Report Item 1:

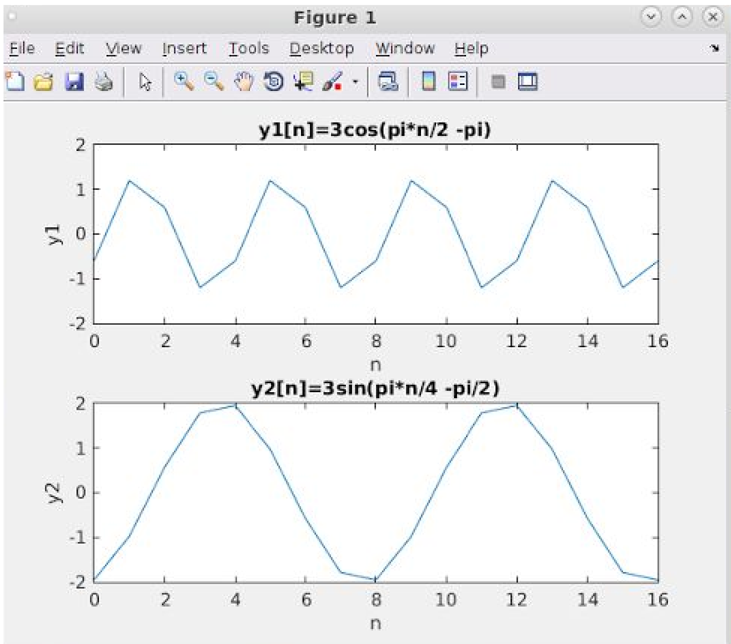
1. y1[n] = abs(Hd(w))*3*cos(pi*n/2 + angle(Hd(w)))

   y1[n] = abs(Hd(w))*3*sin(pi*n/4 + angle(Hd(w)))

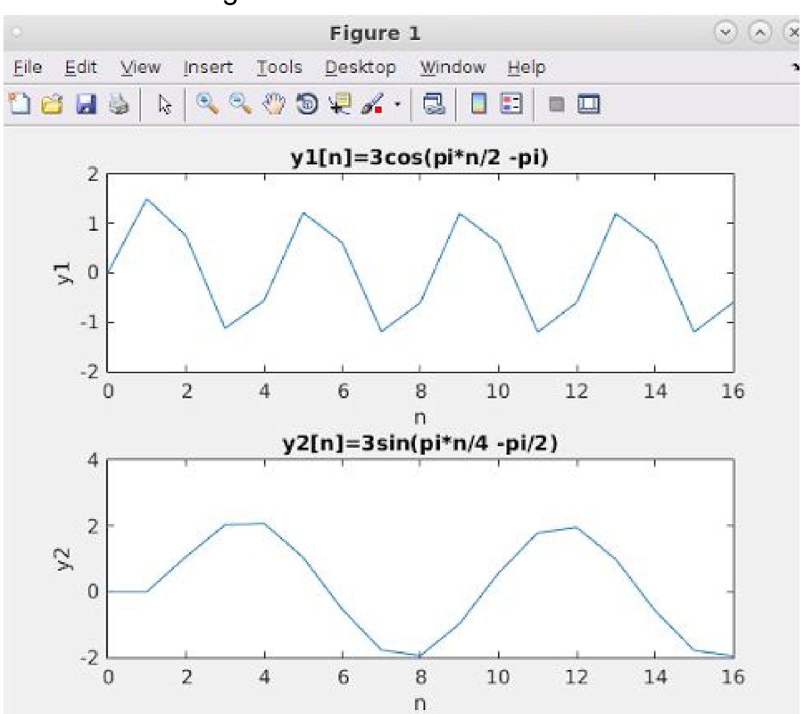
In which,

   Hd(w) = a*exp(-1j*w)/(1-b*exp(-1j*w))

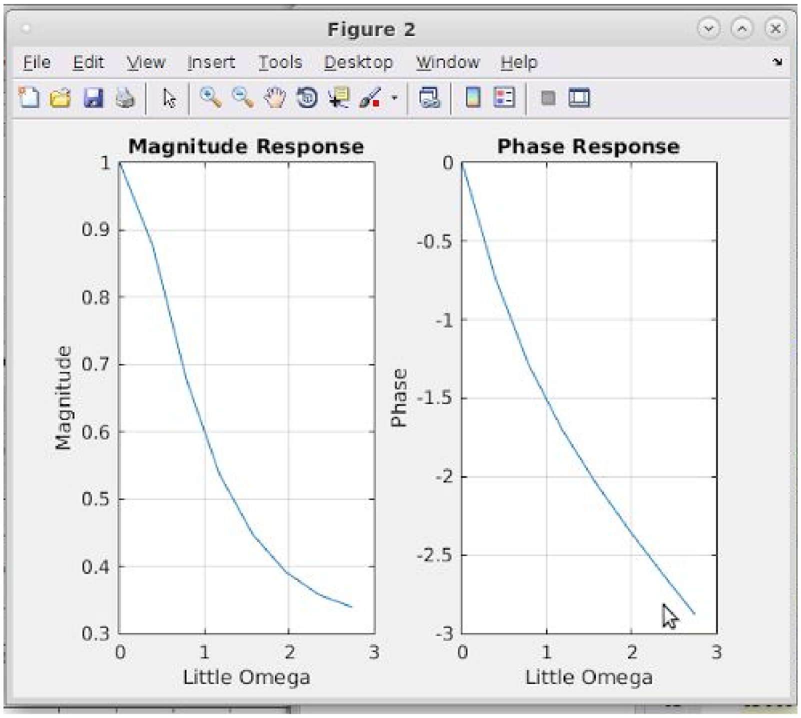
2. Plots of y1[n] and y2[n]



