental requirement for internetworking. You are required to design three stage crossbar switch based on the following criteria.

First Design: A three stage space division switch with total number of inputs, $N=100$, 10 crossbar at first and third stage and 4 crossbars at the middle stage.

Second Design: A three stage space division switch with total number of inputs, $N = 100$ (may varies slightly) and using Clos's criteria.

- (i) Produce the first and second design according to the specifications above by calculating the total number of crosspoints and blocking factor for both design. Then evaluate the performance between the first and second design.

(15 marks)

- (ii) Show the determination of Clos's criteria.

(10 marks)

Q6 (i) TCP general mechanism for handling congestion is based on three phases: Slow Start, Congestion Avoidance and Congestion detection. By constructing the flow diagram and timing graph, analyze the process of congestion control in TCP.

(13 marks)

(ii) Consider TCP is operating in a line of 100 Mbps link that has no congestion. Analyze the behavior of slow start if the link has RTT as 20 ms, receive window of 20 kbytes, and MSS(maximum segment size) of 1 kbyte. How does the speed of the link influence the congestion control behavior if it is set at 1 Mbps and then at 100 kbps?

(12 marks)

- END OF QUESTION -