The Open University of Sri Lanka

Department of Electrical & Computer Engineering
Bachelor of Technology Programme
ECX5234 Data Communications
FINAL EXAMINATION– 2011/2012 (CLOSED BOOK)

DATE: 02nd March 2012 **0930 hrs – 1230 hrs**

Answer any 5 questions. All questions carry equal marks.

Q1 (a) Compare and Contrast the following: [08]

1. OSI reference model and TCP/IP reference model
2. Network layer and transport layer
3. TCP and UDP
4. IP address and MAC address

(b) Briefly explain two broadband Internet Access technologies commonly in use today. [04]

(c) A television signal (video and audio) has a bandwidth of 6MHz. The signal is sampled, quantized and binary encoded to obtain a PCM signal.

(i) Determine the sampling rate if the signal is to be sampled at a rate of 20% above the Nyquist rate.

(ii) If the samples are quantized into 1024 levels, determine the number of binary pulses required to encode each sample.

(iii) Determine the binary pulse rate (bits per second) of the binary encoded signal, and the minimum bandwidth required to transmit this signal.

(iv) Suggest a method to increase the data rate without changing the bandwidth of the signal. [08]

Q2.(a) (i) Describe the theory behind Manchester encoding. [03]

(ii) The waveform of figure Q2 belongs to a Manchester encoded binary data stream. Determine the beginning and end of bit periods (i.e. extract clock information) and give the data sequence. [04]

Figure Q2

(b) Draw the output pulse stream when Differential Manchester encoding is used to encode the above data sequence in the above question (a)(ii). [04]

(c) Differentiate ASK , PSK and QAM modulation schemes. [03]

(d) Draw the constellation diagrams for the following cases:

(i) ASK, with peak amplitude values of 2 and 4
(ii) 8-PSK, with a peak amplitude value of 4
(iii) 8-QAM with peak amplitude values of 2 and 4 [06]

Q3 (a) (i) State the different types of delay components in packet switching. [02]

(ii) Show how these delay components affect the total delay in the following switching methods:

1. Circuit switching
2. Virtual circuit packet switching
3. Datagram packet switching [06]

(b) Let $g_1(x) = x^2+1$ and $g_2(x) = x^2 + x$. Consider the information bits 1011101.

(i) Find the codeword corresponding to these information bits if $g_1(x)$ is used as the generating polynomial. [04]

(ii) Find the codeword corresponding to these information bits if $g_2(x)$ is used as the generating polynomial [04]

(iii) If the 2nd and 3rd bits from the left are in error in the receiving sequence check which of the above polynomials $g_1(x)$ and $g_2(x)$ can detect the error. Show the detection algorithm for each case. [02]

(iv) Discuss reasons for not detecting an error in CRC method. [02]

Q4. (a) For a WAN consisting of 5 nodes,

- draw the topology with the least number of point to point links
- draw a topology that best improves the resilience of this network by adding a single link.
- draw another topology that will maximize the resilience for the whole network
- draw a topology that will minimize the delays between one node and all of the others. [08]

(b) Ethernet frames must be at least 64 bytes long to ensure that the transmitter is still going in the event of a collision at the far end of the cable. Fast Ethernet has the same 64-byte minimum frame size but can get the bits out ten times faster. Clearly explain how it is possible to maintain the same minimum frame size. [03]

(c) Consider building a CSMA/CD network running at 1Gbps over a 1km cable with no repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size? [04]

(d) In wireless networks the hidden station problem can occur. Use a diagram to show what this problem is and describe how this problem is handled in 802.11 networks. [05]

Q5 (a) Consider a Go-back-N sliding window protocol with *n* number of bits in a sequence number. There is a special relationship between the maximum number of sequence numbers and the maximum window size.

(i) What is this relationship? [03]

(ii) Explain with a scenario what would happen if the maximum number of sequence numbers were to be used as the window size of the Go-back-N protocol.

[07]

(b) A transmission station X uses Selective-Repeat protocol as the flow control method to transmit 7 frames to a receiver Y. Assume the 3-bit sequence numbers are used and the window size is 4. Draw the timeline diagram for the transmission by considering the following situations:

(i) The second frame sent by X is lost during the transmission. [05]

(ii) The acknowledgement to the 5th frame is lost [05]

Q6 (a) DNS Architecture is based on a distributed database model as opposed to a centralized database. Explain the meaning of "distributed database model" and give 3 reasons for the selection of this architecture. [05]

(b) Email is one of the most popular and essential application on Internet today. Mail delivery is done via Simple Mail Transfer Protocol (SMTP). Consider the following scenario:

A lecturer at the Open University, having an email address, abc@ou.ac.lk, sends an email to two students def@gmail.com and ghi@yahoo.com about an assignment. Assuming "ns.ou.ac.lk", "ns.google.com", "ns.yahoo.com" are the DNS servers of OUSL, Google and Yahoo respectively, answer the following:

(i) Identify all the DNS transactions that will take place for the purpose of this email delivery. [07]

(ii) What mechanisms can be used to ensure the delivery of email even in the presence of temporary server inaccessibility. [03]

State your assumptions clearly, if any.

(c) Hyper Text Transfer Protocol (HTTP) is a "Stateless" protocol. Explain the meaning of this statement using the example of accessing Open University Main Web Page from your home computer. [05]

Q7. (a) How does Link State routing algorithm differ from Distance Vector routing algorithm in terms how often, to whom and what information included when routing updates are transmitted from a node? [03]

(b) Consider the network shown in figure Q6. Show distance vectors at node A using

a. Link state method

b. Distance Vector method.

Show the successive steps from the start until the network stabilizes by providing suitable table entries or graphs. [10]

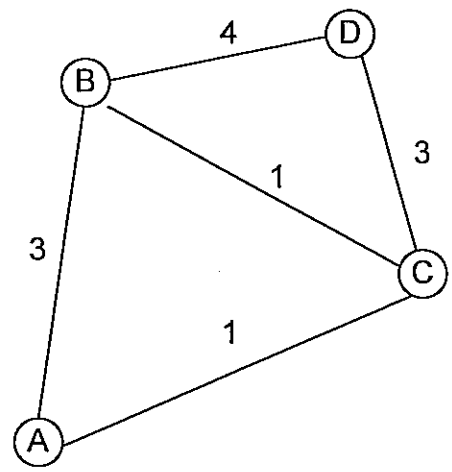

Fig. Q6

(c) In the above network, say after the network stabilizes, the link between nodes C and D was broken. Show how nodes A, B, and C might experience the count-to-infinity problem. [05]

(d) Suggest a method to overcome this problem in distance vector algorithm. [02]

Q8. (a) Assume that you are the administrator at an ISP. You have a 128.20.224.0/20 address block. You have two customers with networks of size 1000 nodes each; two customers whose networks have 500 nodes each; and three customers whose networks have 250 nodes each. What are the addresses blocks (first and last address) you will assign to these customers? [12]

(b) Suppose that all your remaining customers have networks of size 50 nodes each. For how many customers can you allocate address blocks with the remaining addresses you have? [04]

(c) Briefly explain the meaning of "Auto Configuration" in IPv6. Use an example to illustrate your answer. [04]