The Open University of Sri Lanka

ECX5234 Data Communications
FINAL EXAMINATION– 2008/2009 (CLOSED BOOK)

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DATE: 19th March 2009 **0930 hrs – 1230 hrs**

Answer any 5 questions. All questions carry equal marks.

Q1 (a) Which of the OSI layers handles each of the following?

(i) Dividing the transmitted bit stream into frames
(ii) Determining which route to use
(iii) Braking oversized message into number of smaller messages (fragmentation)
(iv) The establishment of virtual circuits [8]

(b) How does DM (Delta Modulation) differ from PCM? [2]

(c) A television signal (video and audio) has a bandwidth of 4.5MHz. This signal is sampled, quantized and binary coded to obtain a PCM signal.

(i) Determine the sampling rate if the signal is to be sampled at a rate 20% above the Nyquist rate. [3]
(ii) If the samples are quantized into 1024 levels, determine the number of binary pulses required to encode each sample. [3]
(iii) Determine the number of bits per second required to encode the signal and the minimum transmission bandwidth required to transmit the encoded signal. [4]

Q2 (a) Assume an asynchronous communications protocol with 1 start bit, 2 stop bits, 1 parity bit, and 7 data bits. Assume that the start and stop bits are never in error, but for the remaining bits the Bit Error Probability = 0.05 (bit errors are independent).

(i) What is the probability that a received word is error-free? [2]
(ii) What is the highest possible probability of bit error if the probability that a received word is error-free must be no less than 0.80? [2]
(iii) What is the probability that a received word is error-free or contains undetectable error(s) or contains detectable error(s)? [2]

(b) Briefly explain how you can detect errors using parity check and Cyclic Redundancy Check (CRC) methods. [3]

(c) If the polynomial used in Cyclic Redundancy Check (CRC) is $x^4 + x^2 + 1$:

(i) What is the degree of the polynomial? [1]
(ii) What is the binary representation of the polynomial? [1]
(iii) Draw the shift register implementation of the transmitter. [3]
(iv) If the transmitted message sequence is 10111110101001 followed by the CRC generated using the above polynomial, find the original message and the Frame Check Sequence. [3]
(v) If the 5th bit from the left is inverted during transmission, show how this error will be detected by the receiver. [3]

Q3 (a) Explain the operation of CSMA-CD media access control method and show that the CSMA-CD needs a minimum frame size to be set. [4]

(b) For a 1000-Mbps CSMA/CD Ethernet with 50 meters span, calculate the minimum frame size. Assume that propagation delay is 5 nanoseconds/m. [4]

(c) Compare the performance of an Ethernet network and a Token Ring network during a high traffic situation and a low traffic situation. [4]

(d) List two(2) key similarities and two(2) key differences between the classic 10Mbps Ethernet LAN and the current IEEE 802.11 WiFi LAN standard. [4]

(e) Briefly describe the "*Hidden station problem*" in wireless LANs. [4]

Q4 (a) What are the drawbacks occurred in Stop and Wait flow control method? [2]

(b) Briefly explain how these drawbacks can be overcome using Sliding Window flow control. [2]

(c) What is the relationship between the maximum window size and the sequence number in sliding window flow control? [3]

(d) A sliding window protocol with a 3-bit sequence number is used between a sender (A) and a receiver (B). The sender wants to send ten(10) packets with a rate of 1packet/1ms. The propagation time is 2 ms for any packet, and the time out period is 8msec. The time for processing a packet is negligible. Assuming that Go-Back-N protocol is used with a window size of 4, show the window positions (with sequence number) of A for the following succession of events:

(i) Before A sends any frames [2]

(ii) After A sends frames 0,1,2 and B acknowledges 0,1 and the ACKs are received by A [3]

(iii) After A sends frames 3, 4 and 5 and B acknowledges 4 and the ACK is received by A. [3]

(e) If the packet 3 is lost, draw a timing diagram for the above system showing information about resending the packet from sender to receiver and ACK the packet in the reverse direction. [5]

Q5 (a) Briefly explain the concept of VPN and the reasons for its wide deployment. [4]

(b) Describe 3 topologies that can improve the resilience of a Wide Area Network and for each topology explain their advantages and disadvantages. [6]

(c) DNS is designed to be a distributed database as opposed to a centralized one. Explain the reason for this and illustrate your answer with real-world examples.

