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% Tune-Up #6 - Fall 2025 - ECE 313 Linear Systems & Signals - Evans

% Copy this file into a Matlab script window, add your code and
% answers to the questions as Matlab comments, hit "Publish", and
% upload the resulting PDF file to this page for the tune-up
% assignment.  Please do not submit a link to a file but instead
% upload the file itself.   Late penalty: 2 points per minute late.

% Homework problem 6.1(a).

% For the first-order unnormalized averaging filter (lowpass filter)
%      y[n] = x[n] + x[n-1]
% and the initial condition x[-1] = 0
% as a necessary condition for LTI
% system properties to hold.
% Determine the formulas for, and
% plot in MATLAB, the following:

% i. impulse response
%    h[n] = d[n] + d[n-1] where d[n]
%    is the discrete-time impulse signal
n = [ 0 1 2 3 ];
filterCoeffs = [ 1 1 ];
impulse = ( n == 0 );
h = conv( filterCoeffs, impulse );
stem([n, 4], h, 'LineWidth',2 );
ylim( [-0.5 1.5] );
xlim( [-0.5 4.5 ] );
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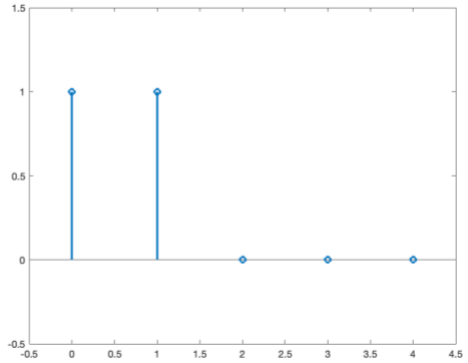


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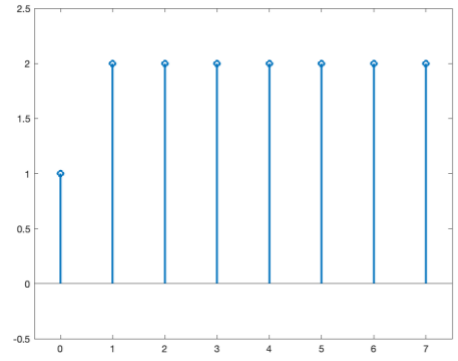
% ii. step response
%     ystep[n] = u[n] + u[n-1]
stepsignal = [ 1 1 1 1 1 1 1 1 ];
ystep = filter( [1 1], 1, stepsignal );
n = [ 0 1 2 3 4 5 6 7 ];
figure;
stem(n, ystep, 'LineWidth',2 );
ylim( [-0.5 2.5] );
xlim( [-0.5 7.5 ] );
```

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% iii. Plot the magnitude and phase of
%      the frequency response using freqz.
%      H( exp(j w) ) = 1 + exp(-j w)
figure;
freqz( [ 1 1 ] );
% Magnitude response: Vertical axis is in
%   deciBels.  AdB = 20 log10(A). A linear
%   of a 1 equals 0 dB. In the magnitude
%   plot, low frequencies pass through
%   with gain (at or above 0 dB) and very
%   high frequencies (close to pi) are
%   attenuated.  Lowpass filter.
% Phase response: A line with a slope of
%   -1/2 if the phase were plotted in rad.
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