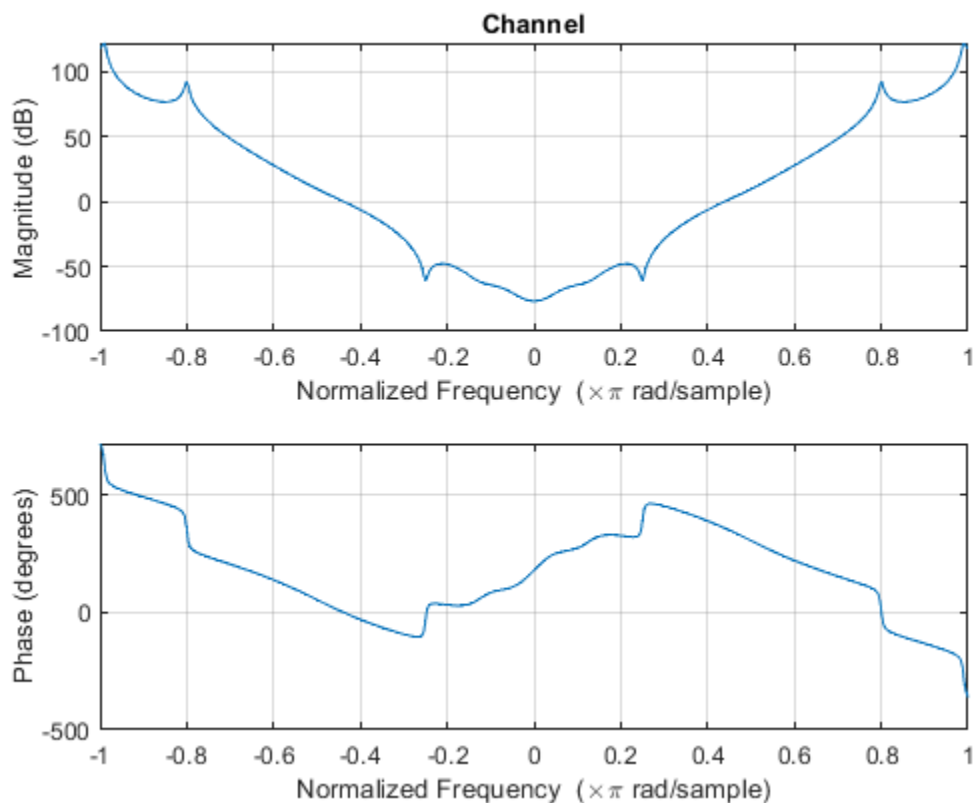

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```
close all
clc
```

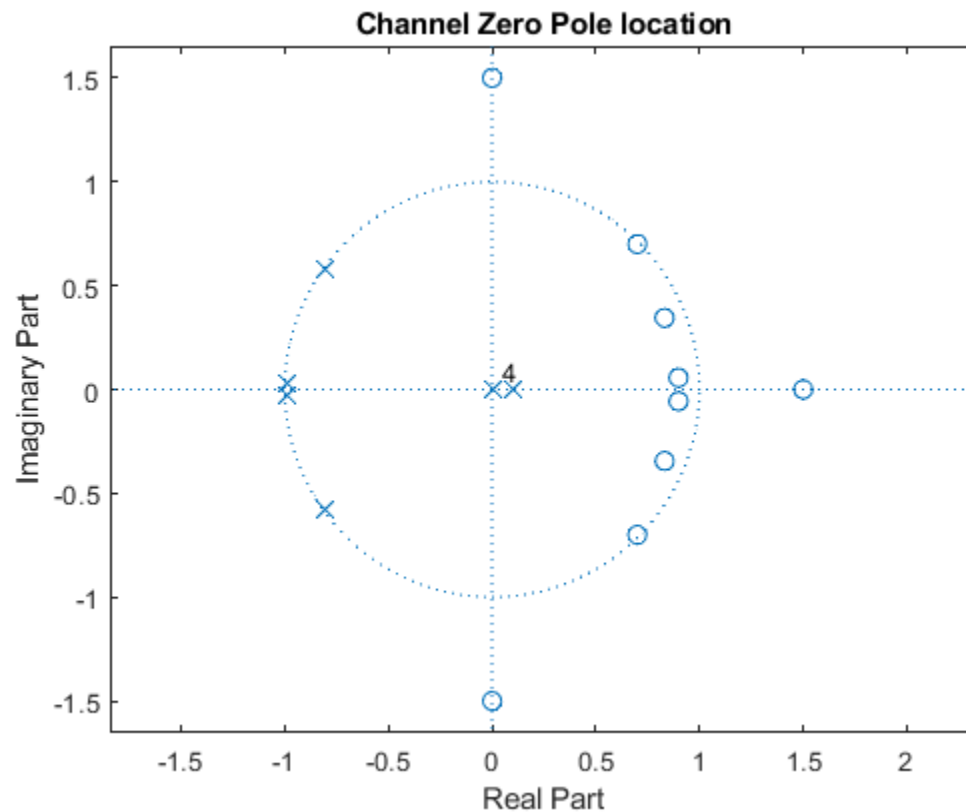
part 1

