The Open University of Sri Lanka
ECX5234 Data Communications
FINAL EXAMINATION– 2007/2008 (CLOSED BOOK)

DATE: 16th May 2008 **0930 hrs – 1230 hrs**

Answer 5 questions. All questions carry equal marks.

Q1.
A construction firm, dealing with roads and other related infrastructure, has setup several branches island-wide. In order to optimize resources and to implement an Enterprise Resource Planning, its IT division has decided to setup a Wide Area Network connecting head office and all its branches. Head Office staff should be able to monitor the branch activities and also the staff at the branches should be able to log into Head Office for different activities. Due to the company taking sub-contracts from foreign construction companies, it has become a necessity to provide good IT resources to each branch as foreign engineers and other people frequently visit the branches. The following information is given:

- Head Office - 200 computers
- Branches – Each branch has a minimum of 10 computers and a maximum of 20 computers.
- No. of branches – 9 (covering all provinces)

You are required to develop the IP addressing plan to cover the full network. Taking the network address as 192.168.0.0/22, find the following for the head office and **one branch**:

- Network Address in CIDR format and Subnet mask
- Usable IP range for the desktops and laptop computers

Q2.
(a) A Service Provider is planning to provide CD quality music from its new service "Audio-on-Demand" and has requested you to calculate the bandwidth requirements. The following data is given:

- Sampling : 44.1KHz Quantization : 32768 levels
- No. of concurrent users : 10

(i) Assuming PCM encoding, compute the maximum data rate required from the ISP side to deliver the CD quality music to its customers.

(ii) Comment on the practicability of the answer you have obtained in (i). Suggest a way to reduce the data rate without reducing the quality.

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(iii) Assuming a S/N ratio of 20dB, what would be channel bandwidth required to cater all 10 users?

(b) The service provider referred to in (a) above, has a choice of selecting circuit switching or packet switching to deliver its service. What would you recommend to the service provider? Provide reasons for your selection.

Q3.

(a) Explain the advantages of having a layered communication hierarchy.

(b) UDP (User Datagram Protocol) is often used for multimedia streaming (sending audio & video over the network). Explain in detail the features of UDP that make it suitable for this purpose.

(c) Explain in detail why TCP (Transmission Control Protocol) is heavily used for data transfers and other application protocols like HTTP.

(d) Some transport layer protocols are considered to be unreliable. Provide reasons for this statement and explain a possible way of eliminating that unreliability.

Q4.

(a) Write short notes on the following:

(i) Class Based Routing vs. CIDR
(ii) VPN
(iii) Leased Line

(b) DNS is considered as the most critical service required for the operation of Internet related work. Answer the following questions related to DNS:

(i) Briefly explain the role of 'Root Server' in the name resolving process
(ii) Under what circumstances will a local DNS server not communicate with 'Root Server'?
(iii) Under what circumstances will the situation in (ii) lead to a problem?
(iv) What do you understand by the term "Reverse Address Resolution"? Why is it important for today's Internet?

Q5.

(a) Ethernet is the dominant LAN protocol in existence today. Briefly explain the approach it uses for accommodating data transmission from multiple users at the Data Link Layer.

(b) With the increasing popularity of laptops, the demand for Wireless LANs has significantly increased.

(i) Briefly explain the approach it uses for accommodating data transmission from multiple users at the Data Link Layer.
(ii) Clearly highlight the similarities and differences of the method in (i) above with the method used in (a).

(c) A university network needs to provide services to 6 different buildings housing many departments and research centers. Due to increased use of network services these departments are demanding fault tolerant (ability to work even in the presence of single link failure) network to be built. All the major servers (which are used by all departments) are located in a separate building dedicated for network services.

(i) Provide 3 different LAN topologies that would meet the requirements.
(ii) What topology would you recommend for this purpose? Why?
(iii) Comment on the type of media you would use for this network.

Q6.

The bit oriented message 11101111 is to be transmitted from a sender to a receiver.

