UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	DATA COMMUNICATION NETWORK
COURSE CODE	:	BEB40903
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 Consider a stop and wait protocol as applied in the telecommunication system where the transmitter and receiver work on the delivery of one frame at a time through an alternation of actions. The efficiency of stop and wait protocol for an error free channel is given as the ratio of effective information transmission to the channel transmission rate.

(a) Derive the protocol efficiency in terms of various frame sizes and delay-bandwidth product. State the definition of each term in the final outcome.

(6 marks)

(b) Consider the efficiencies of stop and wait protocol for various scenarios as given in the Table 1. Assume that the number of overhead bits in a frame and the number of bits in the ACK frame is the same and equal to 8 bytes.

Table 1: Efficiency Comparison for Stop and Wait
Protocol in various scenarios

SCENARIOS	FRAME SIZE	$t_{prop} + t_{proc}$	Bit rate (bps)
1	1024 bytes	50 ms	30 kbps
2	1024 bytes	50 ms	1.5 Mbps
3	64000 bytes	50 ms	30 kbps
4	64000 bytes	50 ms	1.5 Mbps

(i) Calculate the efficiency of each scenario.

(4 marks)

(ii) Produce a comparative analysis on the effect of certain parameters on the efficiencies based on the above scenarios.

(10 marks)

(iii) It was found that in stop and wait protocol, it wasted a certain amount of time for every frame waiting for ACK frame. For each scenario above calculate the amount of time wasted for each frame waiting for ACK.

(5 marks)

Q2 Consider an 8 bit dataword, 1 1 1 0 0 0 1 1 is to be transmitted via a CRC generator which is made up of registers and EX-OR circuits. The circuit produce a 5 bit CRC code. The generator polynomial is given as, X^5+X^4+X+1.

(a) Design and describe the circuit that can perform this task.

(7 marks)

(b) Generate the codeword using the circuit above.

(8 marks)

(c) 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. One of the protocol is the CSMA/CD.

(a) (i) Produce a block diagram that represents the implementation of this protocol by considering the two cases of Non-persistent CSMA and p-persistent CSMA.

(7 marks)

(ii) Derive the throughput of CSMA/CD protocol. Defines all the term used.

(8 marks)

(b) A 10 Gb/s Ethernet LAN with ten users attached to it uses CSMA/CD. The bus is about 10 meters, and users' frames are restricted to a maximum size 1,500 bytes. Based on the statistics, four users in average are active at the same time. Analyze the network by calculating all the performance parameters such as propagation and transmission times, average utilization and the contention probability.

(10 marks)

Q4 (a) One of the main issue of internetworking addressing is the sustainability of each addressing mechanism. Consider an estimated population of 620 million people.

(i) What is the maximum number of IP addresses that can be assigned per person using IPv4? Design an appropriate CIDR to deliver this addressing.

(ii) What is the maximum number of IP addresses that can be assigned per person using IPv6?

(12 marks)

(b) 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.

(13 marks)

Q5 Switching system is a fundamental requirement for internetworking. Multistage switching fabrics provide a very efficient usage of crosspoints as compared to single stage fabric.

(a) You are given a three stage switch fabric as shown in **Figure Q5(a)**. Label the necessary parameters of the fabric, then calculate the total number of crosspoints. Find the ratio of the total number of crosspoints in the three-stage switch compared to a single stage switch.

(10 marks)

(b) 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.

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)

Q6 (a) Consider a wide area network in which two hosts, A and B, are connected through a 100 km communication link with the data speed of 1 Gb/s. Host A wants to transfer the content of a memory with 200 Kb of music data while host B reserves portions of its 10 parallel buffers, each with the capacity of 10,000 bits. Use the Three-Way Handshake diagram and assume that host A sends a SYN segment, where ISN = 2,000 and MSS = 2,000 and that host B sends ISN = 4,000 and MSS = 1,000. Sketch the sequence of segment exchange, starting with host A sending data at time t = 0. Assume host B sends ACK every five frames.

(13 marks)

(b) Consider that Host B transfers a large file of size *f* to Host B with MSS = 2,000 bytes over a 100 MB/s link. Find *f* such that the TCP sequence numbers are not exhausted, given that the TCP sequence number field has 4 bytes. Find the time it takes to transmit file of size *f*. In the calculations, the link, network and transport headers need to be included.
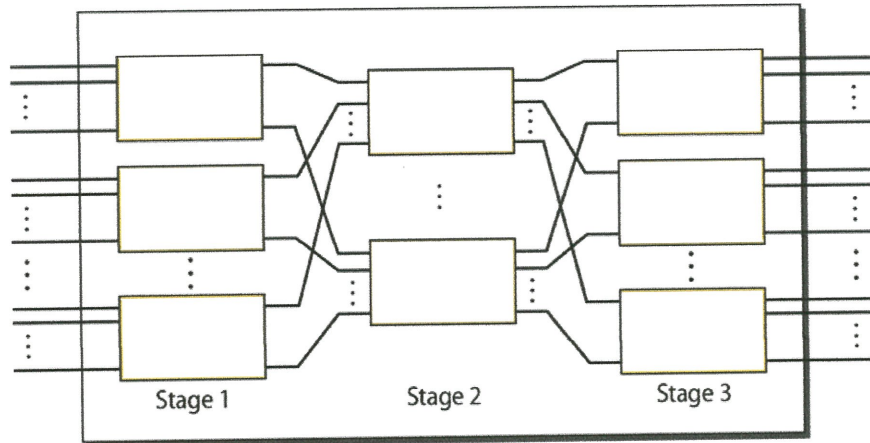
(12 marks)

- **END OF QUESTIONS -**

Figure Q5(a)