姚熙源 3190300677 计算机网络作业 2

1. “Fast” Ethernet operates 10x faster (100Mbps) than regular ethernet.Explain why the following changes were made.
(a) Encoding changed to 4B/5B.
(b) CAT-5 cable has more twists.
Answer :
(a) 4B/5B let every 4bits to be mapped into 5bits, so there will never have a run of more than three consecutive 0s. Although it increase the bandwidth overhead about 25% but it is much faster than Manchester encoding with a 100% increase in bandwidth overhead
(b) The use of CAT-5 cable with more twisted pairs enable multiplexing, increasing the transmission rate.

2. If a binary signal is sent over a 3-kHz channel whose signal-to-noise radio is 20dB, what is the maximum achievable data rate?
Answer :
$v_1 = 2Blog_2V\ bits/sec = 2 * 3k * log_2 2 = 6kbps$
Signal-to-noise is 20dB, so S/N = 100, $\log_2(100+1) = \log_2 101 \approx 6.658$,
$v_2 = Blog_2 101 = 6.658 * 3k = 19.974kbps$
$\therefore$ maximum achievable data rate : $v_{max} = \min(v_1, v_2) = 6kbps$

3. What are the advantages of fiber optics over copper as a transmission medium? Is there any downside of using fiber optics over copper?
Answer :
Advantages :
   - Higher bandwidths and Low attenuation.
   - Not being affected by power surges, electromagnetic interference, power failures, or corrosive chemicals in the air.
   - Thin and lightweight, resulting in much lower installation costs..
   - Fibers do not leak light and quite difficult to tap.

   Disadvantages :

   - Easily damaged by being bent too much.
   - Less familiar technology.
   - Fiber interfaces more expensive.

4. Is the Nyquist theorem true for high-quality single-mode optical fiber or only for copper wire?
Answer : Nyquist theorem is true for single mode fiber because it shows the relationship between maximum data rate, bandwidth, data discrete level, and has nothing to do with specific technology.

5. What is the minimum bandwidth needed to achieve a data rate of B bits/sec if the signal is transmitted using NRZ and Manchester encoding? Explain your answer.
Answer : In NRZ, data rate = signal rate, signal rate is B bits/sec. So the minimum bandwidth need to achieve B bits/sec data rate is B/2 Hz. In Manchester encoding, the date = ½ * signal rate, so the signal rate is 2B bits/sec. So the minimum bandwidth needed to achieve B bits/sec data rate is B Hz.

6. Is an oil pipeline a simplex system, a half-duplex system, a full-duplex system, or none of the above? What about a river or a walkie-talkie- style communication?
Answer : Oil pipeline is a half-duplex system because oil can flow in both direction but not at once, either one direction. A river is a simplex system (from high to low) while a walkie-talkie-style communication is a half-duplex-system, two people can communicate to each other but while one of them talking, another one can’t talk at the time.

7. A modem constellation diagram similar to Fig. 2-23 has data points at the following coordinates: (1,1), (1,-1), (-1,1), (-1,-1). How many bps can a modem with these parameters achieve at 1200 symbols/sec?
Answer : Every symbol can transfer $\log_2 4 = 2$ bits, symbol rate = 1200, So, bit rate(data rate) is $\mathrm{R} = 1200 * 2 = 2400 \text{ bps}$

8. What is the difference, if any, between the demodulator part of a modem and the coder part of codec? (After all, both convert analog signals to digital ones.)
Answer : The demodulator part of a modern accept a modulated sine(trigonometric function) wave and generates a digital signals, while the coder part of codec accepts any analog signal and generates digital signals from it.

9. What is the available user bandwidth in an OC-12c connection?
Answer : OC-12c consists of 12 OC-1, so total of 12*90 columns and 9 rows and the first 3 columns of each OC1 are used to transmit management information (segment overhead, line overhead), and the first column of SPE is used as path overhead, so the transmission bandwidth Is $\mathrm{R} = [12 * (90 - 3) - 1] * 9 * 8 * 8000 = 600.768 \text{ Mbps}$

10. Suppose that A, B, and C are simultaneously transmitting 0 bits, using a CDMA system with the chip sequences of Fig. 2-28(a). What is the resulting chip sequence?

A = (−1 −1 −1 +1 +1 −1 +1 +1)

B = (−1 −1 +1 −1 +1 +1 +1 −1)

C = (−1 +1 −1 +1 +1 +1 −1 −1)

D = (−1 +1 −1 −1 −1 −1 +1 −1)

(a)

Answer :

A = (-1 -1 -1 +1 +1 -1 +1 +1)
B = (-1 -1 +1 -1 +1 +1 +1 -1)
C = (-1 +1 -1 +1 +! +1 -1 -1)
Simultaneously transmitting 0 bits, so results = -1, A*-1, B*-1, C*-1
Resulting chip sequence = (-1)*A + (-1)*B + (-1)*C = (+3 +1 +1 -1 -3 -1 -1 +1)