Department of Electronics & Communication Engineering

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Digital Communication

Assignment-2

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1. A PCM system use a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 bits per symbol .
   (a) What is the maximum message bandwidth for which the system operates satisfactorily?
   (b) Determine the output signal to quantizing noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz is applied to the output.

2. Show that for $\mu = A$ the μ-law and A-law have the same companding gain G_c.

3. Show that the use of A-law companding provides a ratio of maximum step size to minimum step equal to the parameter A.

4. Consider a speech signal with maximum frequency of 3.4 kHz and maximum amplitude of 1 volt. This speech signal is applied to a delta modulator whose bit rate is set at 20 kbps. Discuss the choice of an appropriate step size for the modulator.

5. Differentiate between granular and slope overload noise.

6. Six independent message source of bandwidth W, W, 2W, 2W, 3W and 3W hertz are transmitted on a time division multiplexed basis using a common communication channel.
   (a) Set up a scheme for accomplishing this multiplexing requirement, with each message signal sampled at its Nyquist rate.
   (b) Determine the minimum transmission bandwidth of the channel.
7. Twenty four voice signals are sampled uniformly and the time division multiplexed. The sampling operation use flat-top samples with 1 microsecond duration. The multiplexing

operation includes provision for synchronization by adding an extra pulse of sufficient amplitude and also 1 microsecond duration. The highest frequency component of each voice signal is 3.4 kHz. Assuming a sampling rate of 8 kHz, calculate the spacing between successive pulse of the multiplexed signal.

8. A signal having bandwidth equals to 3.5 kHz is sampled, quantized and coded by a PCM system. The coded signal is then transmitted over a transmission channel of supporting a transmission rate of 50 kbps. Determine the maximum signal to noise ratio that can be obtained by this system. The input signal has peak to peak value of 4 volts and rms value of 0.2 V.
9. A Television signal having bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine
   (a) Code word length
   (b) Transmission bandwidth
   (c) Final bit rate
   (d) Output signal to quantization noise rate.
10. A DM system is designed to operate at 3 times the Nyquist rate for a signal with 3 kHz bandwidth. The quantizing step size is 250 mV.
    (a) Determine the maximum amplitude of a 1-kHz input sinusoidal for which the delta modulator does not show slope overload.
    (b) Determine the post filtered output signal to quantization ratio for the signal of part (a).