Injamamul Haque Sourov
1820170

Question 1

a) S

Code:

```
% y = n^2*d(n, -2,5) - n^2*d(n, -5,-3)
n = -5:5;
y0 = (n.^2).*(stepseq(0,-5,5));
y1 = fliplr(y0(5:10));
y2 = y0-y1;
stem(n,y2)
```

Output:

b) Even/odd

Code:

```
% function to determine even/odd component
function [xe,xo,m] = evenodd(x,n)
m = n;
xe = 0.5*(x + fliplr(x));
xo = 0.5*(x - fliplr(x));
end
```

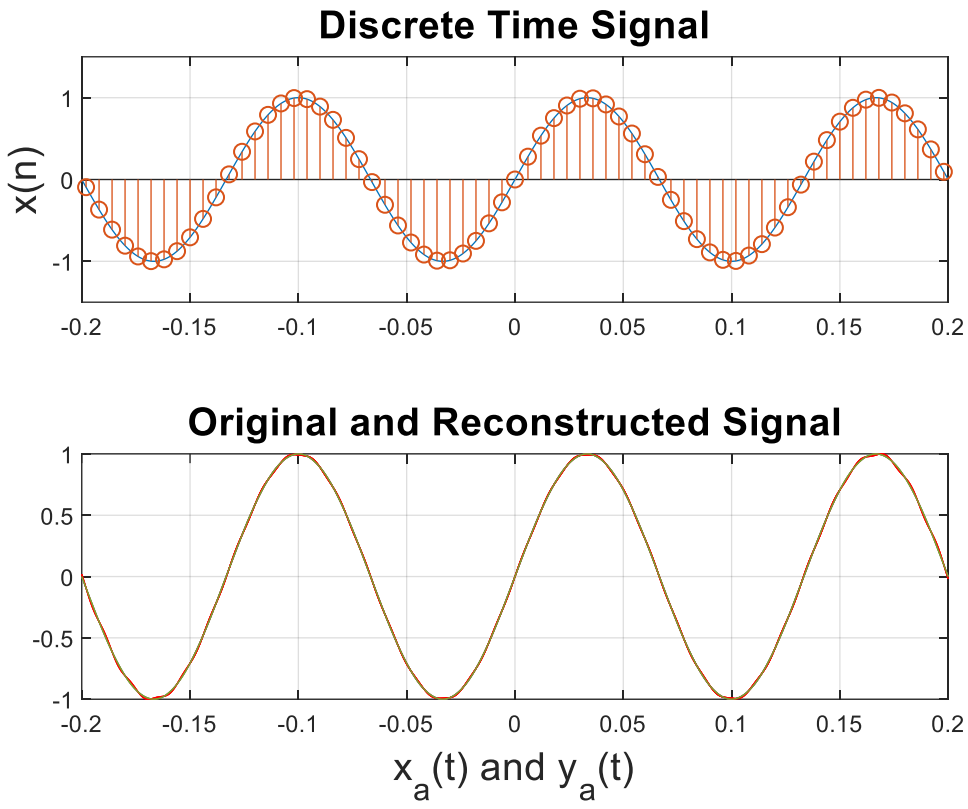
Question 2

Code:

```
% xa(t) = sin(15pit + Ø) (assuming Ø = 0)
t = -0.2:0.00001:0.2;
x_a = sin(15*pi*t);     % original signal

% sampling parameters
Ts = 0.006;     % sampling time
Fs = 1/Ts;
n = -40:40;
nTs = n*Ts;
x_n = sin(15*pi*nTs);   % sampled signal

% analog signal reconstruction
y_a = x_n*sinc(Fs*(ones(length(n),1)*t-nTs'*ones(1,length(t))));
% (optional) error
error = max(abs(x_a-y_a))
% plotting
subplot(2,1,1); plot(t, x_a);
ylabel('x(n)', 'fontsize', 15);
title('Discrete Time Signal', 'fontsize', 15);
axis([-0.2 0.2 -1.5 1.5]);
hold on;
stem(nTs, x_n); grid;
hold off;
```

```
subplot(2,1,2); plot(t,y_a, 'r');
xlabel('x_a(t) and y_a(t)', 'fontsize', 15);
title('Original and Reconstructed Signal', 'fontsize', 15);
hold on;
plot(t, x_a); grid
```

Output:



Question 3:

