CprE 489
Homework 1

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1)

(a) Nyquist rate $\Rightarrow$ 2*(22 KHz), and $2^{10} = 1024$ levels, $\therefore$ m = 10.
Bit Rate = 2(22 KHz) * 10 b/p = 440,000 bps.

(b) The levels must be separated by enough voltage so that the noise cannot push the pulse over halfway from one level to another.
Thus, the levels must be separated by .2*2 volts.

The system can support (1.1V ampl.)*2 / (.2V noise)*2 = 2.2/.4 = 5 levels of logic.

(c) Using Shannon Channel Capacity, $C = (12KHz) * log_2(1 + 35) = 62039.1$
150 Kbps > 62039.1, so this rate of transfer is not viable.

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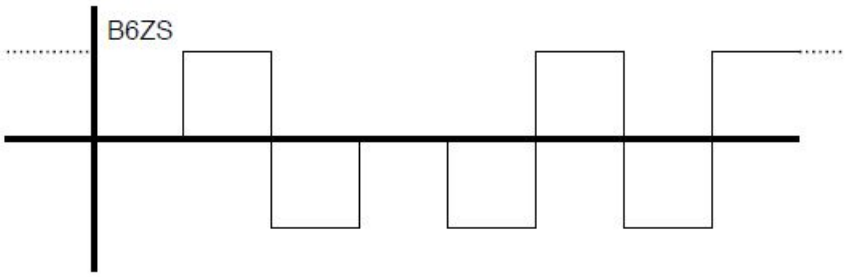
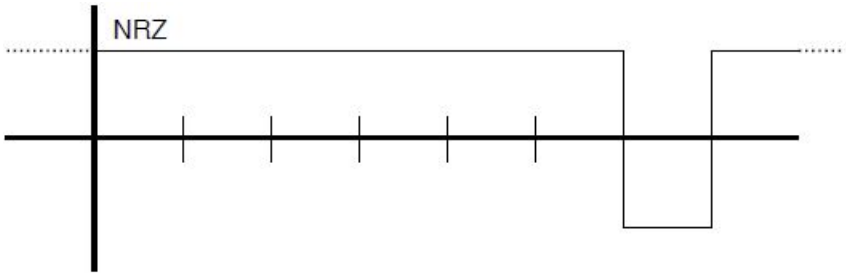
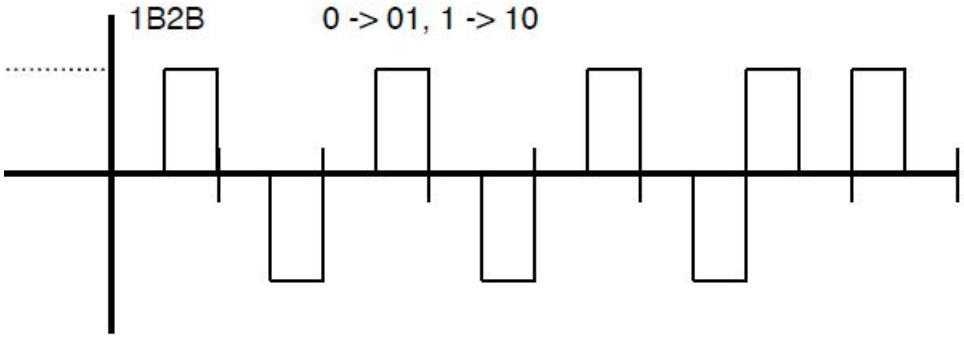
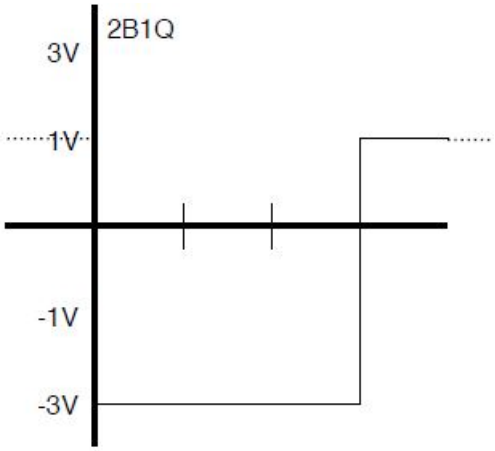
2)




NRZ


1B2B
0 -> 01, 1 -> 10


2B1Q
3V
1V
-1V
-3V