

ICE503 DSP-Homework#9

1. Given a sequence $x[n] = \cos\left(\frac{2\pi n}{N}\right)$, where N is an even integer, calculate the discrete Fourier transform (DFT) of this sequence.
2. The two 8-point sequence $x_1[n]$ and $x_2[n]$ shown in Figure 1. have DFTs $X_1[k]$ and $X_2[k]$, respectively.

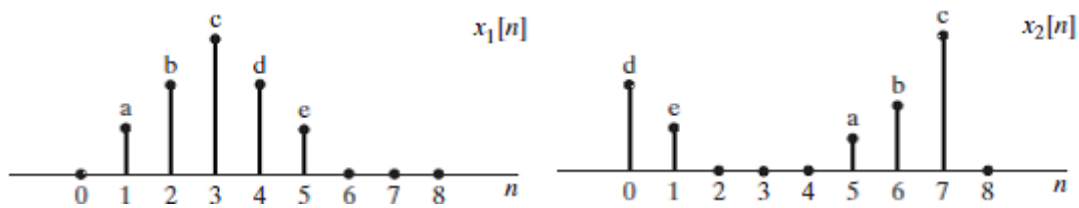


Figure 1. $x_1[n]$ and $x_2[n]$

- (a) Determine the relationship between $X_1[k]$ and $X_2[k]$.
 - (b) Plot the sequence $x_3[n]$ whose DFT is $X_3[k] = W_8^{-5k} X_1[k]$.
3. MATLAB simulation:
Generate a cosine wave for 1 second
$$x(t) = \cos(2\pi 5t).$$

Then, sample the cosine wave $x(t)$ with 100Hz to obtain $x[n]$.
 - (a) Compute the DFT of $x[n]$ with DFT matrix to obtain $X[k]$.
 - (b) Compute the IDFT of $X[k]$ with DFT matrix to obtain $x[n]$.
 - (c) Compute the DFT of $x[n]$ with fft function to obtain $X[k]$.
 - (d) Compute the IDFT of $X[k]$ with ifft function to obtain $x[n]$.
 - (e) Use stem function to plot the amplitude of $X[k]$ and $x[n]$ for (a) ~ (d).