```
load('a.mat' , 'a');
load('b.mat' , 'b');
freqz(b , a, -pi : pi/256:pi)
title('Channel')
```



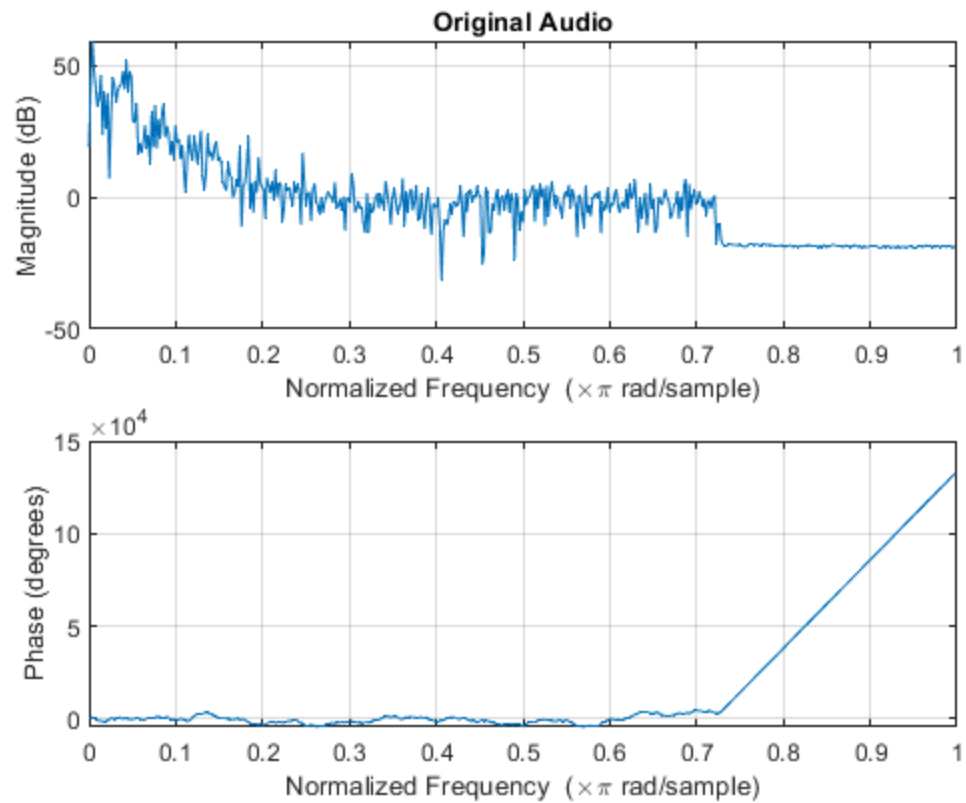
part 2

