Reading Assignments:
Read Chapter 6.1-6.6 of Chen

Paper and Pencil Assignments:
1. Given the following discrete-time input \( x(nT) \), sketch the outputs reconstructed continuous signal \( y(t) \) using Sample-And-Hold and Linear Interpolation.

\[
\begin{align*}
\text{x(nT)} & \\
\hline
0 & T & 2T & 3T & 4T
\end{align*}
\]

2. Show that the impulse response for the low-pass filter used in linear interpolation is as follows, where \( T \) is the sampling period:

\[
h(t)
\]

3. Show that the discrete-time complex exponentials \( u[n] = e^{j\omega nT} \) is an eigen-signal for any discrete-time LTI system \( L \), i.e. the following statement is true:

\[
L[e^{j\omega nT}] = H(\omega)e^{j\omega nT}
\]

Show that \( H(\omega) \) is in fact the Discrete-Time Fourier Transform \( H_d(\omega) \). Use this fact to show the DTFT of convolution \( x[n]y[n] \) is the product of their respective DTFT \( X_d(\omega)Y_d(\omega) \).

4. During lecture, we discussed the Discrete Fourier transform pair:

\[
X_k = \sum_{n=0}^{N-1} x(nT)e^{-j\frac{2\pi kn}{N}}, \quad k = 0,1,\ldots,N-1
\]

\[
x(nT) = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{j\frac{2\pi kn}{N}}, \quad n = 0,1,\ldots,N-1
\]

You are given the discrete-time signal \( x[n] = [1 \ 2 \ 1] \), starting at \( n=0 \). Compute the four-point DFT (\( N=4 \)) and its inverse. Do you get back the original signal? Now repeat the process for a two-point DFT (\( N=2 \)).
5. Problem 6.2
6. Problem 6.3
7. Problem 6.4
8. Problem 6.6
9. Problem 6.8
10. Problem 6.10
11. Problem 6.14