(a) Using an even parity error detection scheme, calculate the parity bit and show the bit stream that would be transmitted.
(b) Instead of parity a CRC-3 is used for error detection. Show the sender calculation for the message using the generator polynomial $x^3 + x + 1$. Show your work and clearly indicate the final bit stream to be transmitted.
(c) Draw the shift register implementation that would perform this task.
(d) A different message was sent between the same two systems and the message 10101100110 was received. Assuming that we used the same CRC-3 from above, determine whether the received message is correct.

Q7.

(a) Briefly describe the Go-Back-N ARQ technique. Explain how this method differs from selective repeat technique.

(b) Station A sends data to station B. After each transmission, A starts an acknowledgement timer for the frame just transmitted. RR(Receiver Ready) and REJ(Reject) frames are used as positive and negative acknowledgements. If B has successfully received the frame (*i*-1), clearly show using frame sequence diagrams how the go-back-N technique takes into account the following cases.

(i) B detects that frame *i* is corrupted and A subsequently sends frame (*i*+1) which is received correctly by B.
(ii) B receives frame *i* correctly and sends RR_{i+1} which is lost in transit. A continues to send frames (*i*+2) and so on.

Q8.

(a) Differentiate between the following regarding routing:

(i) Static routing versus dynamic routing
(ii) Link state approach versus distance vector approach
(iii) RIP versus OSPF

(b) Fig. Q8. shows a configuration of networks and routers. Distance vector routing is used here and the routing table of host X before update is given in table Q8. The following vectors have just come into host X from neighbor routers (Each element in the vector represents the delay from the router to networks 1 to 5)

From B: (3, 1, 4, 3, 4)
From C: (8, 8, 5, 6, 6)
From A: (6, 3, 2, 1, 2)

If X has estimated the delays to B, C and A as 5, 3 and 4 respectively, obtain X's new routing table? Table Q8 below shows the routing table of host X before update.

Table Q8

Destination Network	Delay	Next Router
1	1	-
2	2	B
3	5	B
4	2	A
5	6	A

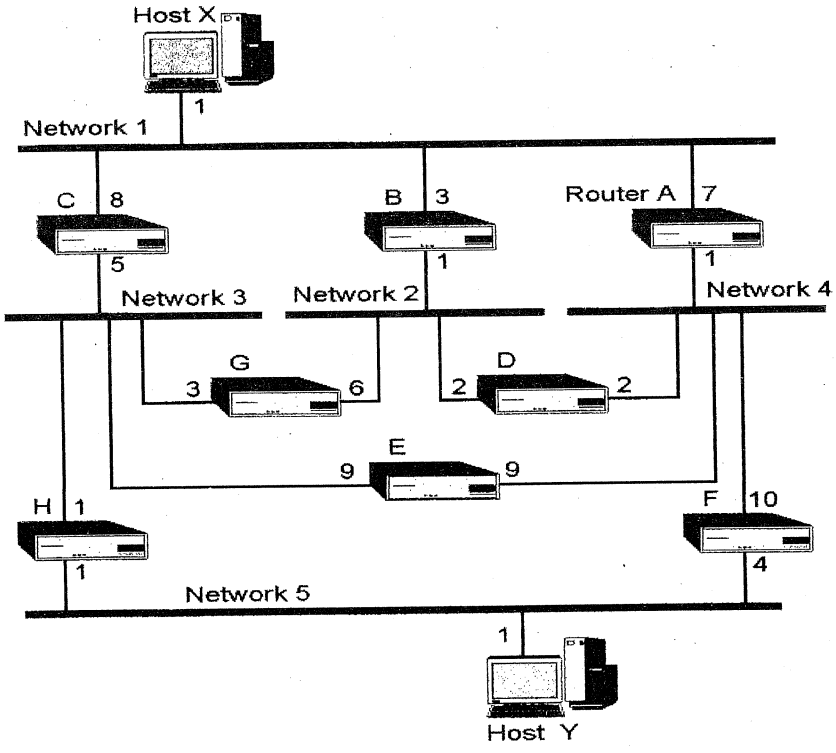

Fig. Q8