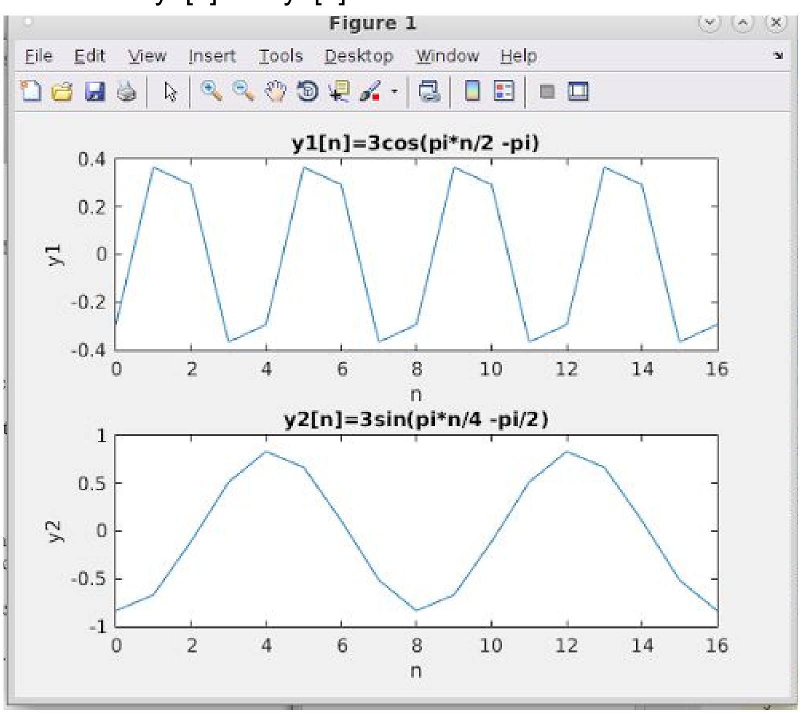
3. Plots using filter



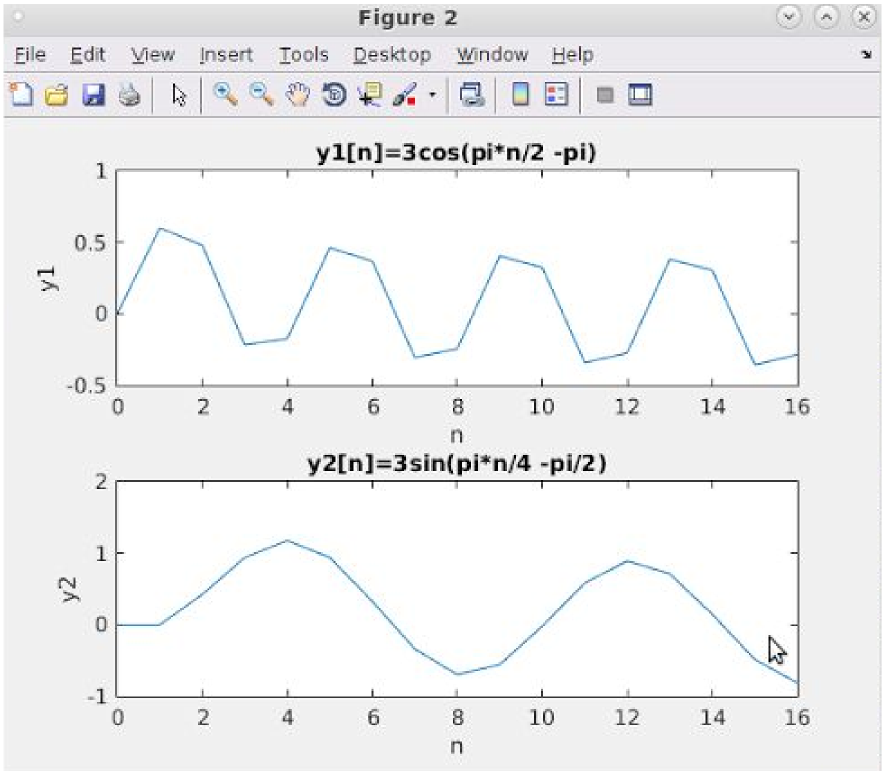
4. Magnitude and frequency response



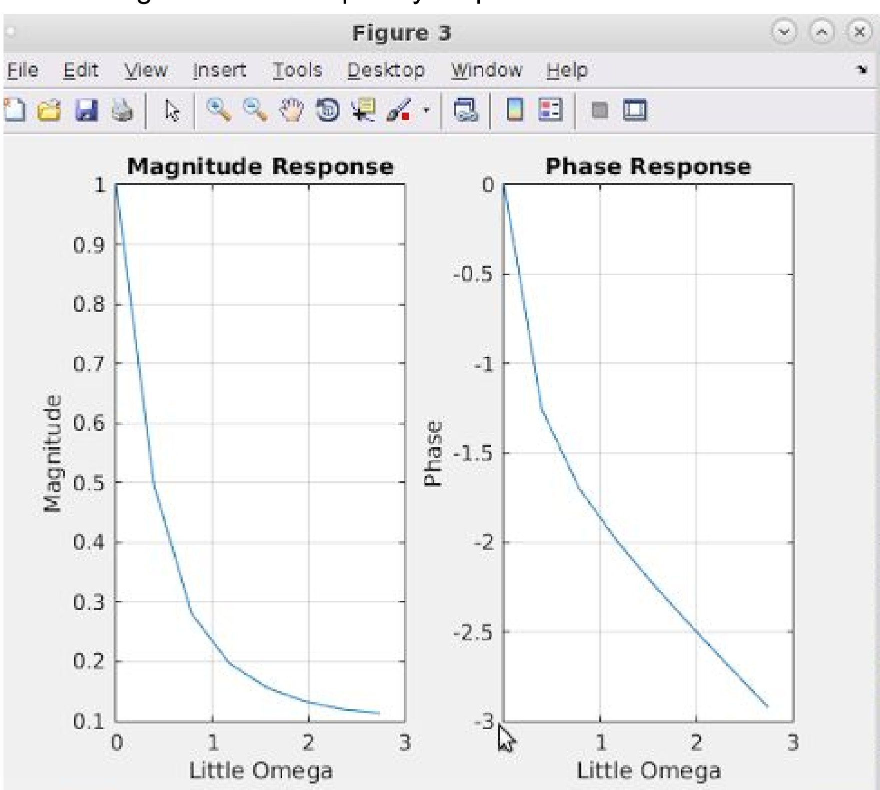
5. Repeat
    a. y1[n] = abs(Hd(w))*3*cos(pi*n/2 + angle(Hd(w)))
       y1[n] = abs(Hd(w))*3*sin(pi*n/4 + angle(Hd(w)))
    In which,
       Hd(w) = a*exp(-1j*w)/(1-b*exp(-1j*w))
    b. Plot y1[n] and y2[n]



c. Using filter function



d. Magnitude and frequency response



Report Item 2:

