The Open University of Sri Lanka
Department of Electrical & Computer Engineering
ECX5234 Data Communications
FINAL EXAMINATION– 2012/2013   (CLOSED BOOK)

DATE: 02nd August 2013   0930 hrs – 1230 hrs

Answer any 5 questions.

Q1. (a) Explain the need of layered architecture in data communication.   [2]

(b) List 3 differences between OSI model and the TCP/IP model.   [3]

(c) Match the following functions to one or more layer/s of OSI model:

(i) Responsibility of carrying frames between adjacent nodes
(ii) Log-in and log-out procedures
(iii) Interface to transmission media
(iv) Error correction and retransmission   [4]

(d) (i) Calculate the theoretical maximum capacity of a channel which has 20kHz bandwidth and signal to noise ratio(SNR) of 30dB. Can this theoretical limit be achieved practically? Give reasons for your answer.   [4]

(ii) Assume that we need to upgrade the above channel to a higher bandwidth. Answer the following questions:

a. Show how the data rate is improved if we triple the bandwidth.
b. Show how the data rate is improved if we triple the SNR.
c. Suggest a method to increase the data rate of the channel without changing the bandwidth and the SNR.   [7]

Q2. (a) Explain how caching improves the performance of DNS. What are the negative effects of caching?   [5]

(b) 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 under following methods. Illustrate your answer with suitable diagrams and state any assumptions you make.
(i) Recursive resolution
(ii) Iterative resolution   [10]

(c) Do you think a recursive resolution is more faster than an iterative one? Explain your answer.   [5]

Q3. (a) Identify the type of errors that cannot be detected from the following error detecting schemes:

    (i)   Single parity check

    (ii)   Two dimensional parity check

    (iii)   Cyclic Redundancy check   [3]

(b) A data bit stream of 1110010101 is to be transmitted by using CRC method as the error detection scheme. If the polynomial is 11010,

    (i)   find the transmitted bit stream.

    (ii)   If the third bit and the fourth bit from the left are inverted in the received bit sequence, check whether these errors can be detected in the above method.

                                [8]

(c) Draw the encoded bit pattern of the data sequence 1101011010 for the following coding schemes:

    (i)   Return to Zero (RZ)

    (ii)   Manchester

    (iii)   Differential Manchester   [9]

Q4. (a) For each of the following networks, discuss the consequences if a connection fails:

    (i) 6 devices arranged in a bus topology

    (ii) 4 devices arranged in a ring topology

    (iii) 5 devices arranged in a mesh topology

    (iv) 7 devices arranged in a star topology   [5]

(b) Consider sending a file of 8000 bytes over a path of 3 links. Each link transmits data at a rate of 200,000 bytes/sec. The network is lightly loaded so that there are no queuing delays. When packet switching is used, the file is broken into 1000 bytes long packets. Propagation delay is negligible.

    (i) Suppose the network is a packet switched virtual circuit(VC) network with the VC set up time is 100 ms. If the sending layers add a total of 20 bytes of header to each packet, calculate the time it takes to send the file from source to destination.   [5]

    (ii) Suppose the network is a packet switched datagram network and a connectionless service is used. Assuming the header size is 40 bytes now, calculate the time it takes to send the file.   [5]

    (iii) Suppose that the above network is a circuit switched network, with the transmission speed between the source and the destination is 200,000 bytes/sec. Assuming a set up time of 100 ms and the header size for the entire file is 20 bytes, calculate the time it takes to send the file.   [5]

Q5. (a) (i) Considering a Go-Back-N ARQ method with k-bit sequence numbers, give the relationship between the maximum sequence number and the maximum window size.

(ii) Explain with a scenario what would happen if the maximum number of sequence numbers were to be used as the window-size. (Use a 3-bit sequence number.) [8]

(b) Consider a communication link which uses Selective Repeat ARQ scheme. Draw the timing diagram for the following scenario using the same diagram. Assume a 3-bit sequence number and the window size is 3. Suppose a time-out value of 3 time units, one way propagation delay is 0.5 time unit, the processing times are negligible and ACK timer is one unit long.

(i) Starting at t=0, frames 0,1 and 2 are sent and acknowledged successfully.

(ii) Frame 3 is lost during the transmission.

