ELEC 421 - Assignment #1

1. Computer the Fourier transform of the following signals.
   (a) $x(n) = \delta(n) + \delta(n-2) + u(n) - u(n-2)$
   (b) $x(n) = \{-1,2,3,2,1\}$
   (c) $x(n) = a^n \sin(\omega_0 n)\, u(n)$, $|a|<1$
   (d) A signal x(n) has the Fourier transform X(w), determine the Fourier transform of $y(n) = x(n) \sin(\omega_0 n) + x(n-1)$, where $X(\omega) = \dfrac{1}{1-0.8e^{-j\omega}}$.

2. For the sequence, N=6. $x_1(n) = \cos(\frac{2\pi}{N} n) + \delta(n)$, and $x_2(n) = u(n) - \delta(n-1)$, $0 \le n \le N-1$.
   (a) Suppose N=6. Determine the N-point DFT of $x_1(n)$.
   (b) Determine the 2N-point DFT of $x_1(n)$ by zero-padding first. What is their relationship?

3. Determine the 8-point DFTs of the following signals
   (a) $x(n) = \{1,0,1,0,0,0,0,0\}$.
   (b) $x(n) = a^n$, $|a|<1$, $0<=n<=7$.

4. Consider the sequence $x_1(n) = \{\underset{\uparrow}{1}, 1, 0, 0\}$ and $x_2(n) = \{\underset{\uparrow}{1}, 1, 3, 6\}$.

   (a) Given the 4-point DFT of the sequence x1(n), compute the DFT of the sequence $y(n) = \{\underset{\uparrow}{1}, 0, 0, 1\}$.

   (b) Determine a sequence y(n) such that $Y(k)=X_1(k)X_2(k)$.

   (c) Calculate the linear convolution $x_1(n)*x_2(n)$ by using DFT.