```
sys1 = tf(b , a);  
figure();  
zplane(b ,a)  
title('Channel Zero Pole location')
```



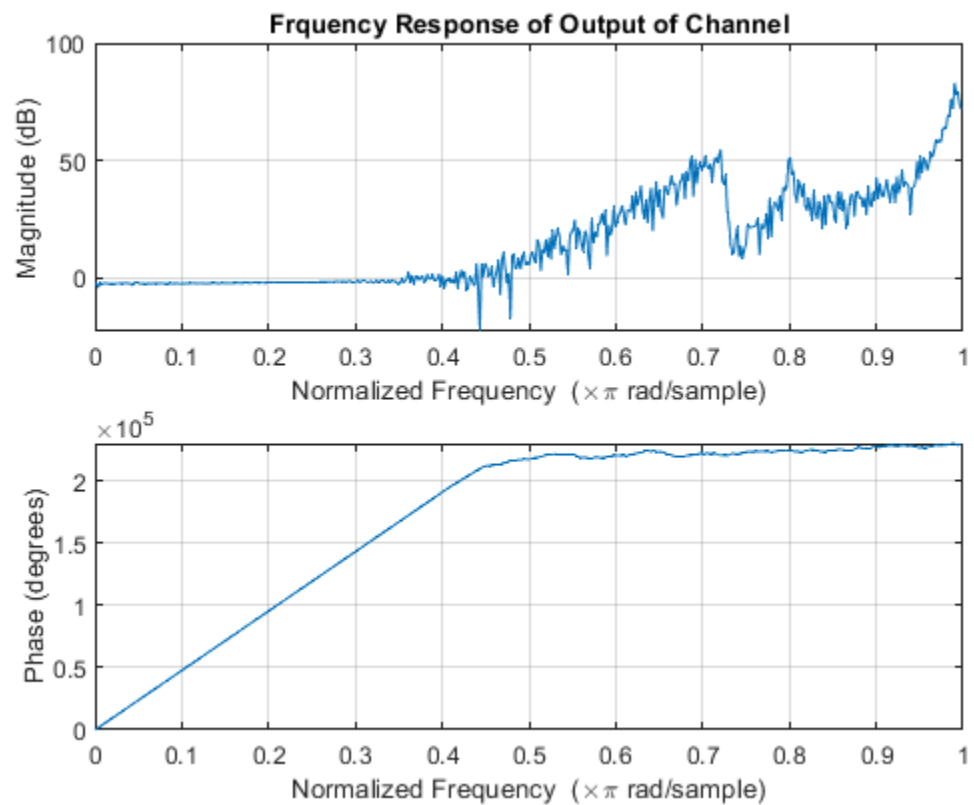
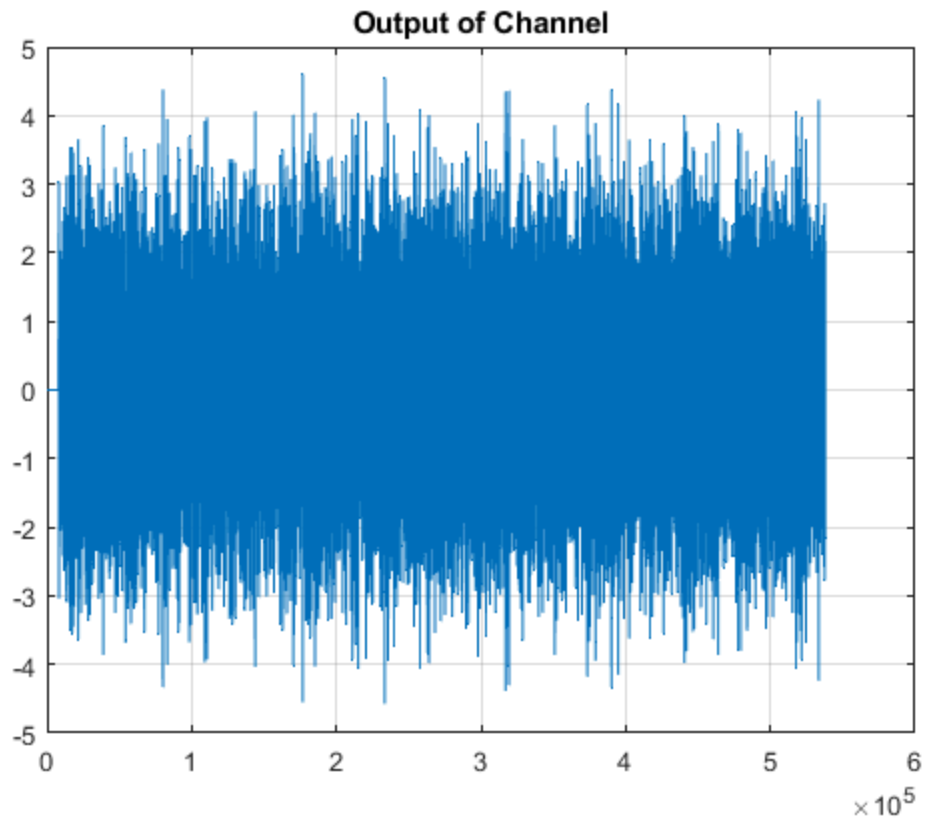
part 3

