# EECS 360 – Signals and Systems
# Lab 8: DFT and FFT

1. Use equation (1) to implement Discrete Fourier Transform for the following signal.

$$X_k = \sum_{n=0}^{N-1} x_n e^{\frac{-j2\pi kn}{N}} \qquad k = 0,1,2,...,N-1 \qquad .....(1)$$

$$x[n] = \begin{cases} 0, & \text{for } n \in [-128,-65]; \\ 1, & \text{for } n \in [-64,63]; \\ 0, & \text{for } n \in [64,127]; \end{cases}$$

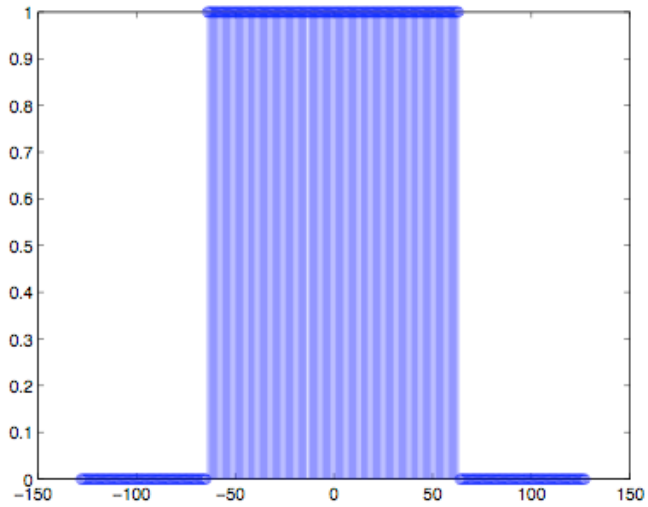


Figure 1: Signal $x[n]$

Use the "*stem*" and "*plot*" commands to graph the original sequence, the magnitude of the spectrum, and the phase of the spectrum.

2. Use the built-in Matlab *fft* command on the sequence given in problem 1. Compare your results to your DFT results. (Hint: They should be the same)

3. Use the *tic* and *toc* commands in Matlab to time how long it takes for each of the Discrete Fourier Transform techniques (DFT/FFT) to calculate the frequency response. Be sure to time only the calculating functions, not plots or other unrelated events. Which technique is the fastest?

4. Repeat step 3 for different sequence lengths (very short ~ 10, short ~ 50, medium ~ 200, long ~ 500, very long ~ 1000). Is one technique always faster or slower than the other?