UNIVERSITY OF TEXAS AT DALLAS
Department of Electrical Engineering

EE/TE 4367 - Telecommunications Switching & Transmission
Solution #3

Date assigned: 1/24/2008
Date due: 1/31/2008

Solution 3.1

(a) Additional two bits of coding would allow a quadrupling in the dynamic range, or 12 dB. If the quantization intervals are decreased by 3dB, 9 dB of the maximum amplitude (Amax) of dynamic range increase remains.

(b) If the sampling rate is reduced to (0.7)(8000)=5600 Hz, the number of bits per sample can be increased to (8)/(0.7)=11.4 bits per sample and maintain the same data rate. The additional 3.4 bits per sample allows the SQR to increase by (3.4)(6.02)=20.6 dB.

Solution 3.2 (optional)

(a) To solve the first part of the problem, you only need to use the μlaw function:

$$F_\mu(x) = \text{sgn}(x)\frac{\ln(1+\mu|x|)}{\ln(1+\mu)}$$

The maximum volts is 2 volts. Thus, find x=0.42/2. Insert μ=255 in the above function.

$$F_{255}\,(0.21) \times 127 = 91.6$$

Round this down to the nearest integer as 91. Convert 91 (in decimal) to 7-bit binary word as 1011011. Add the polarity bit "0" to make it an 8-bit word as 01011011. For negative voltages, the polarity bit is "1". Thus, for a -0.21 volts, the result would have been 11011011.

(b) You need the appendix B in *Digital Telephony.* Therefore, you are not required to study the part (b).

Solution 3.3

$\text{Sampling rate} = 1.1(4.2 \times 2) = 9.24MHz$

$$\text{SQR}= 1.76+6.02\text{n}+ 20\log_{10}\left(\frac{A}{A_{\max}}\right)$$

With $A = A_{\max}$ and SQR= 30 dB (given), n = 4.69 ≈ 5 bits/sample

Minimum bit rate = 9.24x5=46.2Mbps