```
f = 44100;  
samp = [1, 12.2*f];  
[y , Fs]= audioread('sampleaudio.wav', samp);  
figure();  
freqz(y)  
title('Original Audio')  
% sound(y , Fs)
```



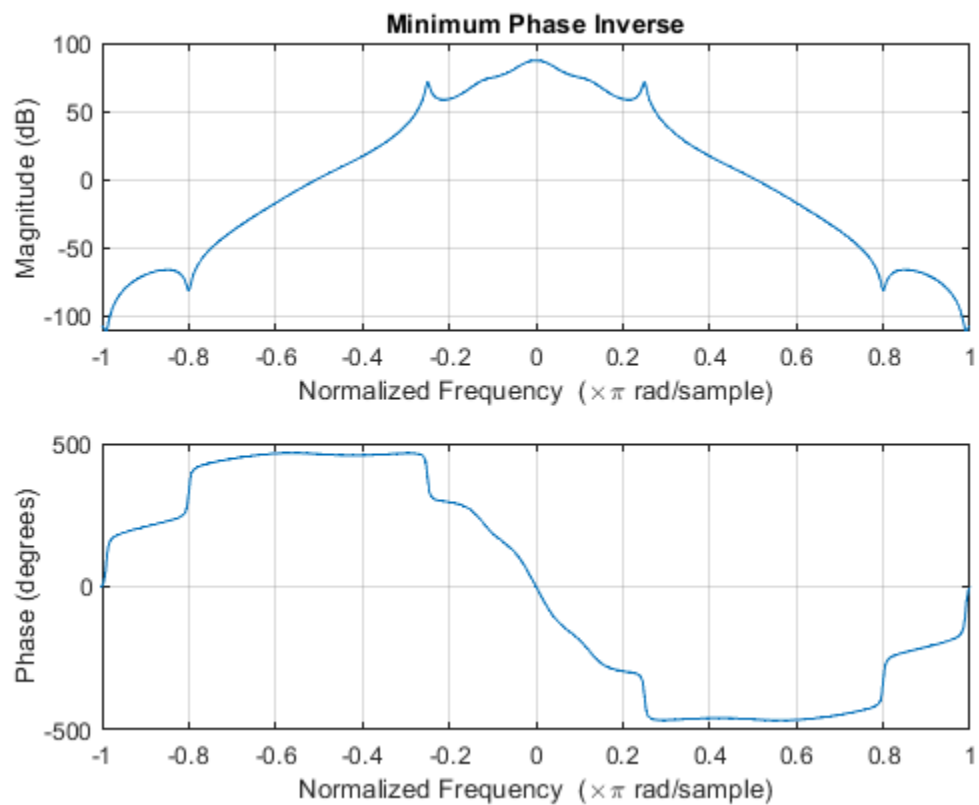
part 4

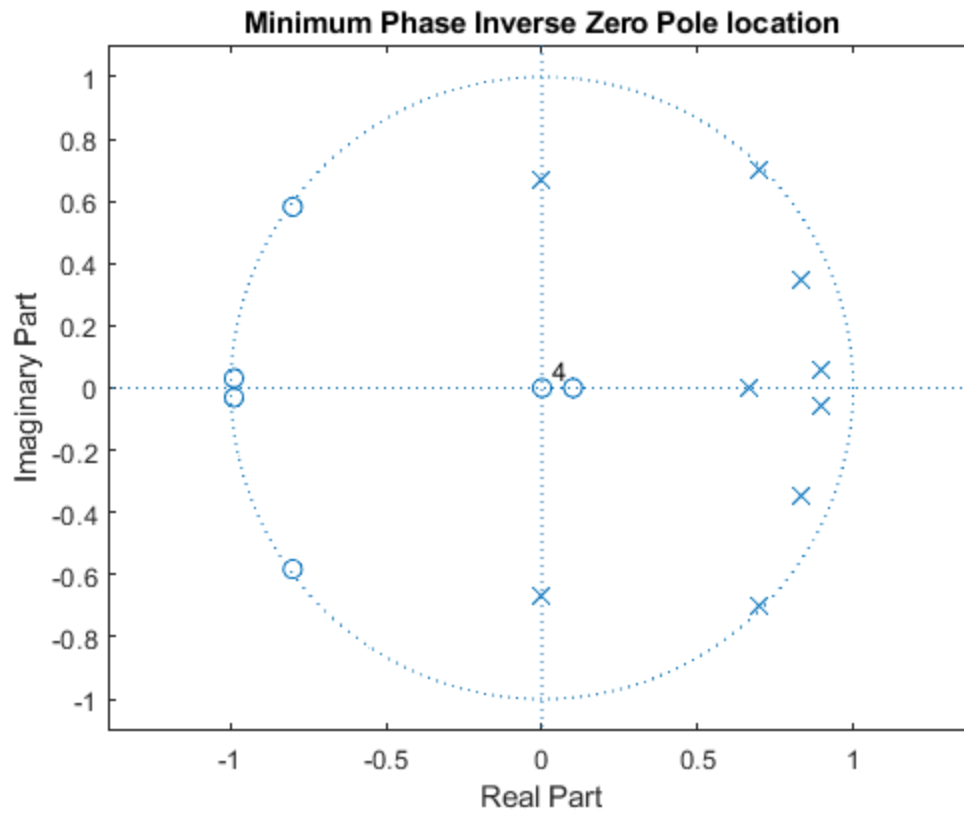
```
outchannel = filter(b , a , y);  
figure();  
plot(outchannel);  