1. Calculation of H(z)

$$h[n] = 1, -2, 3, -4, 0, 4, -3, 2, -1$$

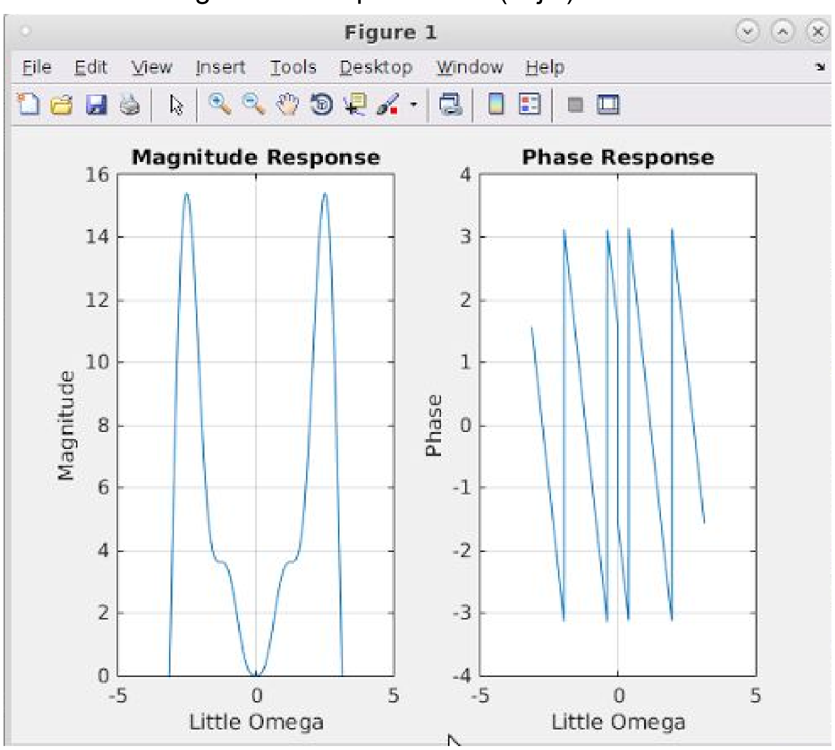
$$h[n] = \delta[n] - 2\delta[n-1] + 3\delta[n-2] - 4\delta[n-3] + 4\delta[n-5] - 3\delta[n-6] + 2\delta[n-7] - \delta[n-8]$$

$$\delta[n] \xrightarrow{Z} 1$$

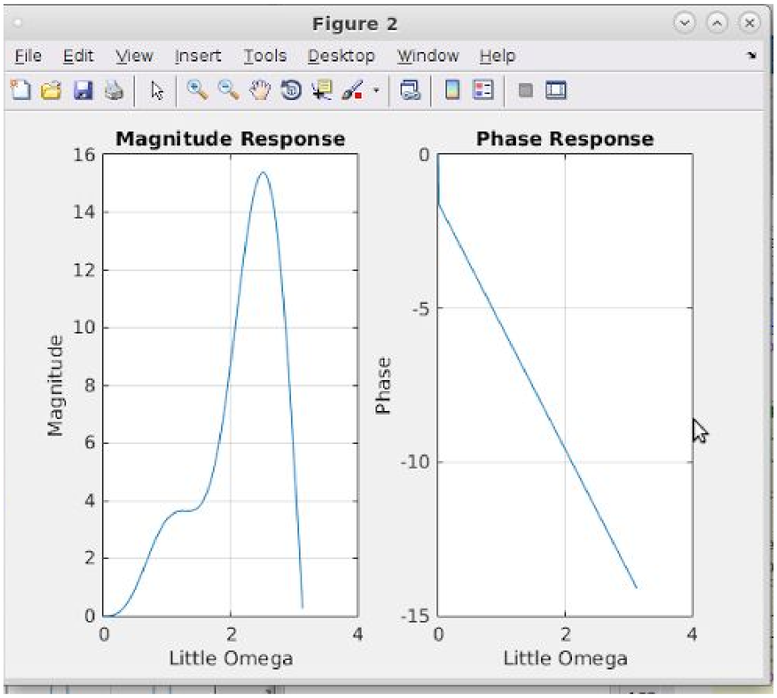
$$2\delta[n-1] \xrightarrow{Z} 2z^{-1}$$

$$H(z) = 1 - 2z^{-1} + 3z^{-2} - 4z^{-3} + 4z^{-5} - 3z^{-6} + 2z^{-7} - z^{-8}$$

2. Plot magnitude and phase of H(e^jw)



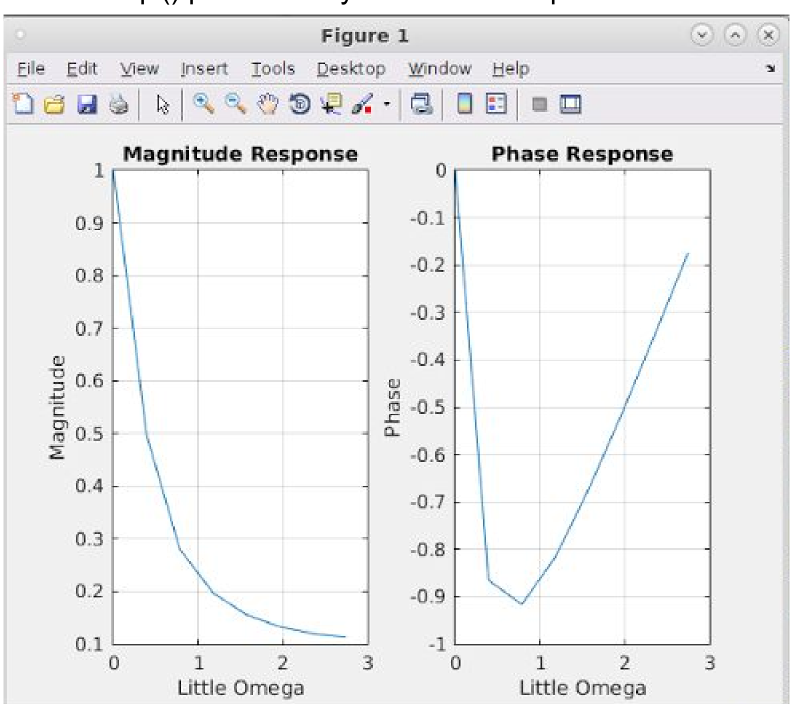
3. Plot magnitude and phase using freqz()



