Birla Institute of Technology & Science, Pilani
First Semester 2010-2011
Computer Networks (BITS C481)
Comprehensive Examination
Thursday, December 02, 2010 (AN) Duration: 3 Hrs Weightage: 40% [80M]

Instructions-:
1. Use separate answer sheets for PART-A and PART-B
2. There is no individual time limit for PART-A and PART-B.
3. Mode of examination is Close Book.
4. Answer all sub parts of the questions all together.

Expected Time: 90 min PART-A Max Marks: 42

Q.1 Answer the following. [Application Layer/Basic Networks] **[4x3=12M]**

I) Host A sends a message to host B over a path of Q links. The message contains M packets of L bits each. Each link transmits at R bps. Assume there is no queuing delay and propagation delay is also negligible.

a) How long does it take to send the message from A to B, if the network is packet switched datagram network and a connectionless service is used? Assume each packet has h bits of header.

b) How long does it takes to send the message over a circuit switched network of R bps transmission rate. Assume t_s setup time and h bits appended to the message as header?

II) Consider a buffer with 100 packets queued; each packet is 1500 bytes in length. The buffer is for an intermediate node with a 100 Mb/s output link. How long will it take for all packets to be transmitted (that is, for the buffer to empty out)?

III) Is it possible for an organization's Web server and mail server to have exactly the same alias for a hostname? How it is achieved?

IV) How is it possible for the "If Modified Since" cache-validation technique to work for http request, even if the two machines have vastly different notions of time (i.e., no clock synchronization)?

Q.2 Answer the following. [Transport Layer] **[3x3=9M]**

I) Host A sends a TCP segment (Seq=43, ACK=103) with payload of 14 bytes. The host B successfully received the segment and wants to send a segment with payload of 14 bytes. What will be the value of Seq and ACK field in the reply from host B? Assume that host A sends the first segment to the host B after connection setup.

II) Consider a pipelined protocol such as Go back N or selective repeat, where the packet size is denoted by S, the acknowledgement size is A, the Window size is W, the transmission rate is R (in either direction), and the round trip time is denoted by RTT. Assuming the network does not introduce errors and is lightly loaded so that there is no queuing delay, and that an ACK is sent for each packet; calculate the smallest window size (in terms of S, A, R and RTT) which allows the sender to send data without idling. Draw the time line diagram to illustrate your answer.

III) In a good multi-path datagram network (i.e. packet will be delivered through different paths and different path has different transmission rate), what is the main advantage of the Selective Repeat over simple Go-back-N?

Q.3 Answer the following. [Network Layer] **[3x3=9M]**

I) Consider destinations connected to a single source (i.e. root of the tree) by a binary tree of routers as shown in Fig.1. Each time a packet is sent over a single link, it incurs one unit of cost.

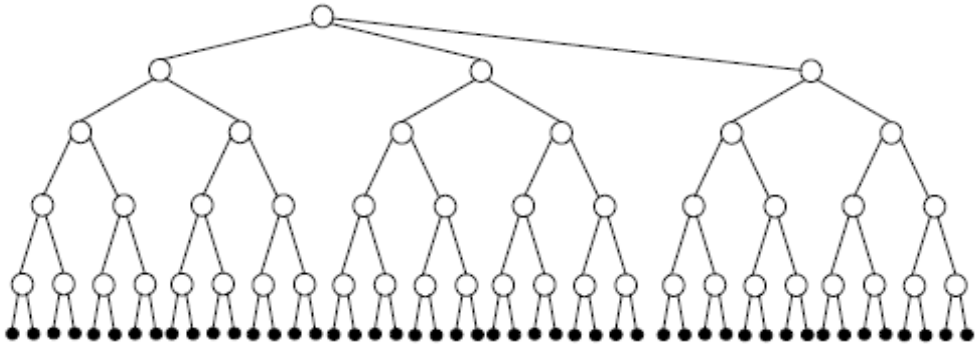

Fig. 1

Assuming there are only 48 destinations (as shown in the Fig.1), what is the cost of sending a broadcast packet using-

a) N-way-unicast.

b) Spanning-tree broadcast.

II) What are the IETF (Internet Engineering Task Force) community arguments for using NAT (Network Address Translation) to overcome from IP addresses shortage? Write any three of them.

III) Consider a router inside one AS that receives a packet for a network inside another AS. Briefly explain how the router decides which router to send it to in its own AS so that it can reach the other AS.

Q.4 Answer the following. [Link Layer] **[4x3=12M]**

I) A 15 bit data word along with parity bits received by the receiver is as follows:

10101**<u>0</u>** 11111**<u>1</u>** 01110**<u>0</u>** **<u>110100</u>.**

Consider the two-dimensional odd parity error detection mechanism to find out which bit is received in error? If, any. The bits shown in bold with underline are parity bits. Assume sender divides the data in a group of 5 bits each to calculate the parity bits.

II) What is IP over ATM? What are the advantages and disadvantages of small ATM cell size?

