

EE450, Homework #3, due Tuesday, October 13

1. If we want to send data at a speed of 3000 bps through a channel of bandwidth 1000 Hz, what is the minimum S/N ratio required?
2. What is the maximum bit rate that can be transmitted over a channel with bandwidth of 500 Hz and a signal to noise ratio of 5 dB?
3. Encode 00110010 by (a) NRZ-L, (b) NRZI, (c) Manchester, and (d) Differential Manchester.
4. Calculate the signaling rate for the following modulation schemes and bit rates:
  - a) 36Kbps, 4-QAM
  - b) 8Kbps, 32-QAM
  - c) 3Kbps, 8-PSK
5. Calculate the bit rate for the following modulation schemes and signaling rates
  - a) 1Kbaud, 32-QAM
  - b) 2Kbaud, BASK
  - c) 5Kbaud, BFSK
6. Assume that you are to design a synchronous TDM carrier to support 30 voice channels using 6-bit samples and a structure similar to T1. Determine the required bit rate.

7. Find the number of the following devices that could be accommodated by a T1-type synchronous TDM line if 1% of the line capacity is reserved for synchronization purposes.
- a) 110-bps teleprinter terminals,
  - b) 300-bps computer terminals,
  - c) 1200-bps computer terminals,
  - d) 9600-bps computer output ports,
  - e) 64-kbps PCM voice frequency lines.

How would these numbers change if each of the sources were operational an average of 10% of the time? In this case, there will be statistical TDM usage and the line should be utilized at most up to 80% of its capacity.

8. Four 1 Kbps devices are to be multiplexed using synchronous TDM. The multiplexor will take one bit from each source during each cycle. Find
- a) The duration of the bit before multiplexing
  - b) The duration of the bit after multiplexing
  - c) The duration of the multiplexed frame
  - d) The multiplexer bit rate
  - e) The multiplexer frame rate.
9. We have 14 sources, each creating 500 8-bit characters per second. Since only some of these devices are active at any moment, a statistical TDM, using character interleaving, is used to aggregate these sources. Each frame consists of 6 time slots (each time slot will support a character). Four bits of overhead (address) are added to each character in each time slot.
- a) The number of bits in the multiplexed frame
  - b) The multiplexer frame rate
  - c) The duration of the multiplexed frame
  - d) The multiplexer bit rate

10. P.5, Chapter 5, Text