grid on;  
title('Output of Channel');  
figure();  
freqz(outchannel);  
title('Frquency Response of Output of Channel');
```



part 5

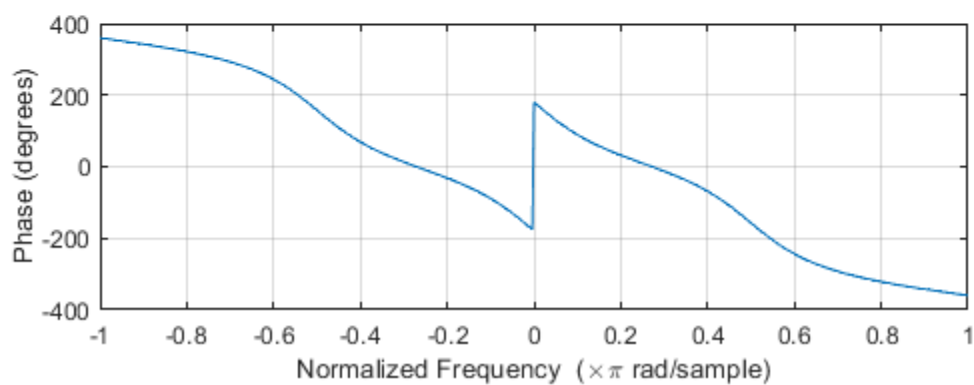
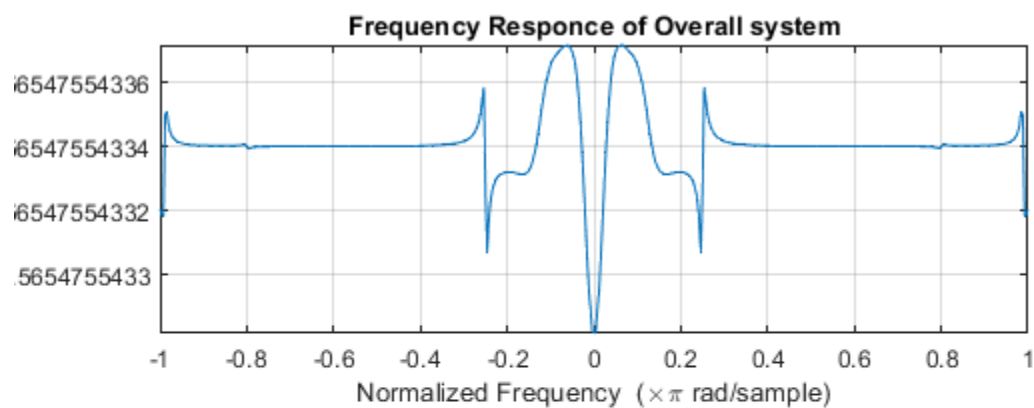
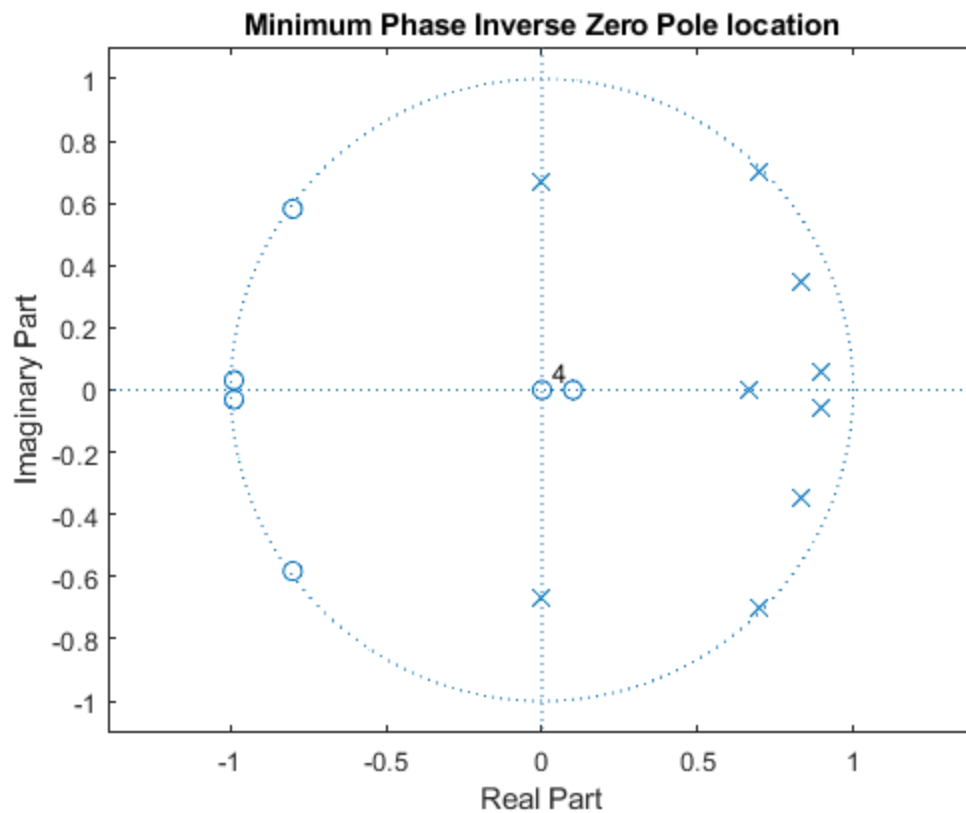
```
[beq , aeq] = MinPhaseInverse(b ,a);  
  