(ii) Frames 4, 5 and 6 are transmitted successfully but the acknowledgement of frame 6 is lost on the way. [12]

Q6. (a) Differentiate the following:

(i) Static routing vs Dynamic routing

(ii) Link state routing vs Distance vector routing

(iii) RIP vs OSPF [6]

(b) Consider the network shown in Figure Q6. With the indicated link costs, use Link State routing algorithm to find the shortest path from X to all other nodes. Show your work by preparing a table. [14]
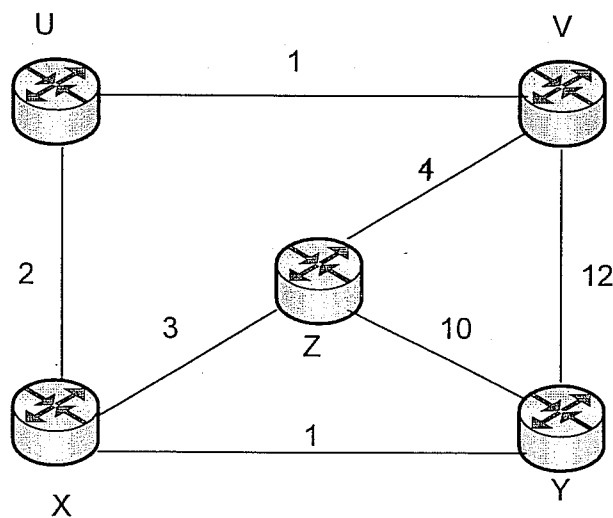

Figure Q6

3

P.T.O

2b

Q7. An organization has been assigned the network address 140.25.0.0/20 and Figure Q7 provides a graphical display of the variable length subnet mask design for the organization.

To arrive at this design, the first step of the subnetting process divides the base network address into 8 equally sized address blocks (A – H). Then Subnet #B is divided into 32 equally sized address blocks and Subnet #G is divided into 16 equally sized address blocks. Finally, Subnet #G-2 is divided into 4 equally sized address blocks (a – d).
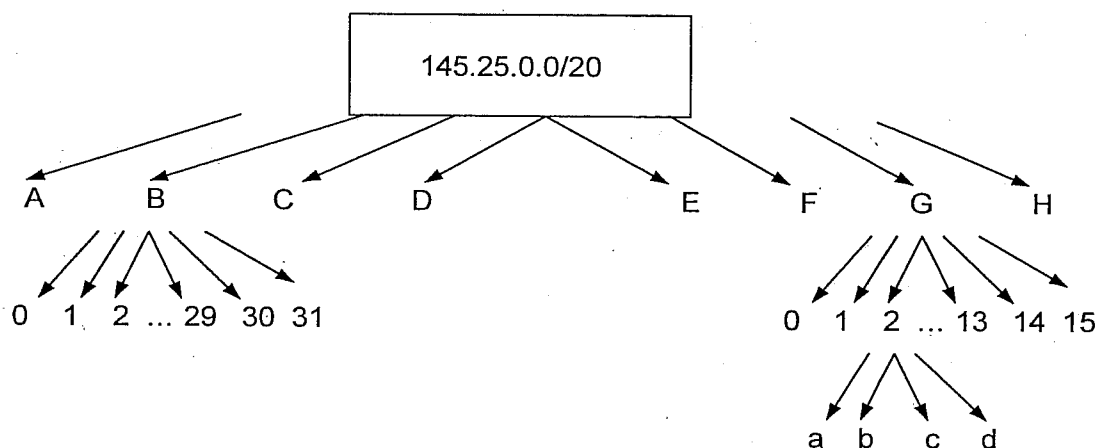

Figure Q7

(i) Give the subnet addresses of 8 main subnets A – H and their subnet mask. [5]

(ii) List the range of usable host addresses that can be allocated to subnet B and identify its broadcast address. [4]

(iii) What is the size of the subnets formed by the subnet B-2? [2]

(iv) List the subnet address, range of usable host addresses and broadcast address of subnet G-2 –b and identify its broadcast address. [6]

(v) Explain the principle of supernetting using the above structure. [3]

Q8. (a) Explain what is meant by VLAN and how VLANs are advantageous in the means of network traffic, cost and security. Use an example to illustrate. [7]

(b) Explain the operating principle of ADSL, highlighting how it has a higher download speed, compared to the upload speed. [5]

(c) List four WAN connection types which are commonly used. Give an advantage and a disadvantage for each of these connection types. [4]

(d) A company might have multiple sites that vary in size. A remote network is necessary to connect the various locations in a company. If you are asked to design a WAN environment for the connectivity of this remote network with the head office, what factors do you need to consider in selecting the WAN type? [4]