Assignment 4: Network Layer
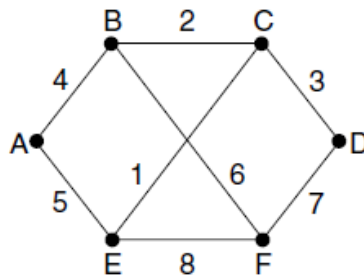
(1)   Consider the network shown below. Distance vector routing is used, and the following vectors have just come in to router C: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10); and from E: (7, 6, 3, 9, 0, 4). The cost of the links from C to B, D, and E, are 6, 3, and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the cost.

(2)   The set of IP addresses from 29.18.0.0 to 19.18.128.255 has been aggregated to 29.18.0.0/17. However, there is a gap of 1024 unassigned addresses from 29.18.60.0 to 29.18.63.255 that are now suddenly assigned to a host using a different outgoing line. Is it now necessary to split up the aggregate address into its constituent blocks, add the new block to the table, and then see if any re-aggregation is possible? If not, what can be done instead?

(3)   For hierarchical routing with 4800 routers, what region and cluster sizes should be chosen to minimize the size of the routing table for a three-layer hierarchy? [Hint: Start with the hypothesis that a solution with k clusters of k regions of k routers is close to optimal, which means that k is about the cube root of 4800 (around 16). Use trial and error to check out combinations where all three parameters are in the general vicinity of 16.]

(4)   Compute a multicast spanning tree for router C in the following network for a group with members at routers A, B, C, D, E, F, I, and K.
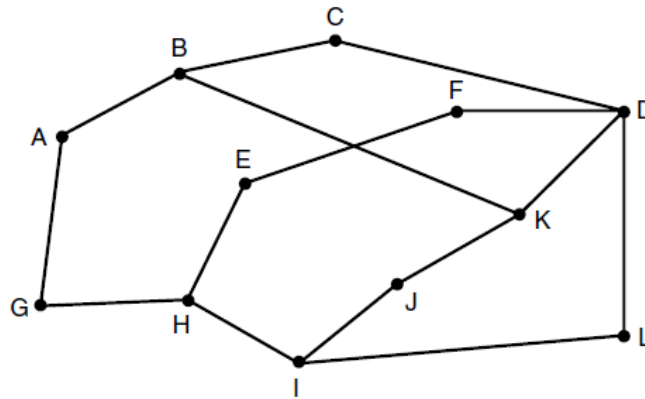
(5)   A datagram network allows routers to drop packets whenever they need to. The probability of a router discarding a packet is p. Consider the case of a source host connected to the source router, which is connected to the destination router, and then to the destination host. If either of the routers discards a packet, the source host eventually times out and tries again. If both host-router and router-router lines are counted as hops, what is the mean number of:
(a) hops a packet makes per transmission?
(b) transmissions a packet makes?
(c) hops required per received packet?

(6)   A token bucket scheme is used for traffic shaping. A new token is put into the bucket every 5 μsec. Each token is good for one short packet, which contains 48 bytes of data. What is the maximum sustainable data rate?

(7)   A computer on a 6-Mbps network is regulated by a token bucket. The token bucket is filled at a rate of 1 Mbps. It is initially filled to capacity with 8 megabits. How long can the computer transmit at the full 6 Mbps?

(8)   A router has the following (CIDR) entries in its routing table:

Address/mask	Next hop
135.46.56.0/22	Interface 0
135.46.60.0/22	Interface 1
192.53.40.0/23	Router 1
Default	Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?
(a) 135.46.63.10
(b) 135.46.57.14
(c) 135.46.52.2
(d) 192.53.40.7
(e) 192.53.56.7

(9)   A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle?

(10) Many organizations have a policy of having two (or more) routers connecting the company to the Internet to provide some redundancy in case one of them goes down. Is this policy still possible with NAT? Explain your answer.