figure();  
freqz(beq , aeq , -pi : pi/256 : pi)  
title('Minimum Phase Inverse')  
figure();  
zplane(beq , aeq);  
title('Minimum Phase Inverse Zero Pole location')
```





part 6

```
bt = conv(b , beq);  
at = conv(a , aeq);  
figure();  
freqz(bt , at , -pi : pi/256 : pi)  
title('Frequency Responce of Overall system')
```



part 8

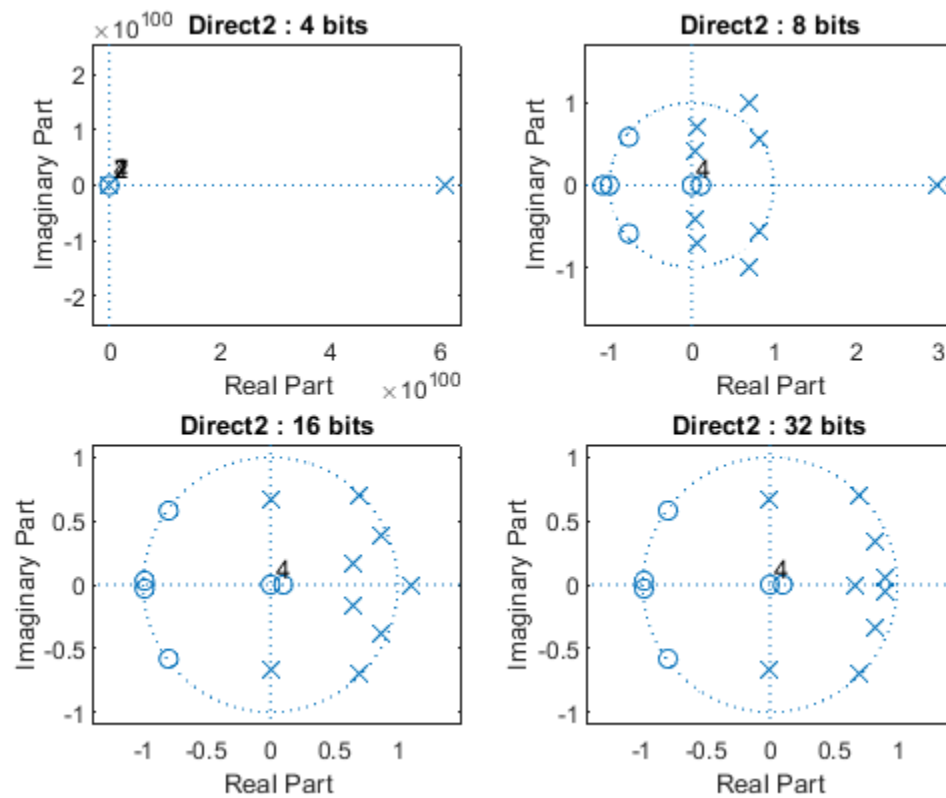
```
figure();
subplot(2,2,1)

zplane(quantize_m(beq,4) , Correct(quantize_m(aeq , 4)));
title('Direct2 : 4 bits')

subplot(2,2,2)
zplane(quantize_m(beq,8) , Correct(quantize_m(aeq , 8)));
title('Direct2 : 8 bits')

subplot(2,2,3)
zplane(quantize_m(beq,16) , Correct(quantize_m(aeq , 16)));
title('Direct2 : 16 bits')

subplot(2,2,4)
zplane(quantize_m(beq,32) , Correct(quantize_m(aeq , 32)));
title('Direct2 : 32 bits')
```



part 9

