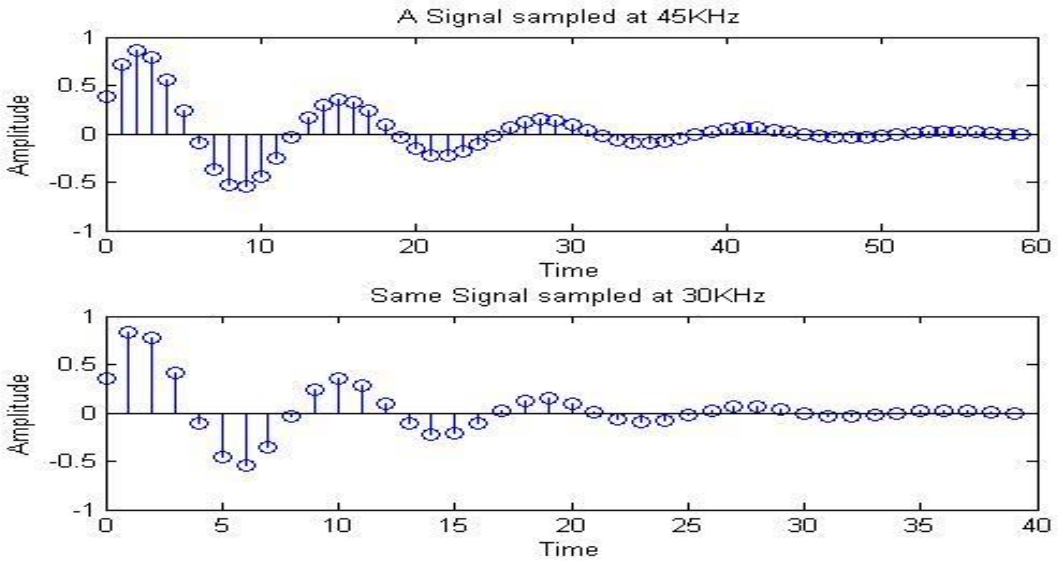
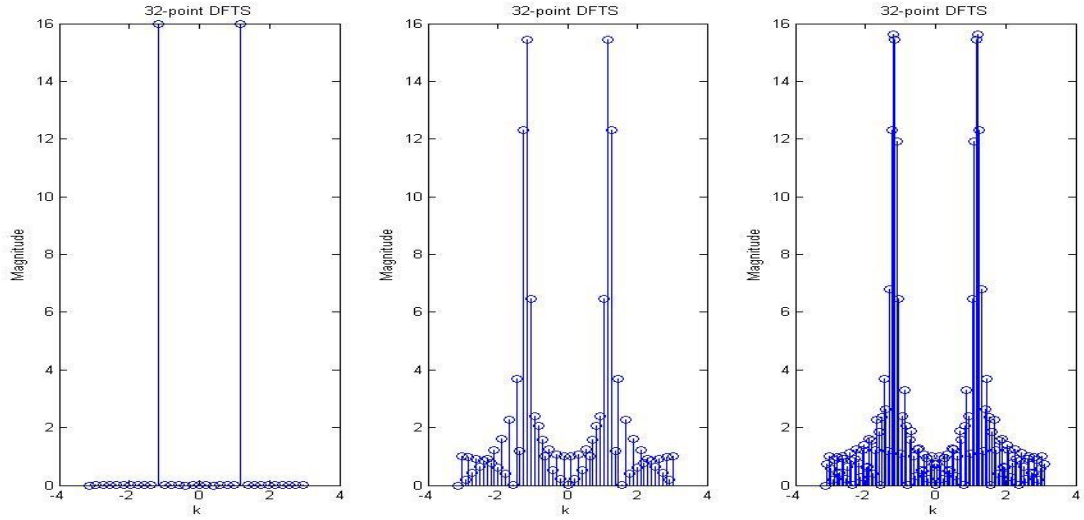
(1) Decimation and Interpolation:

```
close all;clear all;clc;
%Signal generation
fs1 = 45000; fs2 = 30000
n1 = [0:59];
x = exp(-n1/15).*sin(2*pi*n1/13 + pi/8);
p = 2; q = 3;  %% p/q = fs2/fs1 = 2/3
n2 = [0:(p/q)*length(n1)-1];
y = resample(x,p,q);

%Plots of the above signals
subplot(211);stem(n1,x);
title('A Signal sampled at 45KHz');
xlabel('Time');ylabel('Amplitude');

subplot(212);stem(n2,y);
title('Same Signal sampled at 30KHz');
xlabel('Time');ylabel('Amplitude');
```



