1. (4 pt) Answer 'true' or 'false' to the following questions.

56/69
58

-2

T or F

T a) A link with a large propagation delay (compared to transmission delay) benefits more from pipelining protocol than a stop-and-wait protocol.

F b) Go-Back-N needs more sequence number than Selective repeat for a same window size.

F c) Virtual circuit forwarding table keeps only the current connection states whereas packet switching forwarding table keeps entries for all possible destination.

F d) TCP performs network-assisted congestion control.

T e) In the Internet, forwarding is only based on the destination address.

T f) In some networks, connection setup is needed in the network layer.

2. (3 pt) Which of the following is *not* about NAT?
(Ans: b)

(a) It translates IP address and port numbers from/to internal to/from external network
(b) The same ip addresses can be used in an internal network
(c) It improves security by not revealing the actual IP addresses of in the network
(d) It slows IP address space exhaustion

3. (3 pt) Which of the below is *not* related to TCP congestion control?
(Ans: a)

(a) Receiver's buffer size
(b) Slow Start
(c) AIMD
(d) Fast retransmission

4. (3 pt) Which of the following is *not* about DHCP?
(Ans: d)

(a) It delays the need of IPv4 replacement with IPv6
(b) It automatically assigns an address for a host from a pool of addresses
(c) A host does not have to know DHCP server's address to obtain its IP address
(d) An obtained IP address can be used permanently

5. (3 pt) Which of the following is *not* about EWMA (Exponential Weighted Moving Average) (i.e., EstimatedValue = (1- α)*SampleValue + α*EstimatedValue) ? (Ans: c) a

(a) Typically α takes smaller value than 1-α from the above equation
(b) It forgets history gradually/exponentially over time
(c) It is typically used estimations for both RTT average as well as RTT variation
(d) The EstimatedValue changes smoother (i.e., less variable) than SampleValue over time

6. (3 pt) Which of the following is *not* about subnets ? (Ans: c)

(a) Hosts in a subnet has the same subnet part in their IP addresses
(b) A router with multiple interfaces connects to multiple subnets
(c) Hosts in a subnet can reach each other via one router. i.e., the hops counts of the path is two.
(d) To determine the subnets, detach each interface from its host or router, creating islands of isolated networks. Each isolated network is called a subnet

7. (22 pt) Answer the following questions on TCP congestion control?

   (a) (6 pt) Briefly explain AIMD and slow start.
   (b) (6 pt) Briefly explain Fast Retransmission and when/how congestion threshold changes.
   (c) (5 pt) You are downloading a web page with no embedded objects over TCP. Congestion threshold is 9. The length of the page is 50 segments. The round trip time to server is 1 sec. Assume no losses and neglect all other overheads. How many seconds you expect the download to take?
   (d) (5 pt) How does a TCP sender perceive congestion? (i.e., What are the events that TCP considers that network is congested?)

a) AIMD: AIMD stands for Adictive increase multiplicative decrease. In this phase we increase transmission size gradually by 1MSS until loss detected. After loss threshold is set to half of maximum transmission size before threshold. and transmissionsize is also set to half.

Slow start: In this phase we increase transmission exponentially. For every received acknowledgement we send 2 segment. This phase is carried on until threshold is reached

b) Fast Retransmission: If we receive 3 ACKs we transmit the data again. we do not wait for time out to occur. This is known as Fast Retransmission.

-2 how?

Congestion threshold changes whenever loss is detected over network especially during AIMD phase.

c) 50 segment
RTT = 1 sec
Threshold : 9
1st = 1 segment 3 = 4 segment
2 = 2 segment 4 = 8 segment
Now after sending 9 more segments threshold is reached
6 = 10 segments 7 = 11 segments 8 = 12 segments
total time taken = 8 seconds

d) congestion is precived by
1) Repeated Acknowlegement (3 usually) 2) Time out.

8. (10 pt) Below is a list of requests for network address allocations to a service provider. The service provider allocates addresses in the order of organization 1, 2, 3 and 4, beginning at 200.100.0.0. (i.e., 11001000.1100100.00000000.00000000)

Organization 1: 500 hosts
Organization 2: 270 hosts
Organization 3: 1200 hosts
Organization 4: 1100 hosts
Organization 5: 100 hosts

Show the resulting address allocations with CIDR notation. (in binary format)

Once these have been allocated, also show the gaps that exist of unallocated addresses in between those of the networks above.

	Notation of CIDR Address allocation	Range of Addresses Allocated
Organization 1		
Organization 2		
Organization 3		
Organization 4		
Organization 5		

org 1: 200.100.2.0/23

11001000.1100100.00000010.00000000 /23

Range: 11001000.1100100.00000010.00000000 ~
11001000.1100100.00000011.11111111

org 2: 200.100.4.0/22

11001000.1100100.00000100.00000000 /22

Range: 11001000.1100100.00000100.00000000 ~
11001000.1100100.00000101.11111111

org 3: 200.100.24.0/21

11001000.1100100.00011000.00000000 /21

Range: 11001000.1100100.00011000.00000000 ~
11001000.1100100.00011111.11111111

org 4: 200.100.48.0/21

11001000.1100100.00110000.00000000 /21

11001000.1100100.00110000.00000000 ~
11001000.1100100.00111111.11111111

9. (10 pt) The table below is a routing table using CIDR. Address bytes are denoted in binary. The notation '/12' in 11000000.01100000.00000000.00000000/12 denotes a netmask with 12 leading 1-bits, that is 11111111.11110000. 00000000. 00000000.

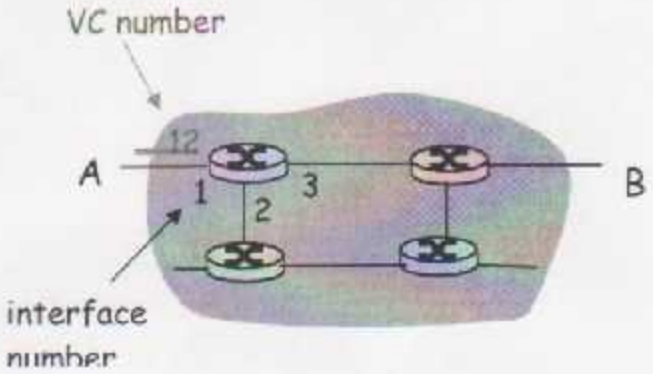
NetMask/Length	NextHop
11000100.01011110.0000001[0].00000000/23	A
11000100.01011110.00000[100].00000000 /22	B
11000100.01011110.10[100000].00000000/19	C
11000100.01011110.01000000.00000000/18	D
11000100.010011[00].00000000.00000000/14	E
11000000.00000000.00000000.00000000/2	F
10000000.00000000.00000000.00000000/1	G

Select to what next hop the packets with the following destination address will be delivered, following the longest prefix matching.

a. (5 pt) 11000100. 01011110.01000001.11001100

b. (5 pt) 11000100.01011110.11001100.10001111

10. (5 pt) Consider the following virtual circuit network. A forwarding table of the northeast router is shown below. On the northeast router, what interface and outgoing VC# will be used for a packet from A?



Incoming interface	Incoming VC #	Outgoing interface	Outgoing VC #
1	12	2	22
2	12	3	18
3	7	2	17
1	97	3	87

outgoing interface: 2
outgoing VC# : 22 ✓

THE END