UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2009/10

SUBJECT NAME	:	DATA COMMUNICATION
SUBJECT CODE	:	BEP4223
COURSE	:	4BEE
EXAMINATION DATE	:	NOVEMBER 2009
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS PAPER CONSIST OF NINE (9) PAGES

Q1 Assume that an audio file containing a stream of static images and voice is transferred via Internet connection.

(a) Identify the OSI layer that responsible for the following task.

(i) Determining the best path to route packets.
(ii) Providing end-to-end communications with reliable service.
(iii) Providing node-to-node communications with reliable service.
(iv) Start and stop the transmission order.
(v) Route data to different network.

(5 marks)

(b) Scanner at the receiver has a resolution of 600 x 600 pixels/square inch. Calculate the bits produced by an 8-inch x 10-inch image if scanning uses:

(i) 8 bits/pixel

(ii) 24 bits/pixel

(5 marks)

(c) Suppose that the speech signal is to be quantized and then transmitted over a 28.8 kbps modem and the bandwidth of 8 kHz. Calculate the SNR_{dB} of the received speech signal?

(2 marks)

(d) Suppose that the system is using a 64 kbps modem, identify the SNR of the received speech signal.

(2 marks)

(e) Assume that the system is using a low-pass communications system with 1 MHz bandwidth. Distinguish:

(i) the bit rate attainable using 8-level pulses.

(ii) Shannon capacity of this channel if the SNR is 20 dB.

(iii) Shannon capacity of this channel if the SNR is 40 dB.

(6 marks)

Q2 Consider a stream of bit is transferred in digital channel.

(a) Assume that the channel is using Go-Back-N-ARQ for data flow control. The header of the frame contains 3 bit information. The system is sending four (4) frames namely Frame (0), Frame (1), Frame (2) and Frame (3). Frame (2) corrupted during transmission time and the successful frame is acknowledged for every two (2) frames sent. Plan the data flow sequence for this transmission.

(6 marks)

(b) Suppose that bit stream for Frame (1) is 0101110. Construct the data sent by using NRZ-L and Manchester encoding scheme. Assume that earlier bit is high.

(2 marks)

(c) The corrupted message of Frame (2) is T = 0001110. Shows that the message is damage by using CRC method with $p(x) = x^3 + x + 1$.

(2 marks)

(d) That system is needed to use synchronous TDM and combine 20 digital sources, each of 100kbps. Each output slot carries 1 bit from each digital source, but one extra bit is added to each frame for synchronization. For this case, evaluate:

(i) the size of an output frame in bits.
(ii) the output frame rate.
(iii) the duration of an output frame.
(iv) the output data rate.
(v) the efficiency of the system (ratio of useful bits to the total bits).

(10 marks)

Q3 Given a company with network address of 192.168.100.0

(a) Suppose that the network is using subnet mask of 255.255.255.192. Calculate:

(i) The numbers of subnets are created.
(ii) The number of host are there per subnet.

(4 marks)

(b) Consider that company wants to distribute the network to three (3) different departments where each department has the following distribution:

i. Administrative Department has four (4) units and each unit has 32 addresses.
ii. Engineer Department has four (4) units and each unit has 8 addresses.
iii. Architect Department has two (2) units and each unit has 16 addresses.

Construct the IP distribution for each department by listing the first and last address for subnet first and subnet last for each department and give the slash notation.

(8 marks)

(c) Propose a network design for that company to make the communication between departments possible. Your design must use the specifications listed in **Table Q3(c)**. Connect all the remote LAN with star backbone topology.

(8 marks)

Q4 Consider a message sent from sender to receiver by passing multiple routers.

(a) By referring to **Figure Q4 (a)** , the message need to pass routers (R1, R2, R3, R4, R5, R6 and R7). Apply Bellman-Ford routing algorithm to the network. Provide the iteration table and routing table for source node. Let Router 1 (R1) as source node.

(10 marks)

(b) Assume Router 4 (R4) and Router 7 (R7) are connected using 10Base2 Ethernet. The length of the network is 1.5 km and the channel propagation speed is 25×10^8 m/s.