(d) Assume that you are accessing the following web site: www.eecs.mit.edu from a computer in OUSL premises. Clearly explain the steps to be followed in the DNS name resolving process and the DNS servers involved. State any assumptions you make. [5]

Q6. (a) Differentiate the following:

(i) Routing vs Bridging

(ii) Layer 2 switch vs Layer 3 switch

(iii) OSPF vs RIP [6]

(b) Use Dijkstra's algorithm to find the shortest path from node B to the other nodes in the undirected graph below. Use the table Q6 to show your answer. Link costs are as shown on the figure Q6. [10]

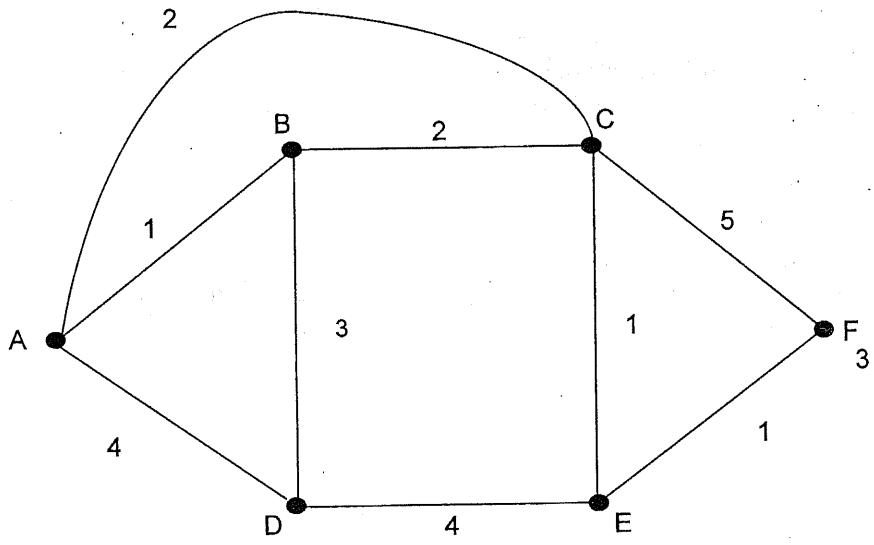

Figure Q6

Step	Nodes considered	Destination Node A		Destination Node C		Destination Node D		Destination Node E		Destination Node F	
		Cost	Path	Cost	Path	Cost	Path	Cost	Path	Cost	Path
0											
1											
:											

Table Q6

(c) Compare Dijiksra's routing algorithm with the Bellman - Ford routing algorithm. Will Dijikstra's algorithm and the Bellman - Ford algorithm always yield the same solution? Explain your answer. [4]

Q7. (a) Explain the meaning of CIDR and discuss the reasons for its development. [2]

(b) Explain the significance of "Subnetting" and "Supernetting" to an Internet Service Provider. Illustrate your answer with suitable real world examples. [4]

(c) A medium sized ISP has decided to allocate the following blocks of IP addresses to a set of customers.

i. Customer A - 32 IP addresses
ii. Customer B – 64 IP addresses
iii. Customer C (A smaller ISP) – 512 IP addresses
iv. Customer D – 128 IP addresses
v. Customer E, F and G – 16 IP addresses each.

It has decided to use the following IP address range for the above :
203.128.128.0/22
For each of the above customers, provide the IP address range in CIDR format and the subnet mask. [12]

(d) Briefly explain the main features of IPv6. [2]

Q8 (a) What would be better for the following two cases: packet switching or circuit switching? Justify your answer.

(i) When all the network sources send their data at a constant data rate

(ii) When all of the network sources are bursty (They only occasionally have data to send.) [4]

(b) Consider the small network of 4 hosts and 3 links as given in the following figure Q8. A message of 1024 kbits is to be sent from A to D. The data bandwidth of the first two links is 0.8Mbyte/sec and the link between C & D is 1.6Mbyte/sec. Assume that the propagation delays of the links and the queuing delays are negligible.

Figure Q8

(i) Calculate the time it takes to send the message from A to D if circuit switching is used. Assume the total circuit set up time is 100msec. [3]

(ii) Assume that message switching is used. What is the time to send the message from A to D? [3]

(iii) If packet switching is used with a packet size (excluding header) of 128 bytes and the header size is 22 bytes, what is the time to send the message from A to D? [3]

(c) For a M/M/I queue, mean number of arrivals is 300. The service time for each arrival is 3 msec. Find ,

(i) Utilization

(ii) Mean number of items in the system

(iii) Mean time an item spends in the system. [7]