III) Assume the round-trip propagation delay for Ethernet is 46.4 micro second. This gives a minimum packet size of 512 bits (464 bits corresponding to propagation delay+48 bits of jam signal).

a) What will be the minimum packet size if the delay remains constant and the data rate rises to 100 Mbps?

b) What is the drawback to so large a minimum packet size?

IV) A bit string 0111101111101111110, needs to be transmitted at the data link layer using HDLC protocol. Is there any modification is required to bit stream to send it across the link? Justify. If yes, what would be the correct bit stream?

End of Part A

Expected Time: 90 min **PART-B** **Max Marks: 38**

Q.1 Consider a network path consisting of four 10 Mbps Ethernet LAN segments A, B, C and D connected by three store and forward switches S1, S2, S3 as shown in Fig.2. Assume that each LAN segment introduces a propagation latency of 10 micro seconds, but the switches introduce no queuing delays. **[1+2+2=5M]**

a) Calculate the path's one way latency (total packet delay) for sending a 1 KB frame from host H1 to host H2.

b) Calculate the effective bandwidth (i.e. actual utilization of the bandwidth) for sending 1KB frame across this path.

c) Calculate the effective bandwidth for sending a sequence of 1KB frames if the source H1 must wait for a 20 Byte ACK of the previous frame before it can send the next packet to the destination H2.

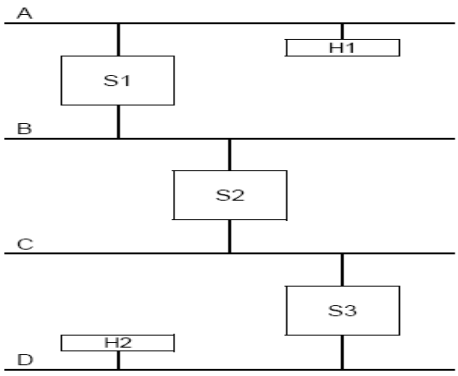

Fig. 2

Q.2 Consider the Fig.2 that shows the interconnection of six LAN segments (LAN A, LAN B, LAN C, LAN D, LAN E, and LAN F) using five bridges (B1, B2, B3, B4, and B5). The numbers shown in figure are representing port numbers of bridges. For example B4 have three ports numbered as 1, 2, 3. Assume that all links are of equal cost. **[2+3=5M]**

a) How the frame transmission is affected in the network with the loop created by bridges B1, B3, and B4? Explain.

b) Identify the route-bridge, route ports and designated ports using spanning tree algorithm. Show the resultant spanning tree.

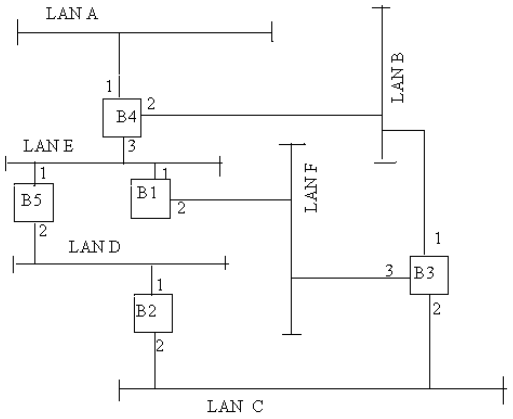

Fig. 3

Q.3 Consider the network topology shown in Fig.4. The numbers on links between the nodes represent the cost corresponding to these links. **[4+3+1=8M]**

a) Using the distance vector algorithm, show the distance tables at node E. Assume that all nodes simultaneously receive distance vectors from their neighbors, compute their new distance vectors, and inform their neighbors if requires.

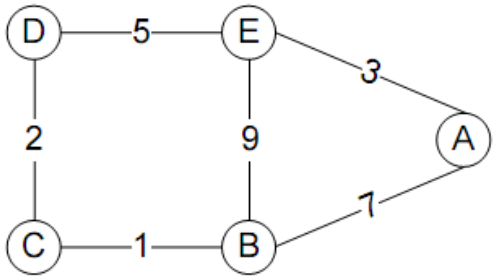

Fig. 4

b) What would be the minimum change in link cost between the nodes C and D that creates the routing loop between node B and C? How does RIP protocol solve this looping problem?

c) Assume the IP addresses of the 5 nodes A, B, C, D and E are 130.132.5.32, 130,132,5,33, 130,132,5,34, 130,132,5,35 and 130,132,5,36. Assume A is the BGP gateway router of the AS represented by the given network. What is the appropriate prefix that node A can announced to other network?