(i) Examine the maximum time taken for a frame from Router 4 (R4) and Router 7 (R7).

(ii) Assume that Router 4 (R4) is sending a frame at $t_0 = 0$s, and Router 7 (R7) is also sending a frame at $t_1 = 0.4\mu$s. Predict the time Router 7 (R7) and Router 4 (R4) will notice about the collision, (t_2) and (t_3) respectively.

(iii) Determine the bits that Router 4 (R4) and Router 7 (R7) had sent before it detects the collision.

(iv) Assume that the minimum frame size channel found in the channel is 512 bits. Distinguish the maximum frame size if we increase the data rate up to 100Mbps.

(8 marks)

(c) Suppose the message sent is "NETWORK SECURITY". Predict the cipher text produce by using keyed monoalphabetic algorithm with key = "DIGEST".

(2 marks)

Q5 The current trend in Local Area Networking is now moving from cable towards broadcasting.

(a) Judge the reason why people choose broadcasting compared by using multiplexers and switches.

(3 marks)

(b) Consider that network is using multistage switch network. By referring to **Figure Q5 (b)**, evaluate the total crosspoints for that network.

(4 marks)

(c) A file containing one million 8-bit characters is being transferred using 10BaseT between two (2) terminals that are attached by a dedicated line in bus topology local network. The distance between terminals is 25 meters, all frames are of length 125 bit and the signal propagates on the line in the speed of 2.5×10^8 m/s. Each frame is acknowledged by 88-bit frame before the next frame is sent.

Calculate:

(i) Propagation time (T_p)

(2 marks)

(ii) ACK packet transmit time (T_a)

(2 marks)

(iii) Data packet transmit time (T_d)

(3 marks)

(iv) Cycle time (C)

(3 marks)

(v) Total time required (T)

(3 marks)

Q6 An audiovisual real-time application uses packet switching to transmit 32 kilobit/second speech and 64 kilobit/second video over the following network connection. The data is sent in a packet containing 10 milliseconds of speech and 10 milliseconds of audio. Each packet has 40 byte header. By referring to **Figure Q6**:

(a) Calculate the amount of bit sent in one packet.

(5 marks)

(b) Examine the percentage of packet header overhead.

(3 marks)

(c) Assume that the signal propagate at a speed of 1km/5μs. Each switch has 1ms, 2ms and 3ms delay respectively. Evaluate all the delay components when to transmit one (1) packet data.

(5 marks)

(d) Is that good to use switch in datagram network compared to circuit switching network in this environment? Validate your answer.

(5 marks)

(e) Explain in your words the process of sending a data from sender to receiver using packet switching.

(2 marks)

Q7 Suppose that 64kbps Pulse Code Modulation (PCM) coded speech is packetized into a constant bit rate ATM cell stream. Assume that each cell holds 48 bytes of speech and has 5 byte header.

(a) Discuss the features of Asynchronous Transfer Mode (ATM).

(3 marks)

(b) Calculate the time taken to send one full cell.

(3 marks)

(c) Calculate the time taken to transmit the cell at 155 Mbps.

(3 marks)

(d) Estimate the highest cell rate that can be occur in this system.

(3 marks)

(e) If a leaky bucket used to control liquid flow, calculate how many gallons of liquid are left in the bucket if the output rate is 5 gal/min, there is an input burst of 100gal/min for 12s, and there is no input for 48s?

(3 marks)

(f) Analyze why Virtual Path Connection (VPC) concept has been introduced in high-speed networking.

(3 marks)

(g) There are two different approach used in handling streams of packet in network. Differentiate between datagram approach and virtual circuit approach.

