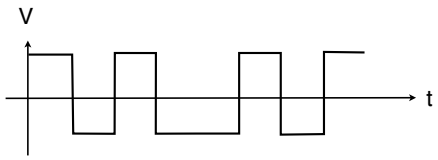
National University of Singapore
School of Computing

CS2105 **Problem Set 9** Semester 2 13/14

1. For each encoding method below, show how the bit sequence `01011001` is encoded: RZ, NRZ-I, NRZ-L, Manchester, Differential Manchester.

   Assume that the signal for the first bit (i.e., bit 0) starts at positive value.

2. The following signal is received. The first bit is 0. Decode the bit sequence if the encoding scheme used is (i) NRZ-I; (ii) Manchester coding; and (iii) Differential Manchester coding.



3. A given transmission medium has a SNR of 127 and supports frequency ranging from 1Mhz to 3MHz. A signal is transmitted using the following modulation scheme:

$$s(t) = \begin{cases} 5\cos(2\pi ft + 45°) & 000 \\ 5\cos(2\pi ft + 135°) & 001 \\ 5\cos(2\pi ft + 225°) & 010 \\ 5\cos(2\pi ft + 315°) & 011 \\ 10\cos(2\pi ft + 45°) & 100 \\ 10\cos(2\pi ft + 135°) & 101 \\ 10\cos(2\pi ft + 225°) & 110 \\ 10\cos(2\pi ft + 315°) & 111 \end{cases}$$

   (a) Draw the constellation for the modulation scheme above.

   (b) What is the theoretical maximum bit rate that can transmitted through the medium?

   (c) What is the maximum baud rate achieved?

   (d) If the transmission medium is noiseless, what is the achievable bitrate?