





5. A voice-grade telephone line has a bandwidth of 3100 Hz. A 2 level ASK modulation scheme is used.
- Calculate the maximum possible channel capacity (bit rate).
  - The analog telephone line is to be used to transmit digitized voice (instead of raw analog voice). If the maximum voice frequency is 3000 Hz, and an 8-bit ADC is used, what is the bit rate required for this signal? **Warning:** avoid aliasing.
  - How many symbols will a modulation scheme have to support in order to transmit this bit stream on the telephone line?
  - What is the baud?
6. (This problem is not related to the previous one.) A voice-grade telephone line has a bandwidth of 3100 Hz and an S/N ratio of 30 dB.
- Calculate the maximum channel capacity (bit rate).
  - How many symbols will a modulation scheme have to support in order to transmit this bit stream on the telephone line?
  - What is the baud?

7. A cable television company uses a TV channel's worth of bandwidth (6 MHz) for delivering Internet data to a neighborhood. To keep customers happy, the cable company needs to support a peak data rate of  $60 \times 10^6$  bits/sec on the channel. What is the minimum SNR that allows this data rate?