

# Data and Computer Communications

## Chapter 3 Assignments

### 3.13.

- a. Suppose that a digitized TV picture is to be transmitted from a source that uses a matrix of 480 X 500 picture elements (pixels), where each pixel can take on one of 32 intensity values. Assume that 30 pictures are sent per second. (This digital source is roughly equivalent to broadcast TV standards that have been adopted.) Find the source rate  $R$  (bps).
- b. Assume that the TV picture is to be transmitted over a channel with 4.5-MHz bandwidth and a 35-dB signal-to-noise ratio. Find the capacity of the channel (bps).
- c. Discuss how the parameters given in part (a) could be modified to allow transmission of color TV signals without increasing the required value for  $R$ .

3.15. A telephone line has a bandwidth of 2800 Hz and its signal-to-noise ratio has been computed as 3000. Compute the highest bit rate of this line.

3.16. Data needs to be sent over a noiseless channel of 30-kHz bandwidth.

- a. Find the number of signal levels  $M$  needed if the bit rate desired is approximately 400 kbps.
- b. What maximum bit rate will you get with  $M$  signal levels found in part (a)?

3.20. Consider a channel with a 1 MHz capacity and an SNR of 63.

- a. What is the upper limit to the data rate that the channel can carry?
- b. The result of part (a) is the upper limit. However, as a practical matter, better error performance will be achieved at a lower data rate. Assume we choose a data rate of  $2/3$  as the maximum theoretical limit. How many signal levels are needed to achieve this data rate?