```
[scas , g] = tf2sos(beq , aeq);
sizes = size(scas);
ls = sizes(1);
```

```

nb = 4;
squan = scas;
for r = 1 :ls
    squan(r , 1:3) = quantize_m(scas(r , 1:3),nb);
    squan(r , 5:6) = quantize_m(scas(r , 5:6),nb);
end
[bc4 ,ac4] = sos2tf(squan , g);

nb = 8;
squan = scas;
for r = 1 :ls
    squan(r , 1:3) = quantize_m(scas(r , 1:3),nb);
    squan(r , 5:6) = quantize_m(scas(r , 5:6),nb);
end
[bc8 , ac8] = sos2tf(squan , g);

nb = 16;
squan = scas;
for r = 1 :ls
    squan(r , 1:3) = quantize_m(scas(r , 1:3),nb);
    squan(r , 5:6) = quantize_m(scas(r , 5:6),nb);
end
[bc16 , ac16] = sos2tf(squan , g);

nb = 32;
squan = scas;
for r = 1 :ls
    squan(r , 1:3) = quantize_m(scas(r , 1:3),nb);
    squan(r , 5:6) = quantize_m(scas(r , 5:6),nb);
end
[bc32 ,ac32] = sos2tf(squan , g);

figure();
subplot(2,2,1)

zplane(bc4 , ac4);
title('CaseCade Form : 4 bits')

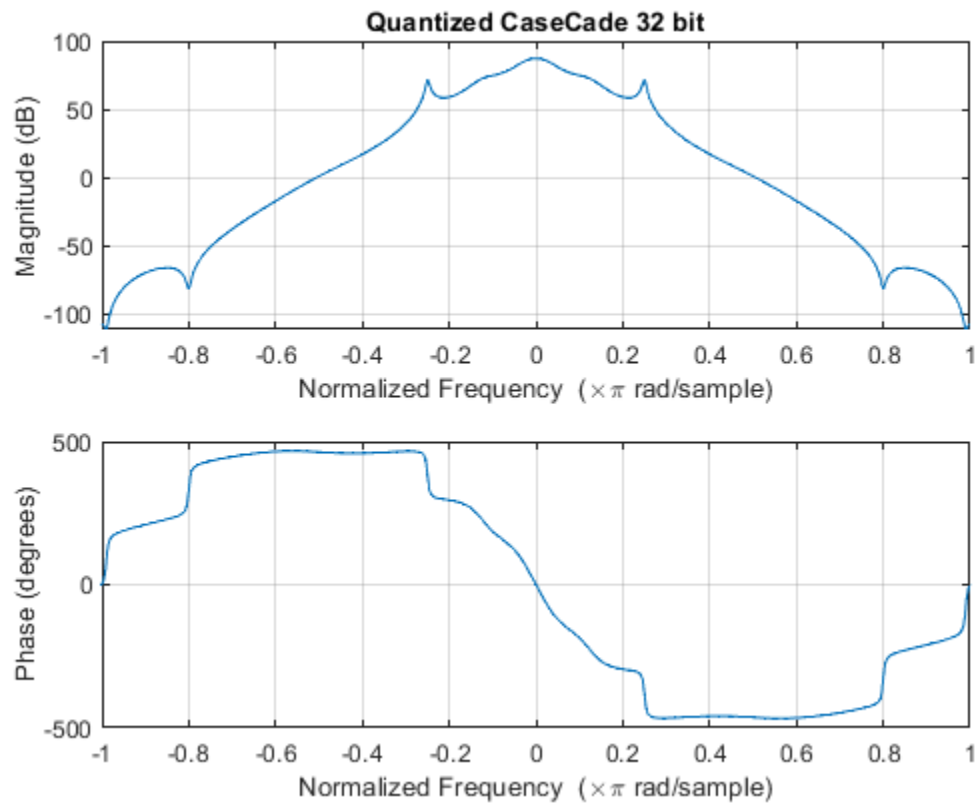
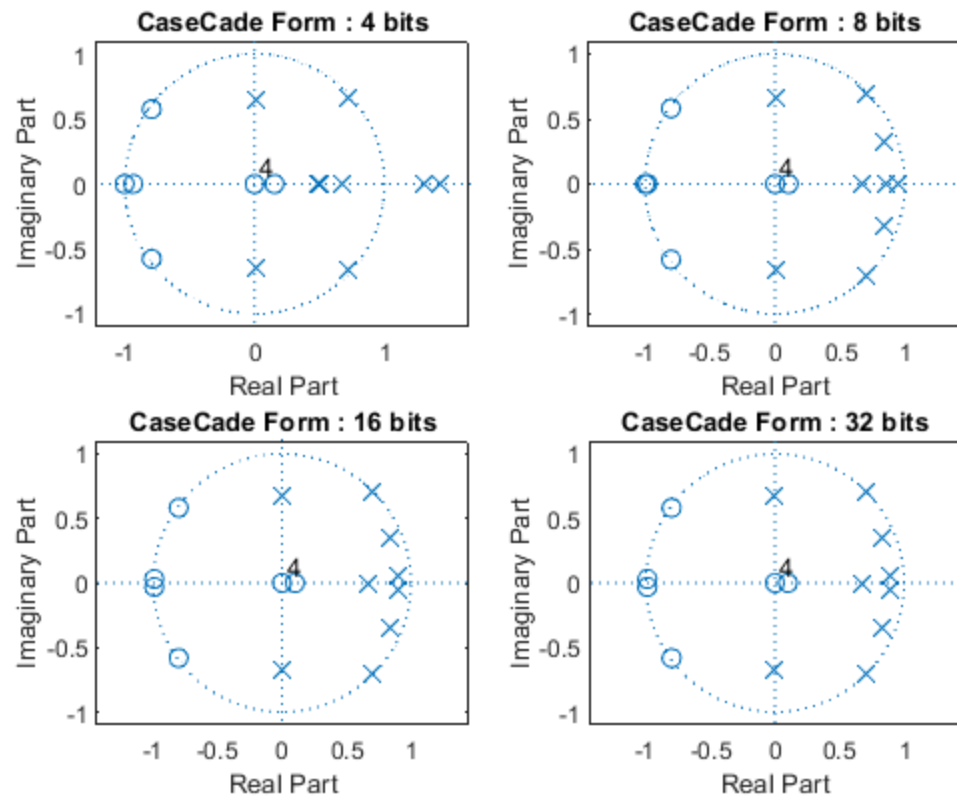
subplot(2,2,2)
zplane(bc8 , ac8);
title('CaseCade Form : 8 bits')