(2 marks)

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Table Q3 (c): LAN Design Spesification

Department	Topology	Cable Type	Length (km)
Administrative	Bus	10Base5	1
Engineering	Star	10BaseT	none
Architect	Ring	10Base2	0.4

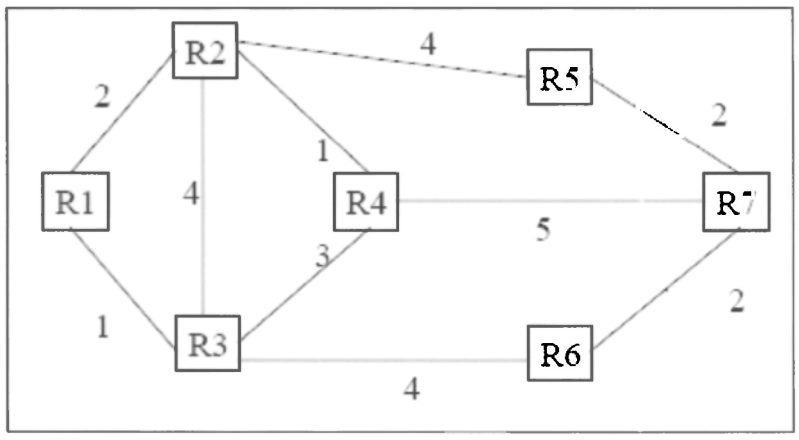

Figure Q4: Network with multiple routers

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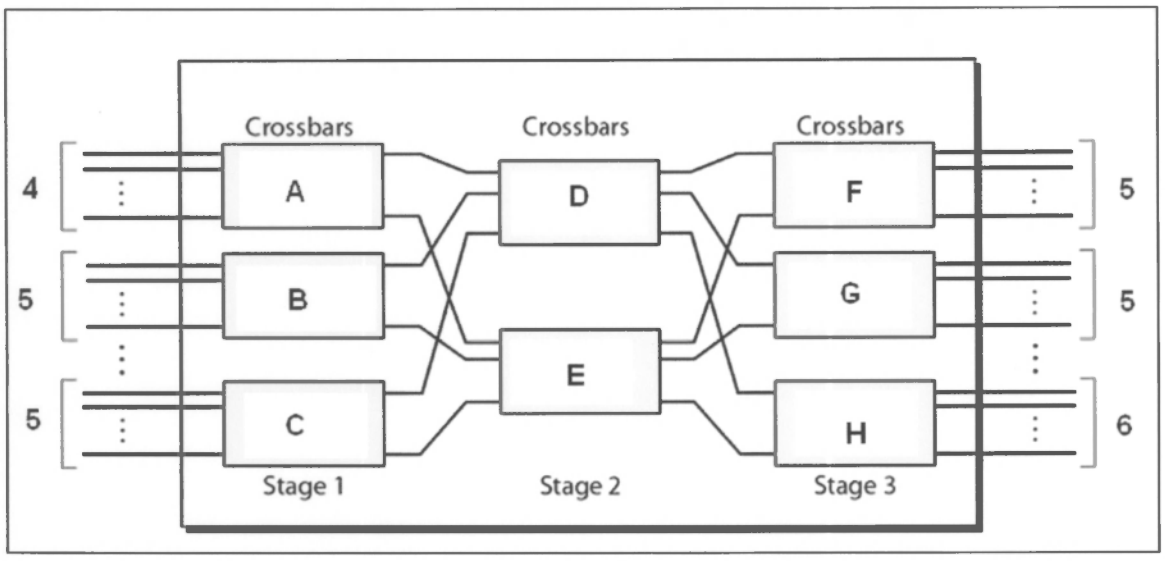

Figure Q5 (b): Multistage switch

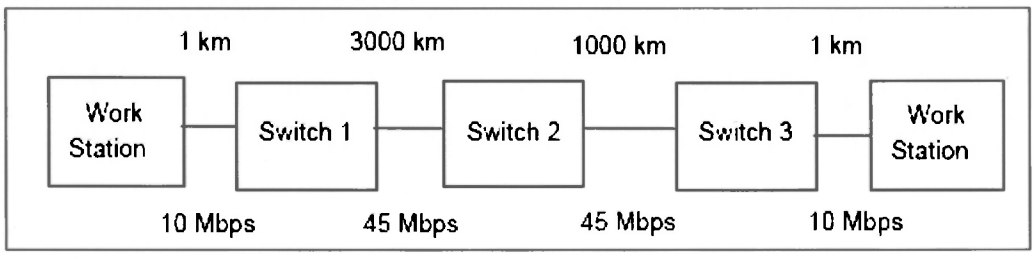

Figure Q6: Packet Switching Network