1. The TCP/IP protocol suite is built on a datagram network technology, the IP layer. Please describe three advantages the datagram network layer provides.

2. Compare the way ping and traceroute measure the round-trip time.

3. The OSPF packet has a checksum field, but the RIP packet does not. Why?

4. Calculate the latency (from the first bit sent to the last bit received) for:

   (a) A 1-Gbps Ethernet with a single store-and-forward switch in the path, and a packet size of 5000 bits. Assume that each link introduces a propagation delay of 10 us and that the switch begins retransmitting immediately after it has finished receiving the packet.

   (b) Same as (a) but with three switches.

   (c) Same as (b) but assume the switch implements cut-through switching: it is able to begin retransmitting the packet after the first 128 bits have been received.

5. In stop-and-wait transmission, suppose that both sender and receiver retransmit their last frame immediately on receipt of a duplicate ACK or data frame; such a strategy is superficially reasonable because receipt of such a duplicate is most likely to mean the other side has experienced a timeout.

   (a) Draw a timeline showing what will happen if the first data frame is somehow duplicated.

   (b) Suppose that, like data, ACKs are retransmitted if there is no response within the timeout period. Suppose also that both sides use the same time-out interval. Identify a reasonably likely scenario for triggering the Sorcerer's bug.

6.
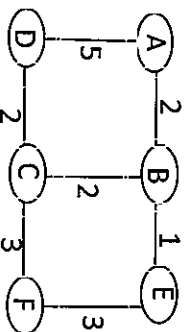
For the network given above, give global distance-vector table when

   (a) Each node knows only the distance to its immediately neighbors.

   (b) Each node has reported the information it had in the preceding step to its immediately neighbors.

   (c) Step (b) happens a second time.

7. TCP uses a host-centric, feedback-based, window-based resource allocation model. How might TCP have been designed to use instead of the following mode?

   (a) Host-centric, feedback-based, and rate-based.

   (b) Router-centric and feedback-based.

8. In mobile IP, what is home address and what is care-of address? How can a message be sent to destination when the destination node is not in its home address? Please draw a picture to show how a message is transferred from a host to the mobile node.

9. What is ARP? What is RARP? How does proxy ARP and gratuitous ARP are introduced to perform ARP on mobile IPv4 when a node is away from home?

10. Let $P \leq 1$ be the fraction of machines in a network that are big-endian; the remaining $1 - p$ fraction are little-endian. Suppose we chose two machines at random and send an int from one to the other. Give the average number of byte-order conversions needed for both big-endian network byte order and receiver-makes-right, for $p = 0.1$, $p = 0.5$, and $p = 0.9$.