subplot(2,2,3)
zplane(bc16 , ac16);
title('CaseCade Form : 16 bits')

subplot(2,2,4)
zplane(bc32 , ac32);
title('CaseCade Form : 32 bits')

figure();
freqz(bc32 , ac32 , -pi : pi/256 : pi);
title('Quantized CaseCade 32 bit')

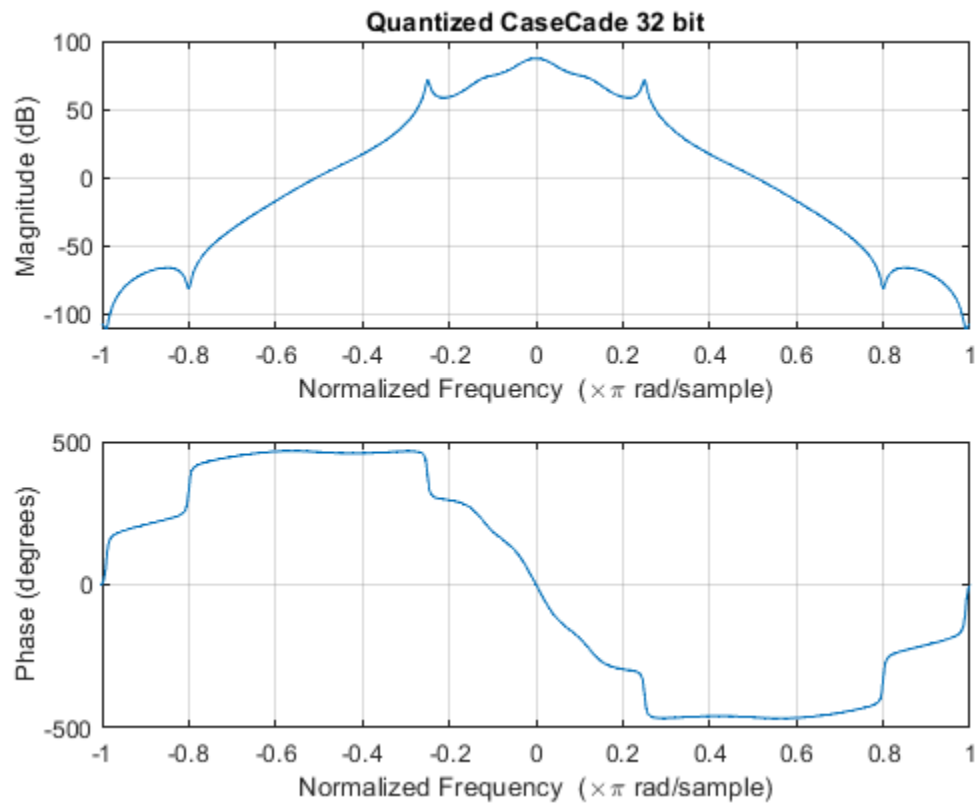
```



part 10

```
outsig = filter(bc32 , ac32 , outchannel);  
audiowrite('FinalAudio.wav',outsig , Fs);
```

Warning: Data clipped when writing file.



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