B38CN: Introduction Communications and Networks
Tutorial 3 (Chapter 2)

1. Is the Nyquist theorem true for optical fiber or only for a copper wire?

2. Radio antennas often work best when the diameter of the antenna is equal to the wavelength of the radio wave. Reasonable antennas range from 1 cm to 5 meters in diameter. What frequency range does this cover?

3. The 66 low-orbit satellites in the Iridium project are divided into six necklaces around the earth. At the altitude they are using, the period is 90 minutes. What is the average interval for handoffs for a stationary transmitter?

4. Is an oil pipeline a simplex system, a half-duplex system, a full-duplex system, or none of the above?

5. 1) A modem constellation diagram has data points at the following coordinates: (1, 1), (1, -1), (-1, 1), and (-1, -1). How many bps can a modem with these parameters achieve at 1200 baud?

   2) A modem constellation diagram has data points at (0, 1) and (0, 2). Does the modem use phase modulation or amplitude modulation?

   3) In a constellation diagram, all the points lie on a circle centered on the origin. What kind of modulation is being used?

6. How many frequencies does a full-duplex QAM-64 modem use?

7. What is the essential difference between message switching and packet switching?

8. Compare the delay in sending an x-bit message over a k-hop path in a circuit-switched network and in a (lightly loaded) packet-switched network. The circuit setup time is s sec, the propagation delay is d sec per hop, the packet size is p bits, and the data rate is b bps. Under what conditions does the packet network have a lower delay?

9. In a typical mobile phone system with hexagonal cells, it is forbidden to reuse a frequency band in an adjacent cell. Assume that 840 frequencies are available and all the cells have equal number of frequencies. How many frequencies at most can be used in a given cell?

10. Sometimes when a mobile user crosses the boundary from one cell to another, the current call is abruptly terminated, even though all transmitters and receivers are functioning perfectly. Why?