HW # 9 Solutions

6.2-1: $L = 128$ characters (levels).

The source (computer) generates 100,000 characters per second.

(a) $n = \log_2 L = \log_2 128 = 7$ bits per character.

(b) The output rate is $7(100{,}000) = 700$ kbits/s.

$B_T(\min) = \frac{700}{2} = 350$ kHz.

(c) For 8 bits instead of 7 bits, we have output rate = 800 kbits/s and $B_T(\min) = 400$ kHz.

6.2-2: Bandwidth $B = 15$ kHz (audio signal).

(a) $R_{Nyquist} = 2B = 30$ k samples/s.

(b) $L = 65{,}536$ levels, then $n = \log_2 L = 16$ bits.

(c) The number of bits per second required to encode the audio signal is

$R_{source} = 30 \times 10^3 \times 16 = 48$ k bits/s.

(d) For a sampling rate aqual to 44,100 samples/s, then

$R_{source} = 44{,}100 \times 16 = 705.6$ Kbits/s.

$B_T(\min) = \frac{1}{2} R_{source} = 352.8$ kHz

6.2-3: Bandwidth $B = 4.5$ MHz.

(a) Sampling rate $= (1.2)(2)(4.5 \times 10^6) = 10.8$ M samplas/s.

(b) $L = 1024$, then $n = \log_2 L = 10$ bits/sample.

(c) The bit rate of the signal is

$R_b = 10\ (10.8) \times 10^6$ bits/s $= 108$ M bits/s.

$B_T(\min) = \frac{1}{2} R_b = 54$ MHz.