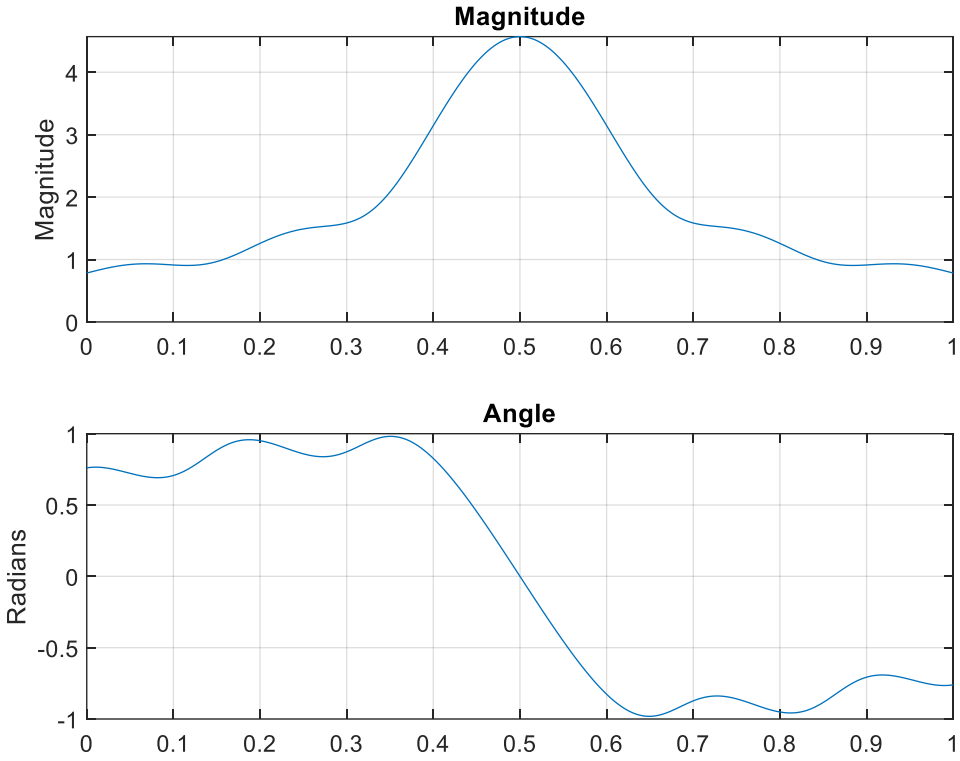
a)

Code:

```
% define signal
n = 0:10;
x = (0.8*exp(j*pi/2)).^ n;

% dtft
M = 500; % arbitrary number of frequency points between (0,?)
k = 0:M;
w = (pi/500)*k;
X = exp(j*w)./(exp(j*w)-0.5*ones(1,501));

% Plotting
```

```
subplot(2,1,1); plot(w/pi, magX); grid
title('Magnitude'); ylabel('Magnitude');
subplot(2,1,2); plot(w/pi, angX); grid
title('Angle'); ylabel('Radians');
```

Output:



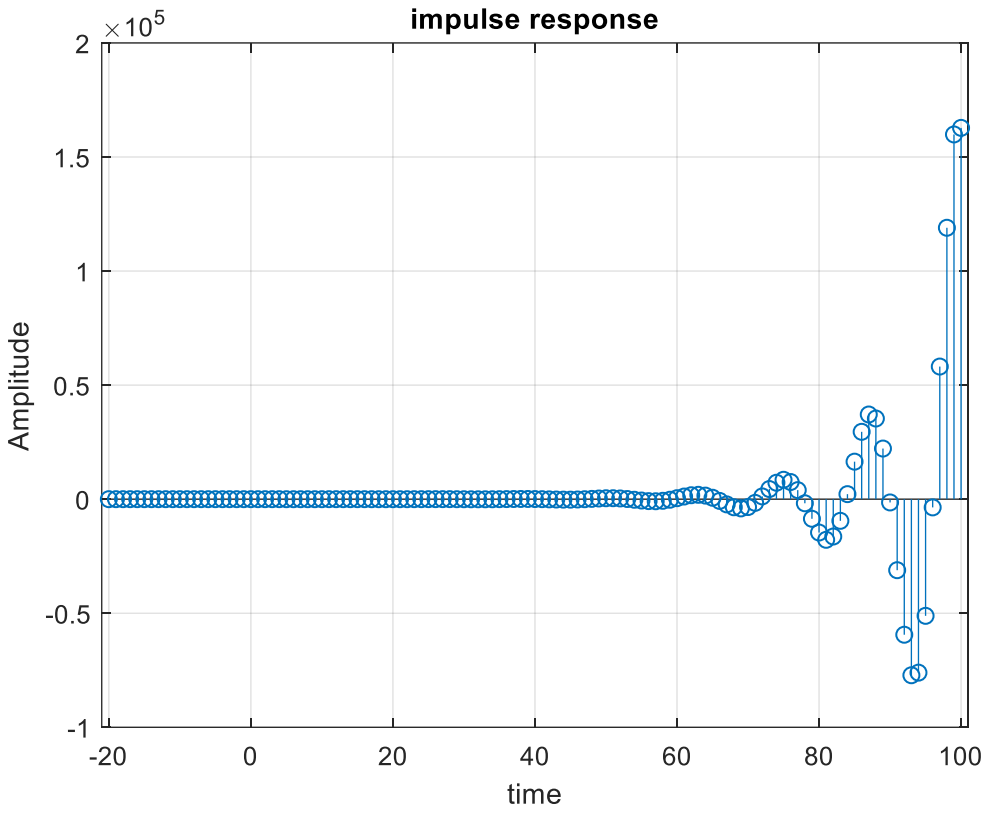
b)

Code:

```
b = [1];
a = [1 -1 0 0 0.8];
n = -20:100;

H = tf(b,a)
d = impseq (0,-20,100);
s = stepseq (0,-20,100);

h = filter(b,a,d);
s = filter(b,a,s);

figure(1);
stem(n,h)
grid
```

```
xlabel('time'); ylabel('Amplitude');
xlim([-21, 101])
title('impulse response')

figure(2);
stem(n,s)
grid
xlabel('time'); ylabel('Amplitude');
xlim([-21, 101])
title('step response')
```

Output:



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