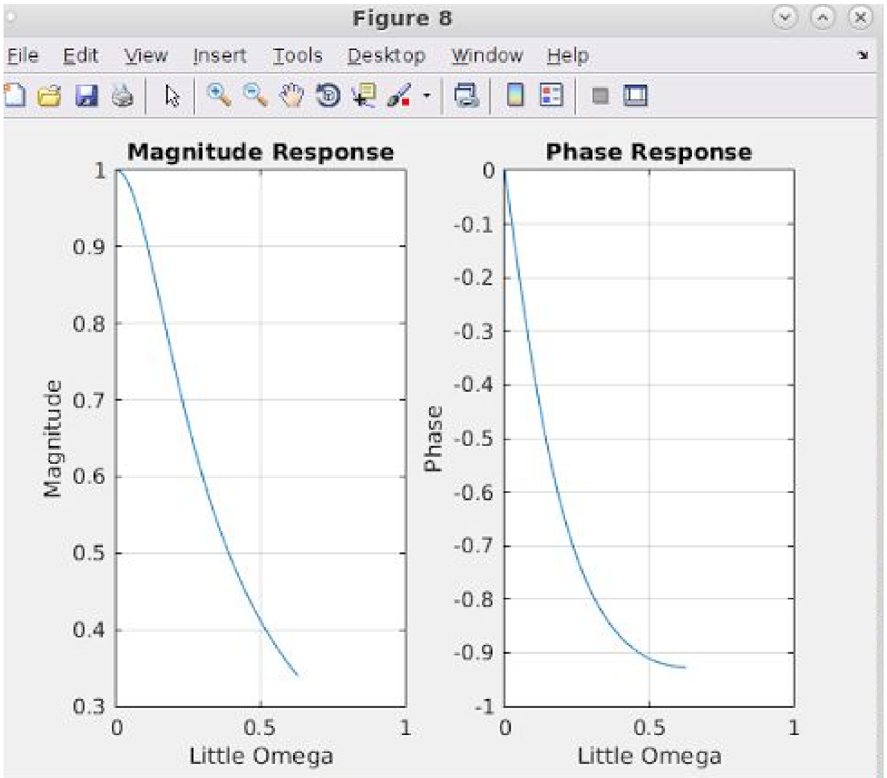
4. The two plots are not the same. By using the eigenvector method, we are plotting both negative and positive responses. However, the freqz() only evaluate the positive portion.

Report Item 3:

1. freqz() plot of the system from 0 to pi

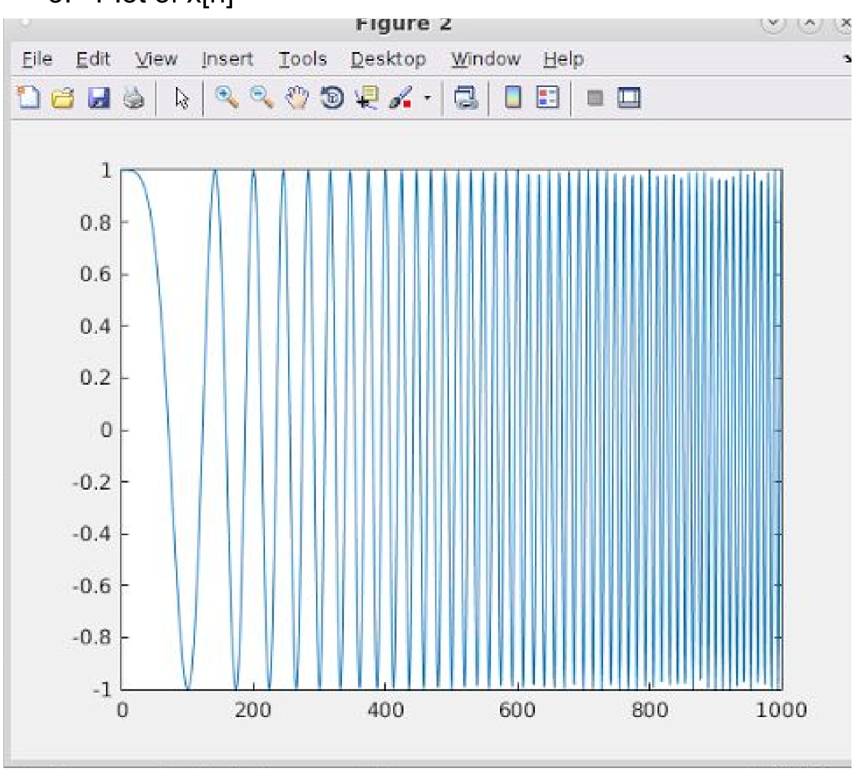


2. Frequency response plot

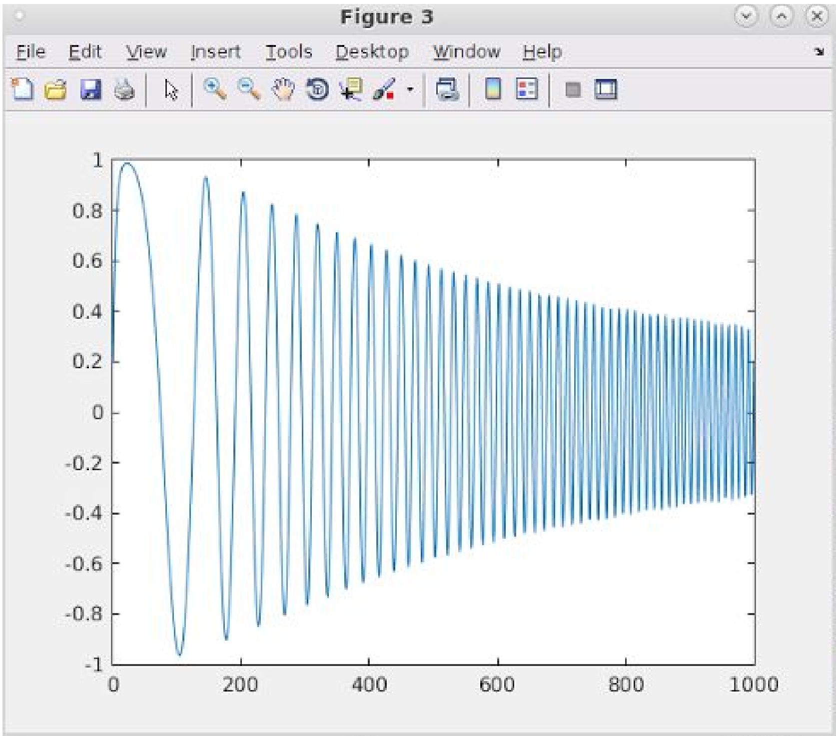


This is a portion of the plot in 1).

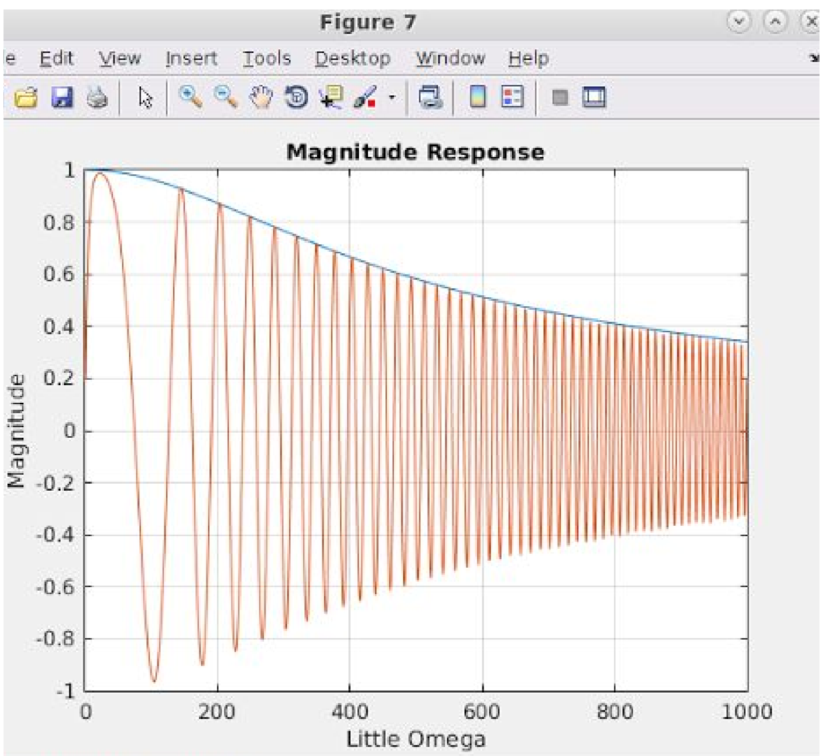
3. Plot of x[n]



