B.Sc. Engg. / HD CSE 4th Semester

201

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION — SUMMER SEMESTER, 2017-2018

DURATION: 3 HOURS — FULL MARKS: 200

CSE 4405: Data and Telecommunications

Programmable calculators are not allowed. Do not write anything on the question paper.

There are 8 (eight) questions. Answer any 6 (six) of them.

Figures in the right margin indicate marks.

1. a) What are the layers in TCP/IP protocol suite? Explain the followings in terms of OSI model. 2+9
   i. Process to process delivery
   ii. Host to host delivery
   iii. Node to node delivery

   b) What is the difference between a port address, a logical address, and a physical address? Observe Figure 1 carefully where the packet header format is given. Each device is attached with a specific logical address and physical addresses. Complete each of the packet headers with appropriate logical and physical addresses. 3+6

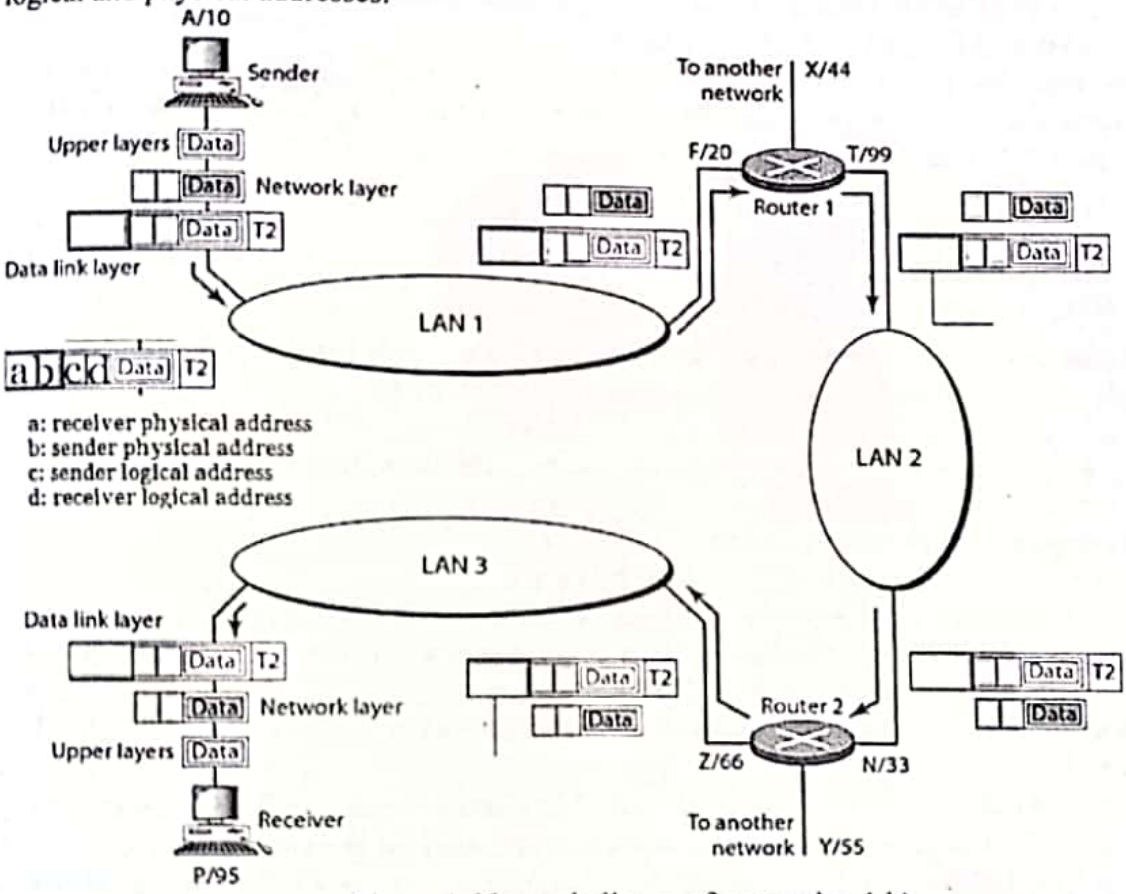

Figure 1: Network diagram for question 1.b)

   c) What do you mean by switching? Compare and contrast a circuit-switched network with a packet-switched network. 13.33