Q. 4 Consider the network shown below which has eight hosts H1,…,H8 and seven routers R1,…,R7 each of which is much faster than any of the links. All links are full-duplex with bandwidths as shown in the Fig.5. Show which routers can never be congested and which ones are more vulnerable to congestion. Justify your answer with proper arguments. **[4M]**

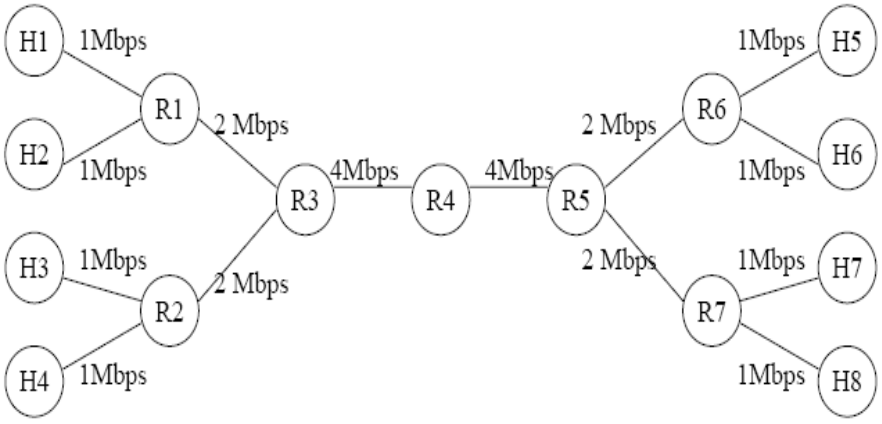

Fig. 5

Q.5 Consider the plot shown in Fig. 6 of TCP congestion window size as a function of time for two TCP connections A and B. In this problem we will suppose that both TCP senders are sending large files. We also assume that the packet loss events are independent in connection A and B. **[2+2+1+3+3=11M]**

a) Considering the above values of congestion window for the connections A and B, can you identify the type of TCP connections (Reno or Tahoe) that have been used? Justify your answer.

b) What are the values of the Threshold parameter between the 1st and the 14th transmission rounds for each connection?

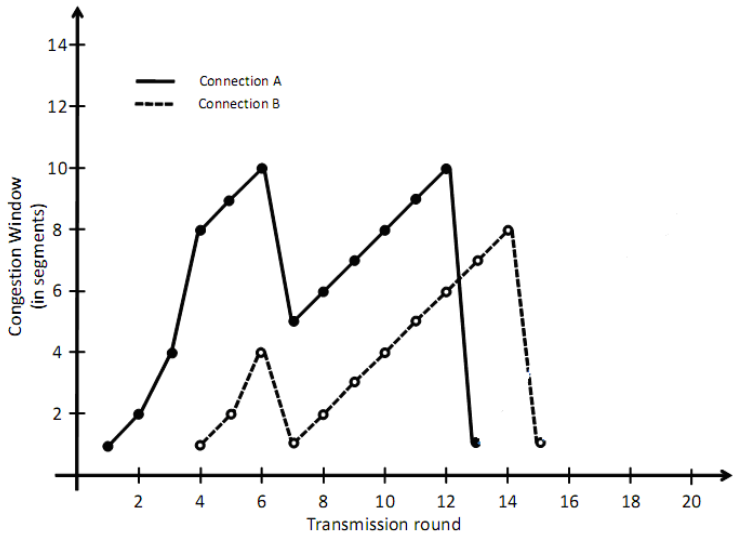

Fig. 6

c) At the 12th transmission round for connection A, is segment loss detected by a triple duplicate ACK or by timeout? Justify your answer.

d) Draw the congestion window values of both connections up to the 20th transmission round, considering that there neither timeout nor duplicate ACK for any of the connections. (Extend the Fig.6)

e) Assume that the segment size is 1460 bytes and that a total of 87600 bytes have been successfully transmitted over connection A before the 13th transmission round. At which transmission round the cumulative amount of the successful transmitted data is equal to 163520 bytes? Again assume that there is neither timeout nor duplicate ACK after the 13th transmission round.

Q.6 Consider the networks shown in the Fig.7. There are two user machines m1.a.com and m2.a.com in the network a.com. Suppose the user at m1.a.com types the URL *www.b.com/myfile.htm* into a browser to retrieve a file from *www.b.com*. Immediately after (in few minutes), machine m2.a.com makes a request to the same URL that m1.a.com made. What will be the sequence of DNS and HTTP messages are exchanged to fulfill the second request made by m2.a.com? **[5M]**

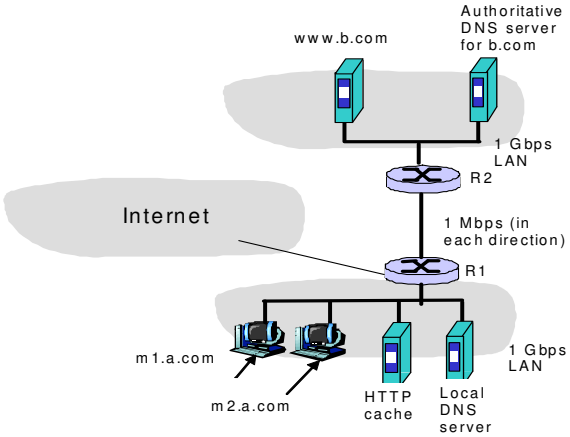

Fig. 7

Assume that Every HTTP request come from a.com is passing through HTTP cache server and all DNS requests are iterated queries.