4. Plot of filtered x[n]



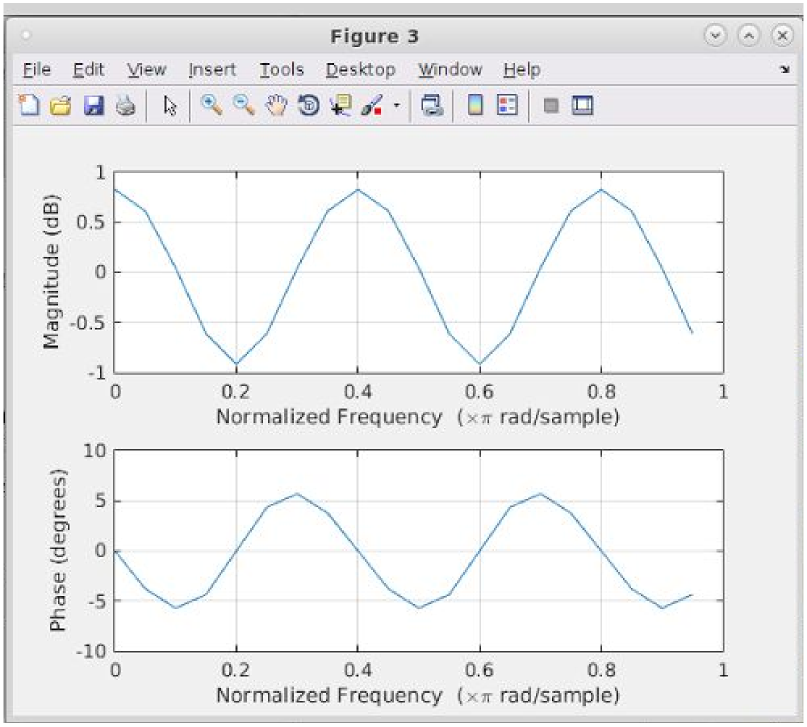
5. Verify result



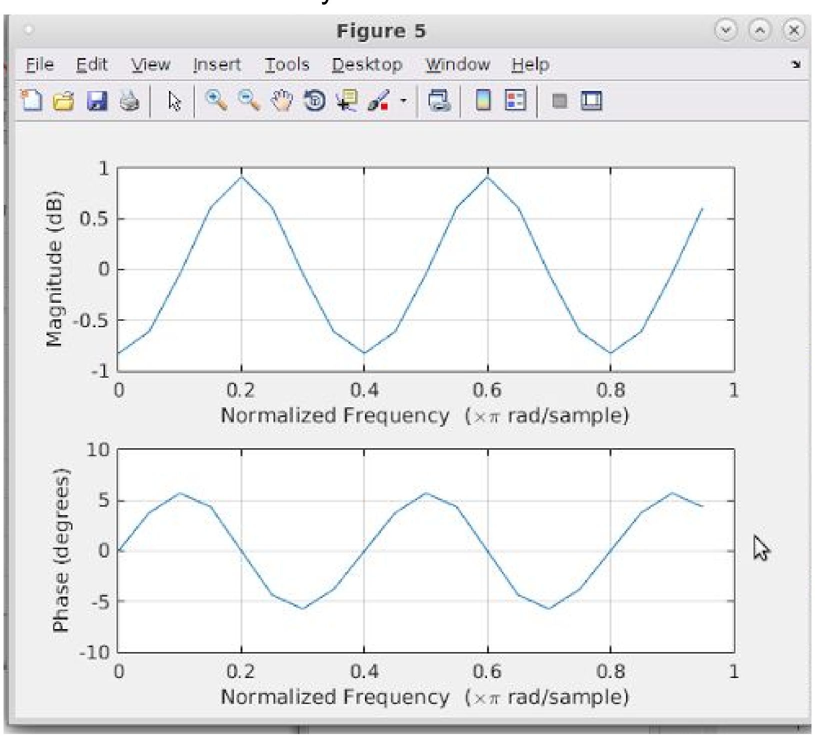
The two graphs fits pretty well.

Report Item 4:

