1. Describe how packet loss can occur at input ports. Describe how packet loss at input ports can be eliminated (without using infinite buffers).

2. Consider some of the pros and cons of virtual-circuit and datagram networks.
   a. Suppose that in order to provide a guarantee regarding the level of performance (for example, delay) that would be seen along a source-to-destination path, the network requires a sender to declare its peak traffic rate. If the declared peak traffic rate and the existing declared traffic rates are such that there is no way to get traffic from the source to the destination that meets the required delay requirements, the source is not allowed access to the network. Would such an approach be more easily accomplished within a VC or a datagram architecture?
   b. Suppose that in the network layer, routers were subjected to stressful conditions that might cause them to fail fairly often. At a high level, what actions would need to be taken on such router failure? Does this argue in favor of VC or datagram architecture?

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 125 interfaces, and Subnets 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

4. Consider the topology shown in Figure 4.17. Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Networks D, E, and F. Assign network addresses to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Of course, subnets D, E and F should each be able to support two interfaces. For each subnet, the assignment should take the form a.b.c.d/x or a.b.c.d/x — e.f.g.h/y.
5. Consider sending a 3,000-byte datagram into a link that has an MTU of 500 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are their characteristics?

6. Consider the network fragment shown below. $x$ has only two attached neighbors, $w$ and $y$. $w$ has a minimum-cost path to destination $u$ (not shown) of 5, and $y$ has a minimum-cost path to $u$ of 6. The complete paths from $w$ and $y$ to $u$ (and between $w$ and $y$) are not shown. All link costs in the network have strictly positive integer values.

   ![Network Fragment](image)

   a. Give $x$’s distance vector for destinations $w$, $y$ and $u$.
   b. Give a link-cost change for either $c(x,w)$ or $c(x,y)$ such that $x$ will inform its neighbors of a new minimum-cost path to $u$ as a result of executing the distance-vector algorithm.
   c. Give a link-cost change for either $c(x,w)$ or $c(x,y)$ such that $x$ will not inform its neighbors of a new minimum-cost path to $u$ as a result of executing the distance-vector algorithm.

7. Consider a network in which all nodes are connected to three other nodes. In a single time step, a node can receive all transmitted broadcast packets from its neighbors, duplicate the packets, and send them to all of its neighbors (except to the node that sent a given packet). At the next time step, neighboring nodes can receive, duplicate, and forward these packets, and so on. Suppose that uncontrolled flooding is used to provide broadcast in such a network. At time step $t$, how many copies of the broadcast packet will be transmitted, assuming that during time step 1, a single broadcast packet is transmitted by the source node to its three neighbors.