Department of Computer Science and Engineering
Motilal Nehru National Institute of Technology
End Semester Exam. Computer Networking(~~CS502~~)
BTech (IT) V Semester CS/503
Time: 3 Hour. MM:60

Note: There are 5 questions. First Question is of 20 marks. Rest are 10 marks each.

1. Suppose you are hired as a networking consultant to some institute. Institute currently operates separately in four departments, each having four sections with 100 (can be increased by 100% in 5 years) hosts. The departments are located in neighboring buildings and sections are at different floors of a building. Management wants to interconnect the departmental networks and to connect the resulting institute network to the Internet through a single gateway.
   (a) List the name and number of devices required to configure the network described above.
   (b) Your task is to plan the network and deliver a graph of the topology and set of instructions for system administrators on how to configure the routing tables. Also give a plan of addressing scheme and route summarization.
   (c) Based on your design, also state the sequence of actions performed at every layer of the devices involved:
      - When two interdepartmental nodes want to have telnet session.
      - When two intra-departmental nodes want to have telnet session.
      - When user from any department wants to check his/her Gmail.

2. Suppose we have a Chord DHT with 5-bit key space and there are 7 nodes in the network, with node ID equal to 2, 5, 8, 13, 19, 20, 26. Further, there are 11 content objects with hashed IDs 03,01,05,08,10,12,19,21, 26, 30,31 already stored on DHT. Answer the following questions:
   (a) Draw a ring to represent the DHT key space; indicate where the 7 peers are situated on this ring.
   (b) Give the finger table for each peer.
   (c) Show the distribution of content objects.
   (d) Suppose you are at peer with ID=8. You have a query for content object that hashes to value 2. Indicate the routing steps that leads you to find the peer that stores the desired content object.
   (e) Suppose now a new node with ID=29 joins the node, write ALL the changes in each peer (finger, successor, predecessor and stored keys).
   (f) Now node 08 wants to unjoin (informed leave) the overlay, write ALL the changes in each peer (finger, successor, predecessor and stored keys), considering the changes already made by part (e).

3. Consider the network shown in Figure.1 on the next page.
   (a) Show the operation of Dijkstra's (LinkState) algorithm for computing the least cost path from E to all destinations.
   (b) From these results, show the least cost path from E to A, and briefly describe (in 1-2 sentence) how you got that answer from your work in part (a)
   (c) What are distance vectors in node E,D and C ? In two or three sentences, explain how least cost path from E to A is determined by E based on these three distance vectors. *Note: You do not have to run Distance Vector Algorithm. You should be able to compute distance vectors by inspection*
   (d) Let us focus again on node E and distance vector routing. Suppose all distance vectors have been computed in all nodes and now suppose that link from E to B goes down. Approximately how many distance vector messages will be sent by node E as a result of this link going down? Explain

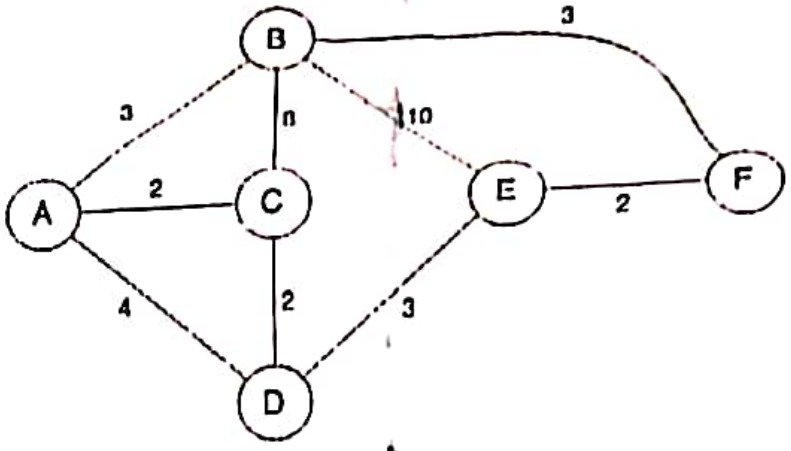

Figure 1: Figure for Question.3

4. (a) Assume that in the network shown in Figure.2, two parallel TCP connections are performed. TCP1 connection (between Source A and Sink A) uses TCP Tahoe (fast retransmit) whereas TCP2 connection (between Source B and Sink B) uses TCP Reno (fast retransmit and fast recovery). Initial *ssthresh* for both connection is set to 32. In this specific scenario, no additional delay is introduced. Thus the RTT is only composed of the sums of the delay indicated on each link times two. (a) For the TCP1 transmission, draw the graph of resultant congestion window with respect to time assuming that a packet loss (triple duplicate ACKs) is detected at time 900 ms. (b) For the TCP2 transmission, draw the graph of resultant congestion window with respect to time assuming that a packet loss (triple duplicate ACKs) is detected at time 650 ms.

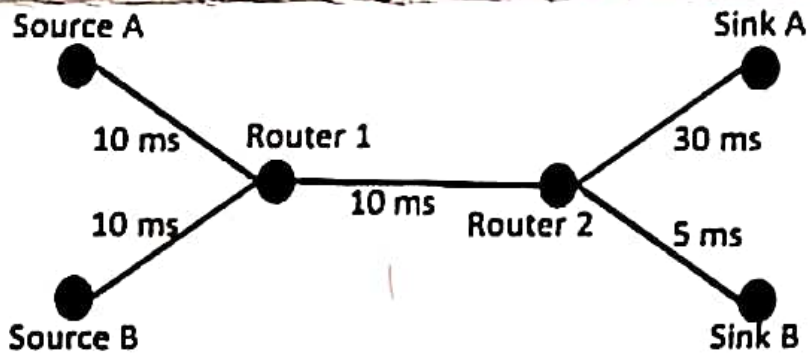

Figure 2: Figure for Question.4

(b) Suppose that s bits are used to represent the sequence number. In class we said that the maximum window size W for Go-Back-N protocol is $W = N - 1$, where $N = 2^s$. The claim is that this is correct only when the packets cannot be re-ordered by the network during the retransmission, i.e., *a packet, P1, sent before another packet, P2, by the sender cannot show up at the receiver later than P2!* Use an example (say, use $s = 2$) to show why $W = N - 1$ will not work correctly if the network can indeed re-order the packets.

5. Write short technical notes on:
   (a) Working of Self-learning layer-2 switch.
   (b) Collision avoidance in IEEE 802.11
   (c) Border Gateway Protocol with description of eBGP and iBGP connections.
   (d) Concept of control plane, data plane and management plane in computer networks.