

EECS 122 (SPRING 07): Handout 1

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Question 1:

(a) Suppose that a digitized TV picture is to be transmitted from a source that uses a matrix of 480×500 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).

Question 2:

The audio power of the human voice is concentrated at about 300 Hz. Antennas of the appropriate size for this frequency are impracticably large, so that to send voice by radio the voice signal must be used to modulate a higher (carrier) frequency for which the natural antenna size is smaller.

(a) What is the length of an antenna one-half wavelength long for sending radio at 300 Hz?

(b) Now, suppose the signal is modulated on a carrier frequency so that the bandwidth of the signal is a narrow band centered on the carrier frequency. Suppose we want a half-wave antenna to have a length of 1 meter. What carrier frequency would we use?

Question 3:

A modified NRZ code known as Enhanced-NRZ (E-NRZ) is sometimes used for high density magnetic tape recording. E-NRZ encoding entails separating the NRZ-L data stream into 7-bit words; inverting bits 2, 3, 6 and 7 ; and adding one parity bit to each word. The parity bit is chosen to make the total number of 1s in the 8-bit word an odd count. What are the advantages or disadvantages of E-NRZ over NRZ-L?

Question 4:

Calculate the ratio of powers when the value in dB is 3. What happens when the value changes to 6? What does a value of 10 represent?

Question 5:

(a) What is the difference between bit rate and baud rate?

(b) A digital signaling system operates at 9600 bps. If a signal element encodes a 4-bit word, what is the minimum required bandwidth of the channel?

Question 6:

Show the NRZ, Manchester, NRZI (low start) codings for 1001111100010001.

⁰Credits: William Stallings and Peterson Davie