BACHELOR OF COMPUTER SCIENCE. & ENGINEERING EXAMINATION, 2013

(3^{rd} 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) Several computers are connected to each other over a wired multi-access channel. Show how Binary Countdown protocol can help them to communicate with each other and also avoid collisions. Derive expression for channel efficiency for this protocol.

   b) If computers 2, 4, 9 & 10 (assume there are 15 computers on the channel) request for the above channel simultaneously, how many bidding rounds would be needed to allow all of them to finish communicating? Explain your answer properly.

   c) A LAN uses the Mok and Ward's version of the Binary Countdown protocol. At a certain instant, the 10 stations in the LAN have virtual station numbers 8, 2, 4, 5, 1, 7, 3, 6, 9 and 10 in that order. The next three stations to transmit are 4, 3 and 9, in that order. What are the new virtual station numbers after all three have finished their transmission? Explain briefly. **((6 + 2) + 7 + 5)**

2. a) Derive expressions for channel efficiency for Bit-Map protocol under
      i) Light load condition
      ii) Heavy load condition

   b) Find optimal level (with proper reasoning) for starting search in the Adaptive Tree Walk protocol. Assume that all stations have a fairly good estimate of the number of ready stations at any point of time.

   c) A large population ALOHA users manage to generate 50 requests/ second, including re-transmissions. Time is slotted in units of 40 milliseconds.
      i) What is the probability of success on first attempt?
      ii) What is the average expected number of transmission attempts before a successful transmission?

   d) Give detailed derivation for expected throughput in a pure ALOHA multi-access channel. **((3 +3) + 3 + (3 + 3) + 5)**

3. 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 employ 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 use for this.

   c) The adjacency matrices for a subnet with 15 routers A through O and sink tree for

router B are given below

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	0	1		1		1									
B	1	0	1												
C		1	0						1	1					
D	1			0			1	1	1						
E					0			1		1					
F	1					0		1			1				
G				1			0					1			
H				1	1	1		0							1
I	1		1						0	1					
J			1		1				1	0				1	
K						1					0	1			
L							1				1	0	1		
M												1	0	1	
N										1			1	0	1
O								1						1	0

Adjacency matrix for the subnet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	0	1		1		1									
B	1	0	1												
C		1	0						1	1					
D	1			0			1	1							
E					0					1					
F	1					0					1				
G				1			0								
H				1				0							
I			1						0						
J			1		1					0				1	
K						1					0	1			
L											1	0			
M													0	1	
N										1			1	0	1
O														1	0

Adjacency matrix for Sink Tree for router B

Find number of packets generated by a broadcast from router B, using

i) Reverse Path Forwarding

ii) Sink Tree for B

Explain briefly. **(5 + 7 + (4 + 4))**

4. 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 in the next page. 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)**

5. a) Discuss the Bit – Map method for Multi-Destination (not complete broadcast) routing.

   b) 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?

   c) Give a precise itemized list of the functions performed by different layers of the ISO OSI model.

   d) Discuss briefly, preferably in an itemized manner, possible factors including policy decisions, if any, that may affect congestion in a network. **(4 + 4 + 6 + 6)**

6. 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: 1000 bytes
   Token bucket filling rate: 10 million bytes/second
   Token bucket size: 1 million bytes
   Maximum transmission rate: 50 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))**

7. a) List the different 'classfull' address formats for IPv4. Can you think of any advantage of splitting the addresses into two parts, i.e., Network number & Host number? Can you think of any disadvantage?

   b) What is a subnet? A subnet mask?

c) Give possible schematic formats for each of the different types of entries that may be there in routing tables for a large network that uses subnetting in some of its regions. How is host to host routing done using these tables? ((4 + 2 + 2) + (3 + 3) + (4 + 2))

8. Write short notes on any four:

i) CIDR
ii) Sliding Window Protocol
iii) 802.11 frame format
iv) CSMA/ CD protocols
v) MACA & MACAW
vi) TCP/ IP & UDP
vii) Dijkstra's routing algorithm
viii) Count to infinity problem

(5 + 5 + 5 +5)