Introduction to Computer Networks   Final Examination, Fall 2009

1. (5%) Describe how the ping utility works.

2. (10%) Describe how the traceroute utility works.

3. (20%) Consider a network with six nodes, s, t, u, v, w, and x. The costs of the links are shown in the following matrix. A dash in the matrix indicates that there is no link between the corresponding nodes. Calculate the shortest paths from node s to all other nodes using the Dijkstra's algorithm. Show how the algorithm works using the following table, where N' is the set of nodes to which the least-cost paths from the source node are known, D(t) is the cost of the least-cost path from the source node to node t, and p(t) is the previous node along the current least-cost path from the source node to node t.

	s	t	u	v	w	x
s	–	1	–	2	8	–
t	1	–	3	–	5	–
u	–	3	–	–	7	6
v	2	–	–	0	5	–
w	8	5	7	5	–	1
x	–	–	6	–	1	–

Step	N'	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(w),p(w)	D(x),P(x)
0						
1						
2						
3						
4						
5						

4. (10%) What information are required in each of the nodes for running the distance-vector routing algorithm?

5. (5%) Node s has three neighbor nodes t, v, and w. The link costs from node s to nodes t, v, and w are respectively 1, 2, and 8. The minimum costs from node t to node x is 6. The minimum costs from node v to node x is 6. The minimum costs from node w to node x is 1. Calculate the minimum cost from node s to node x using the Bellman-Ford equation.

6. (5%) Describe how loops in paths can be detected in BGP.

7. (5%) Describe the disadvantages of the slotted ALOHA protocol.

8. (10%) Describe how address resolution protocol works.

9. (5%) Describe how the Exponential Backoff mechanism in the Ethernet protocol works.

10. (5%) What are the rationalities behind the exponential backoff mechanism in the Ethernet protocol?

11. (20%) Consider a router R with two interfaces, interface1 and interface 2. Subnet 1 is connected to interface 1 and subnet 2 is connected to interface 2. Host A is in subnet 1 and host B is in subnet 2. Suppose that the ARP tables of all interfaces are initially empty. Describe the detailed operations (including network layer, link layer, ARP operations) required for sending a datagram from host A to host B.

12. (10%) Consider the operation of a self-learning switch with six interfaces. Hosts A, B, C, D, E, and F are connected to interface 1, 2, 3, 4, 5, and 6 respectively. The switch table is initially empty. Suppose that (i) host A sends a frame to host C, (ii) host C replies with a frame to host A, (iii) host E sends a frame to host C, (iv) host C replies with a frame to host E. Complete the following switch table.

	MAC address	Interface
host A sends a frame to host C		
host C replies with a frame to host A		
host E sends a frame to host C		
host C replies with a frame to host E		