Problems

1. IPv6 uses 16-byte addresses. If a block of 1 million addresses is allocated every picosecond, how long will the addresses last?
2. The *Protocol* field used in the IPv4 header is not present in the fixed IPv6 header. Why not?
3. When the IPv6 protocol is introduced, does the ARP protocol have to be changed? If so, are the changes conceptual or technical?
4. Write a program to simulate routing using flooding. Each packet should contain a counter that is decremented on each hop. When the counter gets to zero, the packet is discarded. Time is discrete, with each line handling one packet per time interval. Make three versions of the program: all lines are flooded, all lines except the input line are flooded, and only the (statically chosen) best *k* lines are flooded. Compare flooding with deterministic routing ($k = 1$) in terms of both delay and the bandwidth used.
5. a) Write a program that simulates a computer network using discrete time. The first packet on each router queue makes one hop per time interval. Each router has only a finite number of buffers. If a packet arrives and there is no room for it, it is discarded and not retransmitted.

   b) Instead, there is an end-to-end protocol, complete with timeouts and acknowledgement packets that eventually regenerates the packet from the source router.

   c) Plot the throughput of the network as a function of the end-to-end timeout interval, parameterized by error rate.
6. Write a function to do forwarding in an IP router. The procedure has one parameter, an IP address. It also has access to a global table consisting of an array of triples. Each triple contains three integers: an IP address, a subnet mask, and the outline line to use. The function looks up the IP address in the table using CIDR and returns the line to use as its value.
7. Use the *traceroute* (UNIX) or *tracert* (Windows) programs to trace the route from your computer to various universities on other continents. Make a list of transoceanic links you have discovered. Some sites to try are www.berkeley.edu (California)

   www.mit.edu (Massachusetts)

   www.vu.nl (Amsterdam)

   www.ucl.ac.uk (London)

   www.usyd.edu.au (Sydney)

   www.u-tokyo.ac.jp (Tokyo)

   www.uct.ac.za (Cape Town)

Problems – Chapter 6

Note: refer to book for Figures referred as Fig. 6-2 and rest

1. In our example transport primitives of Fig. 6-2, LISTEN is a blocking call. Is this strictly necessary? If not, explain how a nonblocking primitive could be used. What advantage would this have over the scheme described in the text?
2. In the model underlying Fig. 6-4, it is assumed that packets may be lost by the network layer and thus must be individually acknowledged. Suppose that the network layer is 100 percent reliable and never loses packets. What changes, if any, are needed to Fig. 6-4?
3. In both parts of Fig. 6-6, there is a comment that the value of *SERVER_PORT* must be the same in both client and server. Why is this so important?
4. Suppose that the clock-driven scheme for generating initial sequence numbers is used with a 15-bit wide clock counter. The clock ticks once every 100 msec, and the maximum packet lifetime is 60 sec. How often need resynchronization take place
    a. (a) in the worst case?
    b. (b) when the data consumes 240 sequence numbers/min?
5. Why does the maximum packet lifetime, *T*, have to be large enough to ensure that not only the packet but also its acknowledgements have vanished?
6. Imagine that a two-way handshake rather than a three-way handshake were used to set up connections. In other words, the third message was not required. Are deadlocks now possible? Give an example or show that none exist.