BACHELOR OF COMPUTER SCIENCE. & ENGINEERING EXAMINATION, 2017

(3rd year, 2nd Semester)

COMPUTER NETWORKS

Time: 3 hours

Full Marks: 100

Answer any FIVE questions.
(Parts of a question must be answered together)

1. a) For hierarchical routing with 4800 routers, what region and cluster sizes should be chosen to minimize routing table size for a three level hierarchy? What would be the routing table size?

   b) Describe two methods for pruning the spanning trees for different groups in Multicast routing.

   c) Consider the adjacency matrix given below. This represents a network. Distance Vector routing is being used and the following vectors have just come in to router C:
   From B: (5, 0, 8, 12, 6, 2)
   From D: (16, 12, 6, 0, 9, 10)
   From E: (7, 6, 3, 9, 0, 4)

	A	B	C	D	E	F
A	0	1			1	
B	1	0	1			1
C		1	0	1	1	
D			1	0		1
E	1		1		0	1
F		1		1	1	0

   The measured delays from C to B, D and E are 6, 3 and 5 respectively. Construct C's routing table. Give both the outgoing link to use and the expected delay. Explain briefly.

   $((4 + 2) + (3 + 3) + 8)$

2. a) Give the algorithm for 'Selective Repeat' sliding window protocol and explain its working in details.

   a) If 0 to MAX-SEQ is the range of sequence numbers used to identify frames, then
      i) What is the sender's window size in case of Go-Back-N sliding window protocol?
      ii) What is the sender's window size in case of Selective-Repeat sliding window protocol?
      iii) Explain in details the similarity or difference (as the case may be) of your answers to (i) & (ii) above

   c) What is a 'NAK'? Why and where is it used? $((6 + 4) + (2 + 2 + 4) + 2)$

3. a) Consider a CSMA wired channel. Name and briefly explain exactly one protocol under each of the following categories:
      i) Collision free
      ii) Limited contention

b) Briefly describe the 'Binary Exponential Backoff' algorithm as applied to CSMA/CD.

c) Make an approximate performance analysis of the Ethernet under condition of constant heavy load, i.e., k stations always ready to transmit, and hence show that channel efficiency is given by

$$1/(1+2BLe/CF)$$

where   F: frame length
            B: network bandwidth
            L: cable length
            C: signal propagation speed in cable

Assume the optimal case of e contention slots per frame.

$(5+5)+4+6$

7

4. a) Answer the following for IPv4:

    i) An IP packet has arrived with the first eight bits as (01000010 ...). The receiver discards the packet. Why?

    ii) In an IP packet, value of 'IHL' field is 1000 in binary. How many bytes of options are there in this packet?

    iii) An IP packet arrives with the first few hexadecimal digits as (45000028000100000102 ...). How many hops can this packet travel before being dropped?

b) What is subnet in the context of IPv4? Explain clearly.

c) A commercial house is granted the site address 181.56.0.0 (all addresses with network number 181.56). There are 64 departments in the organization. As the network administrator, design the required subnets; give the subnet mask in '/' notation; also give the range of addresses in the first as well as the last subnets.

$(3+2+3)+4+8$

8

5. a) State and prove the Optimality Principle as applicable to routing in a point to point network.

b) A network uses Link State routing. Routers in this network use Flooding technique to send their Link State packets to other routers. Discuss possible steps they may be employed to avoid proliferation of duplicate/ obsolete Link State packets, while completing the process as efficiently as possible. Also discuss the possible data structures they may be used for this.

c) An organization uses private IP addresses from the range 172.16.0.0-172.31.255.255/12 for its local computers. It also uses a NAT box for address translation to its Internet address: 198.60.42.12. Explain clearly how packets in a 'request – reply' session between a local computer client and a remote server on the Internet are handled.

d) An inter-network consists of several hosts connected by point – to – point links as well as several Ethernet LANs with one host from each connected to some host of the point – to – point network by a direct link. Is it possible to send packets between hosts on different LANs using any routing procedure that is designed for use on point – to - point networks only? If so, how? If not, why?

$4+6+6+4$

6. a) Give the IEEE 802.3 frame format and explain in details.

b) Write down the 802.11 frame format and explain in details with special emphasis on the portion that deals with 'Frame Control'

c) Consider an error – free 64 Kbps satellite channel used to send 512 bytes – data frames in one direction with very short acknowledgements coming back the other way. Find maximum throughputs for window sizes of 7 and 15? The earth – satellite propagation time is 270 msec.

6+(4+4)+6

7. a) Briefly discuss the basic idea(s) behind the Open – Loop & Closed – Loop classification of techniques used to manage congestion in a network.

b) 'It is preferable to use End – to – End choke packets as compared to Hop – by – Hop ones' –– justify or refute.

c) Briefly describe the Leaky Bucket technique. Give a possible schematic implementation for a Leaky Bucket that handles variable sized packets.

d) Consider the following flow specification:

Maximum packet size: 2000 bytes
Token bucket filling rate: 10 million bytes/second
Token bucket size: 2 million bytes
Maximum transmission rate: 25 million bytes/second

How long can a packet burst at maximum speed last? Explain your answer and derive any relation that you use.

(4 + 3 + (3 + 3) + (3 + 4))

8. Write short notes on any four:

i) Bridges & Switches
iii) Dijkstra's routing algorithm
v) DCF & PCF in wireless network
vii) MACA & MACAW

ii) Pure ALOHA & slotted ALOHA
iv) CIDR
vi) WDMA
viii) TCP & UDP

[4 × 5]