UNIVERSITY OF TEXAS AT DALLAS
Department of Electrical Engineering

EE/TE 4367 - Telecommunications Switching & Transmission
Solution #5

Date assigned: 2/21/2008
Date due: 2/28/2008

Solution 5.1
We need to use Shannon's channel capacity formula:

$$C = W\log_2(1 + SNR)$$

SNR in this expression has to be in linear scale. Thus,

(a) W=2.4KHz, and SNR=20 dB → SNR=100 (linear), → $C = 2400\log_2(1 + 100) = 15.98Kbits/sec$
(b) W=3KHz and SNR=20 dB → SNR=100 (linear) → $C = 3000\log_2(1 + 100) = 19.975Kbits/sec$
(c) W=3KHz and SNR=40 dB → SNR=10000 (linear) → $C = 3000\log_2(1 + 10000) = 39.864Kbits/sec$

Solution 5.2
The bandwidth is 1 MHz → Maximum pulse rate → 2W=2MHz/sec
Using 8-level pulses, L=8, we have the data rate as

$$R = \log_2(L)(2W) = 6Mbits/sec$$

The Shannon channel capacity at 20 dB SNR is

$$C = \mathrm{W}\log_2(1 + \mathrm{SNR}) = 6.6582\mathrm{Mbits/sec}$$

The Shannon channel capacity at 40 dB SNR is

$$C = \mathrm{W}\log_2(1 + 10000) = 13.2879\mathrm{Mbits/sec}$$