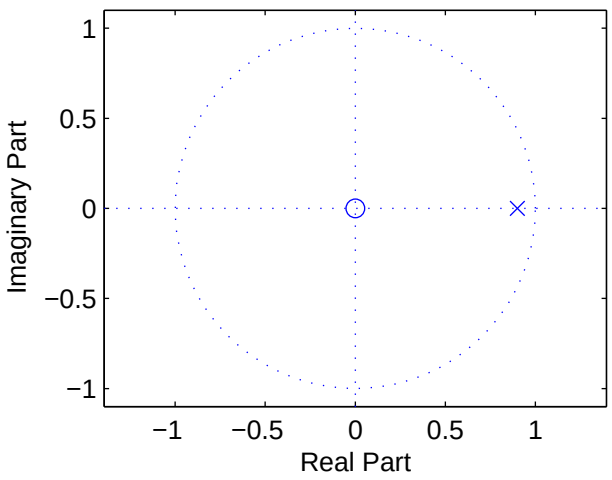
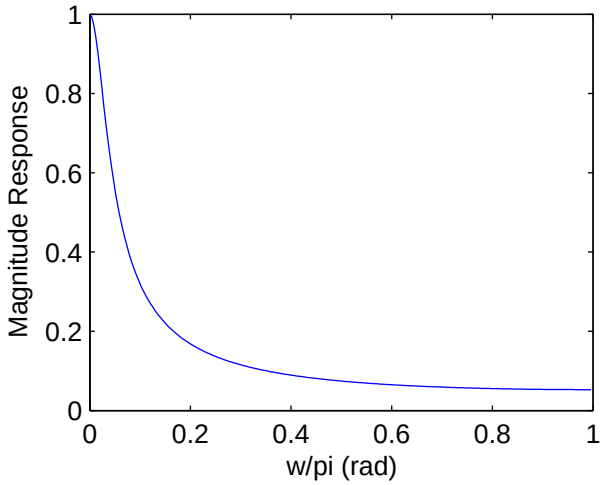
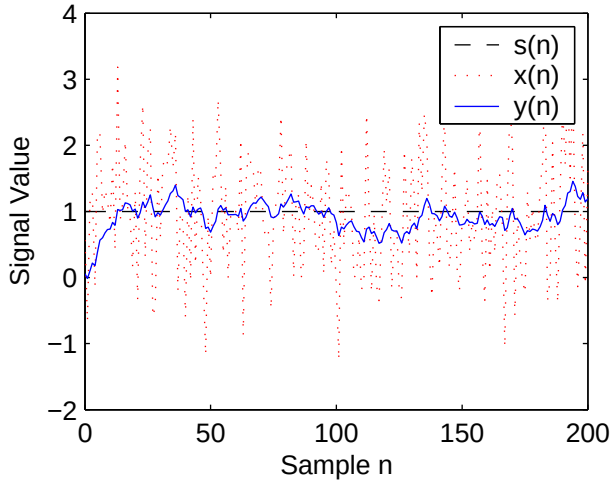
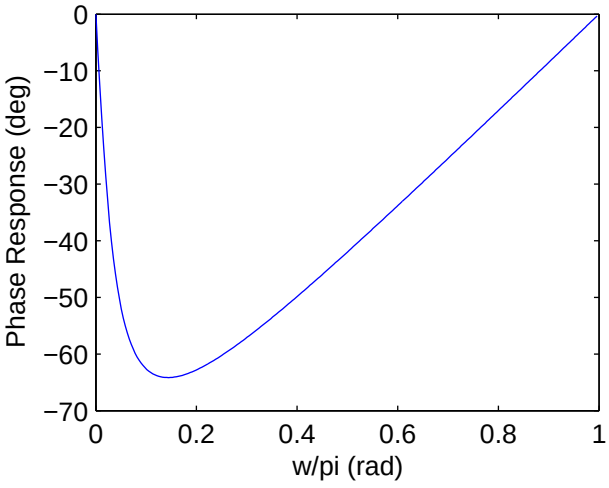
```
% EE253, DSP I
% Example Lowpass Filtering of a Noisy Signal (Lec 11-B, p. 2)
% ------------------------------------------------------------
                              % generate the signal
n=[0:1:200];                  % time index
sn=ones(size(n));             % DC signal (all samples = 1)

                              % generate the noise
sigma_w = 1.0;                % (sigma_w)^2 is the noise variance
wn=sigma_w*randn(size(n));    % white Guassian noise

xn=sn + wn;                   % input noisy signal

                              % filter coefficients
alpha = 0.9;                  % called 'a' in the lecture notes
b0 = 1-alpha;
b=[b0];                       % vector of b-coefficients

a0 = 1;
a1 = -alpha;
a=[a0 a1];                    % vector of a-coefficients

nn=256;                       % number of frquency samples over [0 pi]
[H,w] =freqz(b,a,nn);         % frequency response

yn = filter (b,a,xn);         % output filtered signal

                                                    % plot the esults
subplot(2,2,1), zplane(b,a)                         % pole-zero diagra

subplot(2,2,2), plot(w/pi , abs(H), '-b')           % magnitude response
xlabel('w/pi (rad)'), ylabel('Magnitude Response')

subplot(2,2,4), plot(w/pi , angle(H)*180.0/pi, '-b')    % phase response in deg
xlabel('w/pi (rad)'), ylabel('Phase Response (deg)')

subplot(2,2,3), plot(n,sn,'--k', n,xn,':r', n,yn,'-b');   % input and output signals
xlabel('Sample n'), ylabel('Signal Value')
legend('s(n)','x(n)','y(n)')
```


Imaginary Part
Real Part
1
0.5
0
−0.5
−1
−1
−0.5
0
0.5
1


Magnitude Response
w/pi (rad)
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1


Signal Value
Sample n
s(n)
x(n)
y(n)
4
3
2
1
0
−1
−2
0
50
100
150
200


Phase Response (deg)
w/pi (rad)
0
−10
−20
−30
−40
−50
−60
−70
0
0.2
0.4
0.6
0.8
1