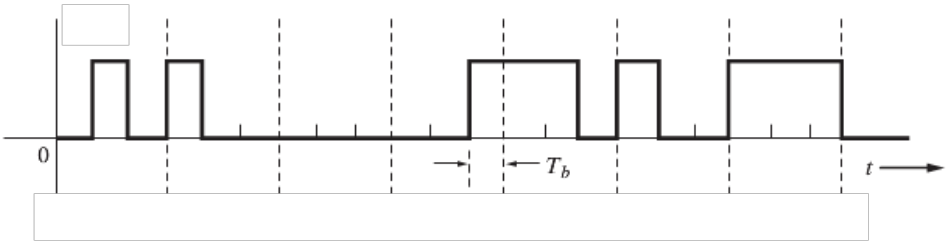
Question 1:
Assume we want to transmit the following binary string: 1101001. Show the resulting signal on the one using the following line coding techniques: (**HINT: Read the slides**)

- Unipolar NRZ
- Unipolar RZ
- Manchester NRZ

Question 2:
Consider a 3-level DAC system with M=8. Assume the signal mapping is given as follow. Answer the following questions:

Digital Word	Output Level, $(a_n)_i$
000	+7
001	+5
010	+3
011	+1
100	−1
101	−3
110	−5
111	−7

A- Show the polar NRZ output waveform of the given binary input: (include the input as shown below- also show the bit and symbol periods. Tb is already shown here) HINT: identify the input stream first, that is 1's and 0's.



B- Assuming the bit rate is 1KHz, what is the symbol rate?

C- For the case above, calculate the null bandwidth (include the unit)

D- Calculate the mean of the mapped signal (a_n)

E- Calculate the variance of the mapped signal (a_n)

F- Using Matlab, plot the power spectral density of the output line code. HINT: Use the sample code below)

G- Show the null bandwidth on your plot, mark it and compare it with your calculated value.

```
% Calculating the PSD for MULTI-LEVEL NRZ
clear;
clf

% Select the bit rate, Rb (bits/sec), in the next line of code
Rb = 3000;
Tb =1/Rb;

% k is number of multilevels, where the number of multilevels
% M is 2^k
k = 3;

f = 0:0.2:10; % The fequency range can be defined up to pi*Rb

temp1 = SA(pi*x); % sinc function; you should define x; keep the pi!

P = ; %Define the PSD here

plot; % Plot the PSD vs. frequency
xlabel('f in Hz -->');
ylabel('Multilevel NRZ PSD');
title(['PSD for Multilevel NRZ Line Code; bits/sec and M=',num2str(M)]);
grid;
```