2. a) Define the followings with example: 10
   i. Jitter ii. Attenuation iii. Throughput v. Bandwidth-Delay Product

   b) What do you mean by 'data element' and 'signal element'? A signal is carrying data in which one data element is encoded as two signal elements. If the bit rate is 200 kbps, find the signal rate where c=1/2. 4+3

   c) Compare and contrast pulse code modulation (PCM) with delta modulation (DM); discuss using their module diagram. 12.33

   d) A composite periodic signal is decomposed into six sine waves with frequencies of 150, 250, 350, 450, 550 and 650 kHz, what is its bandwidth? Draw the spectrum, assuming all components have amplitude of 20 V. 2+2

3. a) Write short notes on any **three** of the following modulation technique: 3x4
   i. *MLT-3* ii. *AMI* iii. *On-off keying* (OOK) iv. *Phase Modulation*
   v. *Manchester*

   b) What do you mean by scrambling? Consider a bit stream: 11000010000000000. Draw corresponding digital signal for the following line coding schemes. 3+6
   i. *B8ZS* ii. *HDB3*

   c) With necessary diagrams explain the working principal of a fiber optic cable. Name different propagation modes of optical channels. 12.33

4. a) What do you mean by multiplexing? Distinguish between synchronous and statistical time division multiplexing (TDM). 3+6

   b) Briefly explain frequency hopping spread spectrum (FHSS). What is the main motivation of using FHSS that outweighs its bandwidth efficiency? 7+3.

   c) Draw the send and receive window for '*Selective Repeat ARQ*' protocol. Using 5-bit sequence numbers, what is the maximum size of send and receive windows for '*Go-Back-N ARQ*' protocol? 33 5+3

   d) A sender sends a series of packets to the same destination using '*Go-Back-N ARQ*'. If the header of the frame allows 5 bit sequence number that starts with 0, what is the sequence number after sending 100 packets? If the sender uses '*Stop-and-Wait ARQ*' protocol for flow control then what should be the sequence number after sending 100 packets. 3+3

5. a) What do you mean by a linear block code and a cyclic code? Distinguish between forward error correction and error correction by retransmission. 4+3

   b) What do you mean by the Hamming distance and the minimum Hamming distance? With the aid of block diagrams illustrate the structure of the encoder and decoder for a Hamming code C(7, 4). 4+6

   c) Using CRC error detection scheme do the following. (Use 1011 and 0000 as the divisors) 8

      i. Generate the codeword of 1001 using CRC encoder.

      ii. A codeword 1000110 has been received. Determine whether the dataword should be accepted or rejected using CRC decoder.

   d) Mention the limitations of simple parity check codes. How is the simple parity check related to the two-dimensional parity check? 8.33

6. a) Explain the frequency reuse concept in cellular communication with appropriate figure and equation. 11.33

   b) Write short notes on any **two** of the followings- 4x2
   i. Grade of Service ii. Sectoring iii. Multipath Fading

   c) A 30 MHz spectrum is allocated to a wireless system which uses two 25 KHz simplex channels to provide full duplex voice and control channels. Compute the number of channels available per cell if that system uses 7-cell reuse pattern. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell of that system. 6

   d) A system has 1000 cells with 25 traffic channels available where a minimum SIR of 15dB must be maintained. Consider that there are 6 channels in the first tier. Find the minimum cluster size with path loss exponent 3. What will happen if path loss exponent n becomes 4? Will the cluster size increase or decrease? 8

7. a) Neatly sketch the GSM system architecture. How does HLR and VLR work for a roaming user? 10.33

   b) Give the taxonomy of all logical channels available in GSM. 5

   c) Write short notes on any two of the followings- 5x2
   i) Cell dragging ii) Umbrella Cell Concept iii) MAHO

   d) Suppose a new mobile communication standard is specified as an alternative to GSM with the following frequency specifications 8

   Uplink: 1400-1550 MHz Downlink: 1600-1750 MHz

   The new standard also specifies that two carrier frequencies would be working at 400 KHz distance for better voice quality. As a telecommunication engineer, calculate the following specification of the new standard.

i. Wavelength ii. Bandwidth iii. Duplex Distance iv. No of Radio Channels

8. a) With the aid of necessary diagram explain how a call to a mobile user initiated by a PSTN subscriber is established. Mention the name of different logical channels used in different stages of call establishment. 12.33

b) Draw the normal burst used in GSM. What is the significance of using Training sequence (T) Guard Period (GP) and Stealing bits (SF) in a GSM burst? 2+6

c) Mention different stages of the GSM transmission process in appropriate order. Demonstrate how four GSM bursts (each of 156.25 bits) are constructed from a 20 milliseconds voice signal following the steps of the GSM transmission process. 3+10