**Chapter7**

**Problem 1: (7.3)**

Specify the Nyquist rate and the Nyquist interval for each of the following signals:

(a) 

(b) 

(c) 

**Problem 2:(7.7)**

Twenty-four voice signals are sampled uniformly and then time-division multiplexed. The sampling operation uses flat-top samples with duration. The multiplexing operation includes provision for synchronization by adding an extra pulse of sufficient amplitude and also duration. The highest frequency component of each voice signal is .

1. Assuming a sampling rate of , calculate the spacing between successive pulses of the multiplexed signal.
2. Repeat your calculation assuming the use of Nyquist rate sampling.

**Problem 3:(7.17)**

A PCM system that uses a uniform quantizer is followed by a 7-bit binary encoder. The bit rate of the system is equal to .

1. What is the maximum message bandwidth for which the system operates satisfactorily?
2. Determine the output signal-to-quantization noise ratio when a full-load sinusoidal modulating wave of frequency is applied to the input.

**Problem 4:(7.21)**

Consider a sine wave of frequency  and amplitude , applied to a delta modulator of step-size . Show that slope-over-load distortion will occur if



where  is the sampling period. What is the maximum power that may be transmitted without slope-overload distortion?

**Problem 5:(7.22)**

A linear delta modulator is designed to operate on speech signals limited to . The specifications of the modulator are as follows:

* , where  is the Nyquist rate of the speech signal.
* Step-size .

The modulator is tested with a 1-kHz sinusoidal signal. Determine the maximum amplitude of this test signal permissible to avoid slope overload.