CS 536 Fall 2008 - Homework 3
Due 11/06/2008 in class

Problem 1 – 20 pts

Virtual Circuit Network. Consider a virtual-circuit network. Suppose the VC number is a 16-bit field.

1. What is the maximum number of virtual circuits that can be carried over a link ?
2. Suppose a central node determines paths and VC numbers at connection setup. Suppose the same VC number is used on each link along with 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 determined in part (a) yet there is no common free VC number ?
3. 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 thier VC numbers and configure their forwarding tables in a decentralized manner, without reliance on a central node.

Problem 2 – 30pts

Switch fabrics.

1. Why would there be no input queueing if the switch fabric is n times faster than the input line rates, assuming n input lines all have the same line rate.
2. Typical ISP networks overprovision sufficient capacity in the network. That is, the average and peak utilizations of any link is not more than say 10% and 20% respectively. What should be the rate of the switch fabric in terms of line rate, if we do not want any queuing at the input.
3. Consider a router with a switch fabric with 2 input ports A and B, and 2 output ports C and D. Suppose the switch fabric operates at 1.5 times the line speed.
   - If, for some reason, all packets from A are destined to D, and all packets from B are destined to C, can a switch fabric be designed so that there is no input port queuing ? Explain why or why not in one sentence.
   - Suppose now packets from A and B are randomly destined to both C and D. Can a switch fabric be designed so that there is no input port queuing ? Explain why or why not in one sentence.

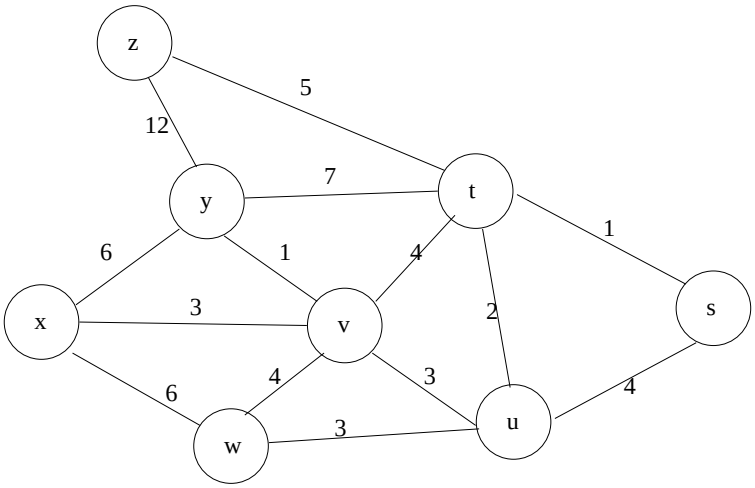
Problem 3 – 10pts

Consider a datagram network that uses 8-bit host addresses. Suppose a router uses longest prefix matching and has the forwarding table in Table 1. For each of the four interfaces, give the associated range of destination host addressess, and the number of addresses in the range.

Prefix Match	Interface
00	0
01	1
10	2
11	3

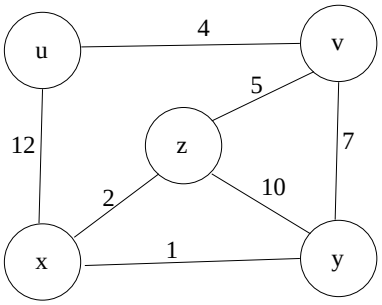
Table 1: Forwarding Table

Problem 4 – 20pts



Dijkstra's shortest-path algorithm. Consider the network shown above. With the indicated link costs, use Dijkstra's shortest path algorithm to compute the shortest path x to all network nodes. Show how the algorithm works by computing a table similar to the one in the text book Table 4.3 in chapter 4.

Problem 5 – 20pts



Distance vector algorithm. Consider the network shown above, and assume that each node initially knows the costs to each of its neighbors. Consider the distances vector algorithm and show the distance table entries at node z similar to the table in Figure 4.30 in chapter 4. How many iterations are required for the shortest path between x and y to converge if the link cost between x and y suddenly increases from 1 to 60.