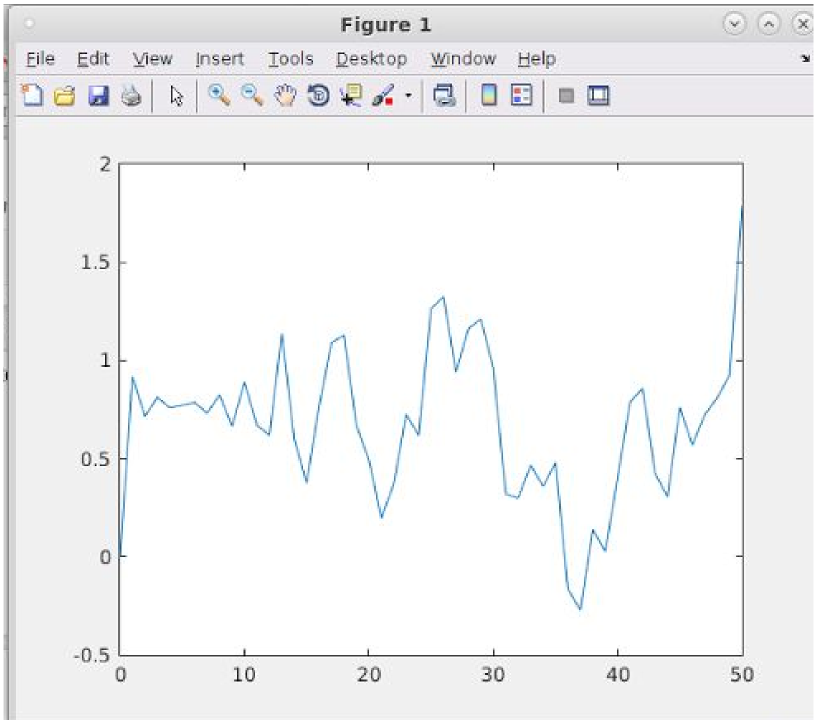
1. Plot the forward system



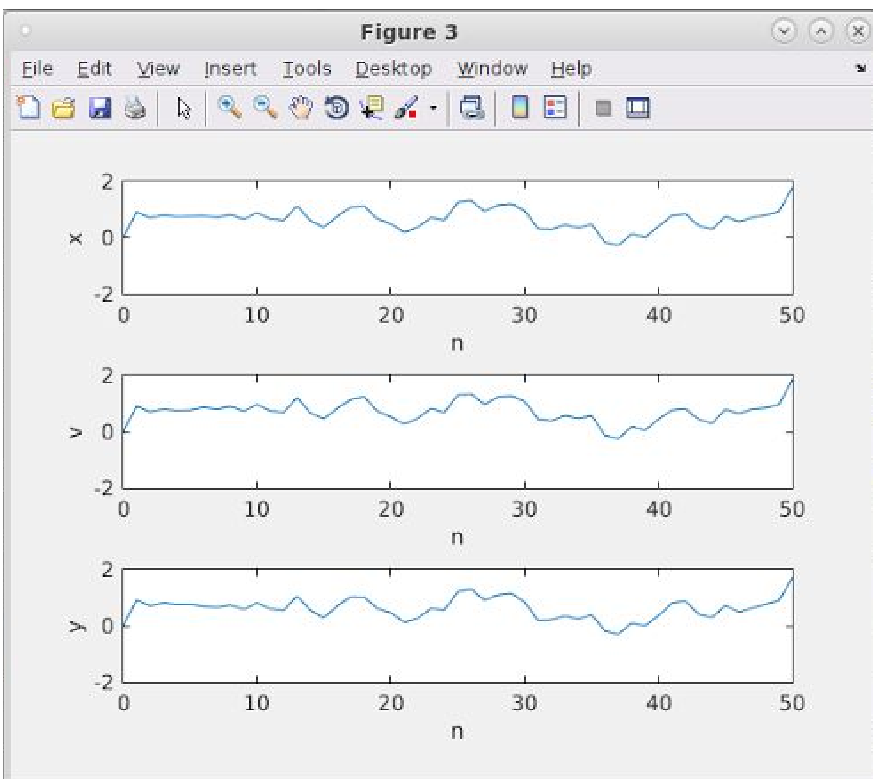
2. Plot the inverse system



3. Plot x[n]



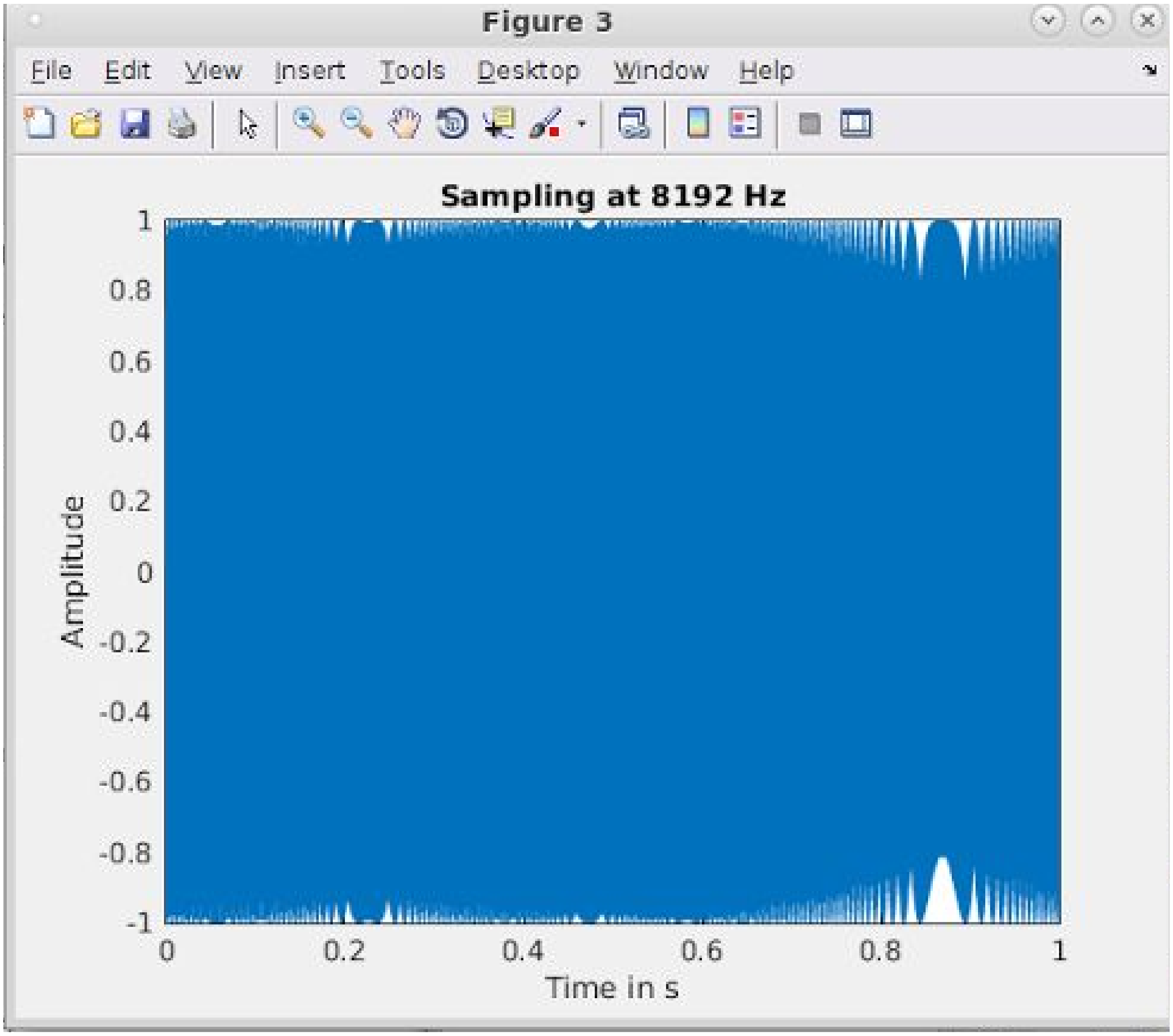
4. Plot x[n], v[n], and y[n]



By going through the forward system and then going through the inverse system, we got the same signal as we have at the first place.

Report Item 5:

