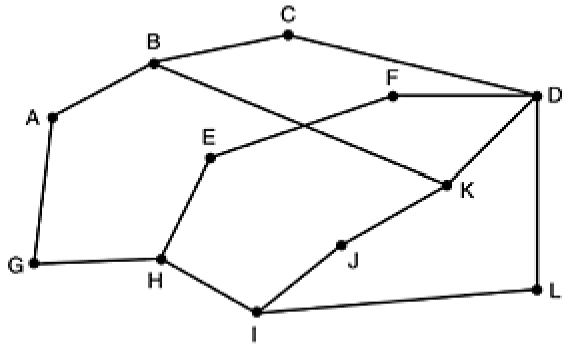
Problems

Note: refer to book for Figures as Fig. 5-13(a), Fig. 5-14 and rest

1. Consider the subnet of Fig. 5-13(a). 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 measured delays 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 expected delay.
2. If delays are recorded as 16-bit numbers in a 25-router network, and delay vectors are exchanged twice a second, how much bandwidth per (full-duplex) line is chewed up by the distributed routing algorithm? Assume that each router has three lines to other routers.
3. In Fig. 5-14 the Boolean OR of the two sets of ACF bits are 121 in every row. Is this just an accident here, or does it hold for all subnets under all circumstances?
4. For hierarchical routing with 5200 routers, what region and cluster sizes should be chosen to minimize the size of the routing table for a three-layer hierarchy? A good starting place is 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 5200.
5. In the text it was stated that when a mobile host is not at home, packets sent to its home LAN are intercepted by its home agent on that LAN. For an IP network on an 802.3 LAN, how does the home agent accomplish this interception?
6. Looking at the subnet of Fig. 5-6, how many packets are generated by a broadcast from *B*, using
   a. the sink tree?
   b. reverse path forwarding?
7. Consider the network of Fig. 5-16(a). Imagine that one new line is added, between *F* and *G*, but the sink tree of Fig. 5-16(b) remains unchanged. What changes occur to Fig. 5-16(c)?
8. Compute a multicast spanning tree for router *C* in the following subnet for a group with members at routers *A*, *B*, *C*, *D*, *E*, *F*, *I*, and *K*.



9. In Fig. 5-20, do nodes *H* or *I* ever broadcast on the lookup shown starting at *A*?
10. Suppose that node *B* in Fig. 5-20 has just rebooted and has no routing information in its tables. It suddenly needs a route to *H*. It sends out broadcasts with *TTL* set to 1, 2, 3, and so on. How many rounds does it take to find a route?
11. In the simplest version of the Chord algorithm for peer-to-peer lookup, searches do not use the finger table. Instead, they are linear around the circle, in either direction. Can a node accurately predict which direction it should search? Discuss your answer.
12. Consider the Chord circle of Fig. 5-24. Suppose that 3 nodes suddenly goes on line. Does this affect node 1's finger table, and if so, how?
13. As a possible congestion control mechanism in a subnet using virtual circuits internally, a router could refrain from acknowledging a received packet until (1) it knows its last transmission along the virtual circuit was received successfully and (2) it has a free buffer. For simplicity, assume that the routers use a stop-and-wait protocol and that each virtual circuit

has one buffer dedicated to it for each direction of traffic. If it takes *T* sec to transmit a packet (data or acknowledgement) and there are *n* routers on the path, what is the rate at which packets are delivered to the destination host? Assume that transmission errors are rare and that the host-router connection is infinitely fast.

14. A datagram subnet 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. (a) hops a packet makes per transmission?
    b. (b) transmissions a packet makes?
    c. (c) hops required per received packet?
15. Describe two major differences between the warning bit method and the (Random Early Detection) RED method.