Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	DATA COMMUNICATION NETWORK
COURSE CODE	:	BEB 40903
PROGRAMME	:	BEJ
EXAMINATION DATE	:	DECEMBER 2014/JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) Sketch the OSI Reference Model and TCP/IP Procotol Suite side-by-side.

(3 marks)

(b) Consider a 4-layer protocol implementation with application, TCP, IP, and Ethernet layers in that order (top to bottom). Each layer requires a header except the Ethernet layer, which requires a header and trailer. The application header is 16 bytes in length, TCP header 20 bytes, IP header 20 bytes, Ethernet header 14 bytes, and Ethernet trailer 4 bytes.

(i) Illustrate a data message for this system by showing and labeling all headers, trailers, and data fields at each layer on both the transmitting and receiving ends.

(4 marks)

(ii) Analyse the amount of overhead (in percentage) for a 4096-byte application message. Assume a maximum data field for an Ethernet frame of 1500 bytes.

(4 marks)

(c) "Digital transmission is the preferred method of transmission by the telecommunication industry."

Assess the above statement by providing FOUR (4) detailed reasonings.

(8 marks)

(d) Consider an asynchronous transmission system with 1 start bit, 3 data bits, 1 parity bit, and 2 stop bits. Calculate the maximum utilization possible on this link (assuming no errors).

(2 marks)

(e) Compare the differences between the OSI Reference Model and the IEEE 802.3.

(4 marks)

Q2 (a) With reference to the error-detection technique:

(i) Distinguish between forward error correction, and error correction by retransmission.

(3 marks)

(ii) Discuss TWO (2) types of error that are undetectable by the checksum.

(4 marks)

(b) In **Table Q2**, the sender sends dataword 10. A 3-bit error corrupts the codeword. Determine if the receiver is able to detect the error.

Table Q2

Datawords	Codewords
00	000
01	011
10	101
11	110

(3 marks)

(c) Given the dataword is 1010011110 and the generator is 10111.

(i) Generate the codeword at the sender site by using polynomial division.

(4 marks)

(ii) Show the process at the receiver site in determining either the codeword contained error.

(4 marks)

(d) Compare between flow control and error control.

(3 marks)

(e) Show how adding sequence numbers and acknowledgement numbers can prevent duplicates in Stop-and-Wait protocol.

(4 marks)

Q3 (a) A system uses the Stop-and-Wait ARQ Protocol. Each packet carries 1000 bits of data with the capacity of 1 Mb/s. Find the time it takes to send 1 million bits of data if the distance between the sender and receiver is 5000 km and the propagation speed is 2×10^8 m/s. Ignore waiting and processing delays, and also the overhead due to the header and trailer. Assume no data or control frame is lost or damaged.

(4 marks)

(b) Repeat **Q3(a)** using the Go-back-N ARQ Protocol with a window size of 7. Similarly, ignore waiting and processing delays, and also the overhead due to the header and trailer.

(5 marks)

(c) Compare the performance of circuit switching, datagram packet switching, and virtual circuit packet switching. Your comparison must include the performance aspects of all three switching technologies, such as delay, storage, connectivity, bandwidth utilisation, and overhead.

(10 marks)

(d) Considering a small network of four hosts and three links;

A → B → C → D

A message containing 1,024,000 bits is to be sent from A to D. The data rate of the first two links is 0.4 MB/s, but the link between C and D is 1.6 MB/s. Processing time at the hosts and propagation delays of the links are negligible. Assuming that packet switching is used, with packet size of 128 bytes and header size of 22 bytes, calculate the time to send the message from A to D. Packets are forwarded one at a time and both set-up and disconnection times are ignored.

(6 marks)

Q4 (a) Consider a network in which for each link, the link capacity is greater than the sum of the input rates for all end systems in the network. Analyse if

(i) the congestion control is needed in this scenario.

(2 marks)

(ii) the flow control is needed in this scenario.

(2 marks)

(i) it would be better to use circuit switching or packet switching in this network.

(2 marks)

(b) Analyse a blocking or non-blocking situation in the Space Division Switching method by referring to both the single-stage and multi-stage switch.

(8 marks)

(c) Differentiate the functions of a hub and a layer 2 switch with reference to a LAN.

(6 marks)

(d) Nodes A and B are attached to the opposite ends of a 100-Mbps Ethernet cable segment. Node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. In order for A to be able to detect collision with B, calculate the maximum length of the Ethernet cable segment. Assume that the transmit frame size is 500 bits and signal propagation speed is 2×10^8 m/s.

(5 marks)

Q5 (a) Internet Protocol (IP) and User Datagram Protocol (UDP) are both unreliable. Analyse the degree of realibility of both protocols.

(4 marks)

(b) An organization is granted the block 16.0.0.0/8. The administrator wants to create 500 fixed-length subnets. Determine:

(i) the subnet mask.

(2 marks)

(ii) the first and last valid addresses in subnet 1.

(3 marks)

(iii) the first and last valid addresses in subnet 500.

(4 marks)

(c) Using Dijkstra least cost algorithm, produce the routing table for node 3 to all other nodes for the network in **Figure Q5(c)** below.

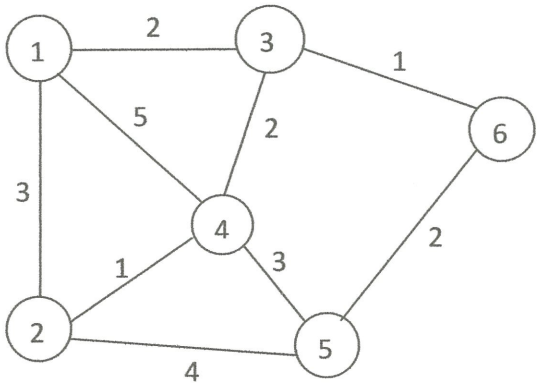

Figure Q5(c)

(6 marks)

(d) Discuss THREE (3) benefits of IPSec (IP Security).

(6 marks)

- END OF QUESTION -