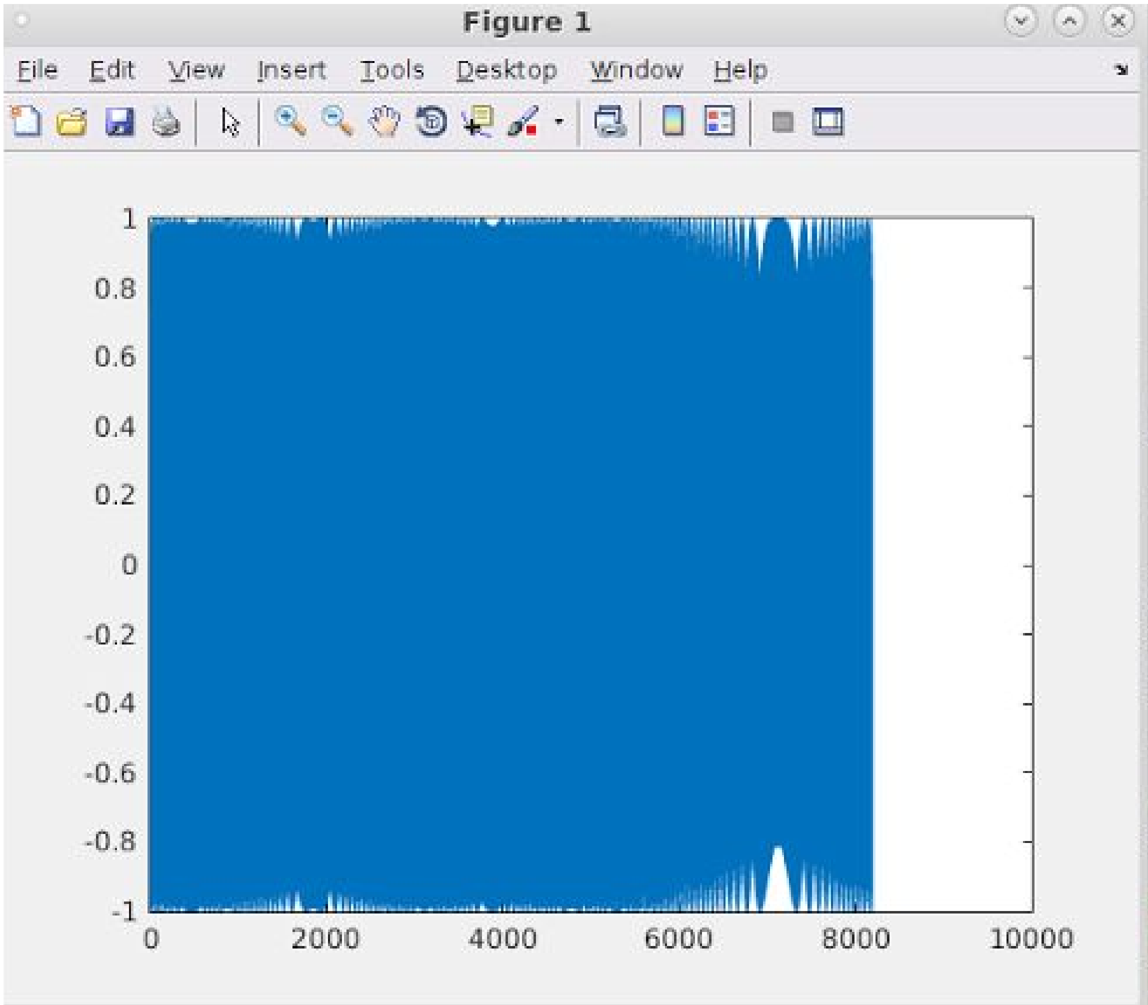
1. Plotting function response



2. Comment on what you hear

I heard a continuous sound. The pitch is pretty high. The sound lasted about 1 second. However, I didn't hear the aliasing.

3. X[n]



4. Time that the signal aliases

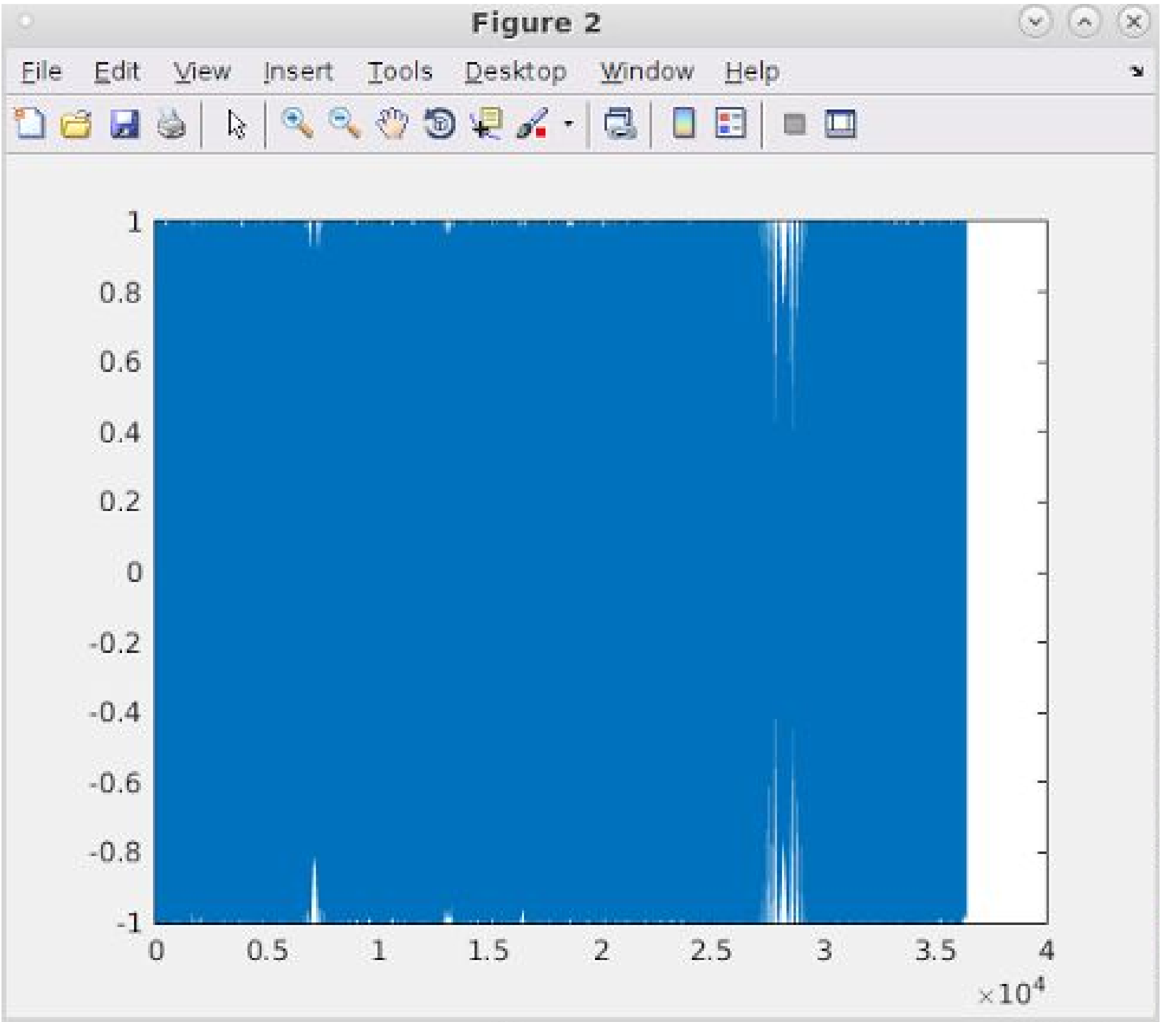
If the instantaneous frequency goes beyond ½ sampling frequency, aliasing will occur.

$\frac{1}{2}*2*\pi*8192 = 2*\pi*3000 + 2000t$

$2000t = (8192-6000)*\pi$

$t = 3.4432s$

5. Plot 1 s after aliasing



This time, after I extended the plot to the time which passes aliasing point by 1 s, I heard a noise toward the end of the sound, which should be at time 3.4432 s.