Problem 7.25 from Oppenheim/Schafer/Buck
Do parts b and f only.

Problem ECE535-7
In this problem you will use the window method to design an FIR linear-phase, causal discrete time filter that approximates the ideal response:

\[ H_d(e^{j\omega}) = \begin{cases} 1 & |\omega| \leq \frac{\pi}{4} \\ 0 & \frac{\pi}{4} < |\omega| \leq \pi \end{cases} \]

(a) Obtain an expression for the infinite duration impulse response \( h_d[n] \).

(b) Determine the coefficients of a 5-tap causal filter using a Hamming window.

(c) What is the group delay of this filter?

(d) Check your solution using Matlab’s \texttt{fir1} command to design the filter. Note that \texttt{fir1} defaults to using the Hamming window. For an accurate comparison to your solution, you will need to use the ‘noscale’ option for \texttt{fir1}. Type \texttt{help fir1} for more information about this command.

Problem 4.14 from Oppenheim/Schafer/Buck
Be sure to show your work, not just your final answers.

Problem 4.44 from Oppenheim/Schafer/Buck

Matlab Exercises: Frequency Sampling Filter Design
Do all exercises in Section 5.4 of Computer Explorations in Signals and Systems by Buck, Daniel, and Singer. Your solution to these exercises should be your Matlab code, plots, and any written work.

This section will give you some insights about another type of filter design, as well as familiarize you with skills you need for the “Advanced Problems” section of Project 3.

Additional instructions for part c: Please include a plot of the phase response \( \hat{H}(\omega) \) that you define.