Assignement Five  
Due Date: 11:00 AM, April, 4th, 2013

Written Assignment (50 points)

1. Consider a virtual-circuit network. Suppose the VC number is an 8-bit field.
   a. What is the maximum number of virtual circuits that can be carried over a link?
   b. Suppose a central node determines paths and VC numbers at connection setup. 
      Suppose the same VC number is used on each link along the VC’s path. Describe how 
      the central node might determine the VC number at connection setup. Is it possible 
      that there are fewer VCs in progress than the maximum as determined in part (a) yet 
      there is no common free VC number?
   c. Suppose that different VC numbers are permitted in each link along a VC’s path. 
      During connection setup, after an end-to-end path is determined, describe how the 
      links can choose their VC numbers and configure their forwarding tables in a 
      decentralized manner, without reliance on a central node. (Page 425 P2)

2. Consider the network below.

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   H1   1   B   2   D   3
   2   4   1   1   2   2
   H2   A   C   H3
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   a. Suppose that this network is a datagram network. Show the forwarding table in 
      router A, such that all traffic destined to H3 is forwarded through interface 3.
   b. Suppose that this network is a datagram network. Can you write down a forwarding 
      table in router A, such that all traffic from H1 destined to host H3 is forwarded 
      through interface 3, while all traffic from H2 destined to host H3 is forwarded through 
      interface 4? (Hint: this is a trick question.)
   c. Now suppose that this network is a virtual circuit network and that there is one 
      ongoing call between H1 and H3, and another ongoing call between H2 and H3. 
      Write down a forwarding table in router A, such that all traffic from H1 destined to 
      host H3 is forwarded through interface 3, while all traffic from H2 destined to host 
      H3 is forwarded through interface 4.
   d. Assuming the same scenario as (c), write down the forwarding tables in nodes B, C, 
      and D. (Page 425 P4)
3. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 63 interfaces, Subnet 2 is required to support up to 95 interfaces, and Subnet 3 is required to support up to 16 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. (Page 428 P12)

4. Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/25. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets? (Page 428 P15)

5. Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors, do the following:
   a. Consider the distance-vector algorithm and show the distance table entries at node z
   b. Use Dijkstra’s shortest-path algorithm to compute the shortest path from z to all network nodes. Show how the algorithm works by computing a table similar to Table 4.3. (Page 430 P24 P26)