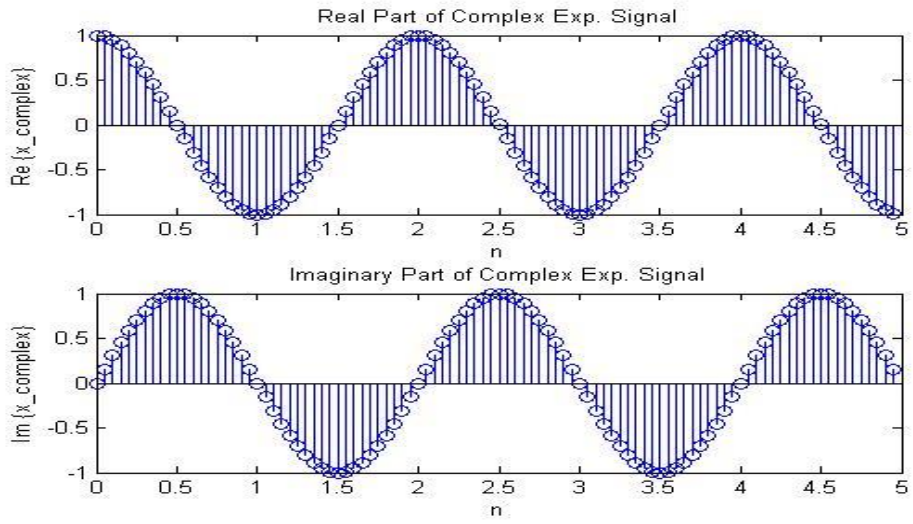
(2) Discrete Time Fourier Series Coefficient:

```
close all;clear all;clc;
n = [0:31];
x = cos(3*pi*n/8);
X32  = abs(fftshift(fft(x)));      %Magnitude for 32-point DFTS
X60  = abs(fftshift(fft(x,60)));   %Magnitude for 60-point DFTS
X120 = abs(fftshift(fft(x,120))); %Magnitude for 120-point DFTS

w32 = [-16:15]*2*pi/32;
w60 = [-30:29]*2*pi/60;
w120 = [-60:59]*2*pi/120;

subplot(1,3,1);stem(w32,X32);
title('32-point DFTS');xlabel('k');ylabel('Magnitude');
subplot(1,3,2);stem(w60,X60);
title('32-point DFTS');xlabel('k');ylabel('Magnitude');
subplot(1,3,3);stem(w120,X120);
title('32-point DFTS');xlabel('k');ylabel('Magnitude');
```



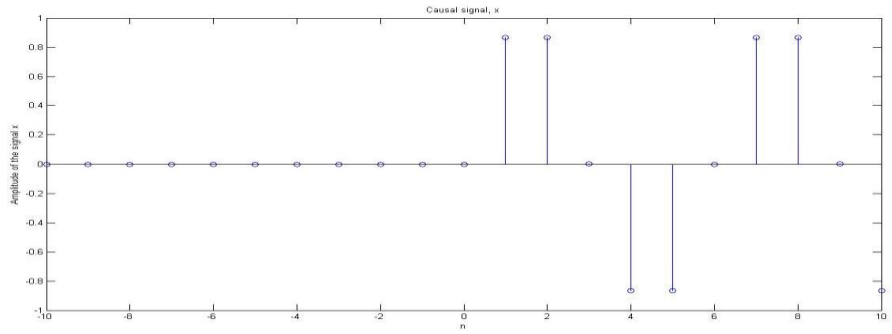
(3) Complex Exponential Signal:

```
close all;clear all;clc;
r = 1;
f = 10;
fs = 20;
T = 5;
n = [0:1/fs:T-1/fs];
w = 2*pi*f/fs;
x_complex = r*exp(j*w*n);

subplot(211);stem(n,real(x_complex));
title('Real Part of Complex Exp. Signal');
xlabel('n');ylabel('Re \{x\_complex\}');

subplot(212);stem(n,imag(x_complex));
title('Imaginary Part of Complex Exp. Signal');
xlabel('n');ylabel('Im \{x\_complex\}');
```



(4) Causal Signal Representation:

```
close all;clear all;clc;
n = [-10:10];
u = [zeros(1,10) ones(1,11)];
x = sin(pi*n/3).*u; %Causal Signal

stem(n,x);title('Causal signal, x');
xlabel('n');ylabel('Amplitude of the signal x');
```



(5) Convolution of two Signals:

```
close all;clear all;clc;
n = [0:10];
u = heaviside(n);
u5 = heaviside(n-5*ones(1,length(n))); %% u5 = u[n-5]
u10 = heaviside(n-10*ones(1,length(n))); %% u10 = u[n-10]
x = (0.8).^n.*(u-u5);
h = (0.5).^n.*(u-u10);
y = conv(x,h);
n1 = length(y);

subplot(131);stem(n,x);title('Input signal, x');
xlabel('n');ylabel('Amplitude of x');

subplot(132);stem(n,h);title('Impulse response, h');
xlabel('n');ylabel('Amplitude of h');

subplot(133);stem(y);title('Output signal, y');
xlabel('n');ylabel('Amplitude of y');
```