भारतीय प्रौद्योगिकी संस्थान तिरुपति

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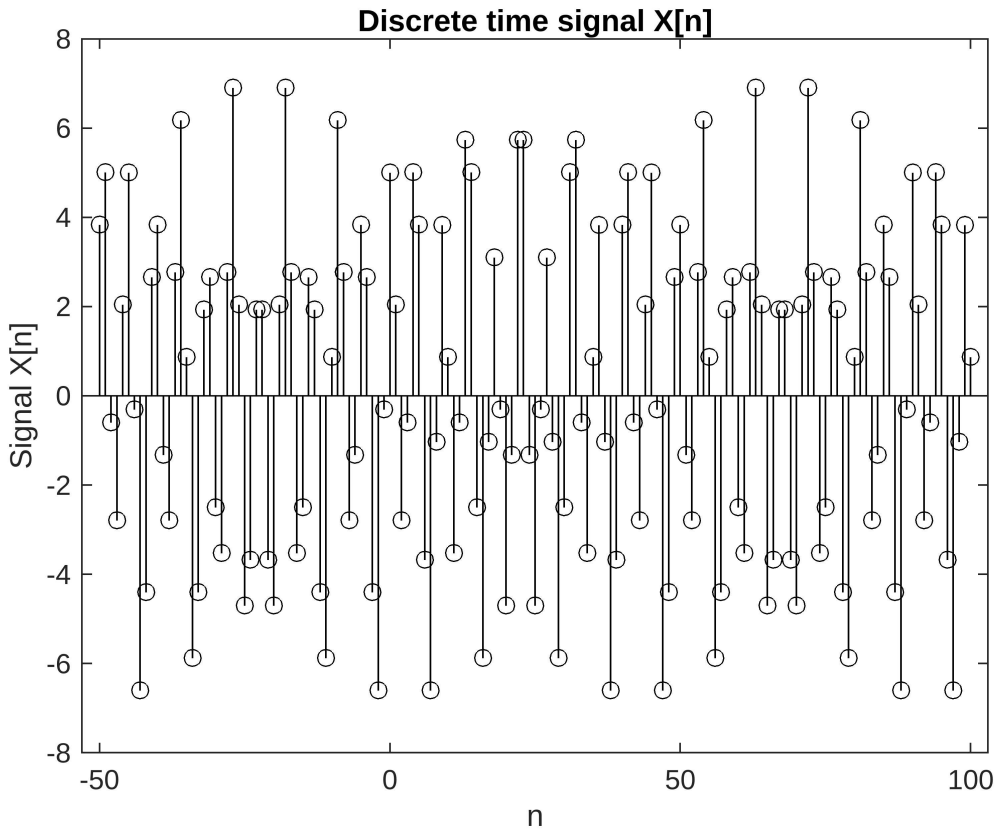
LAB EXAM

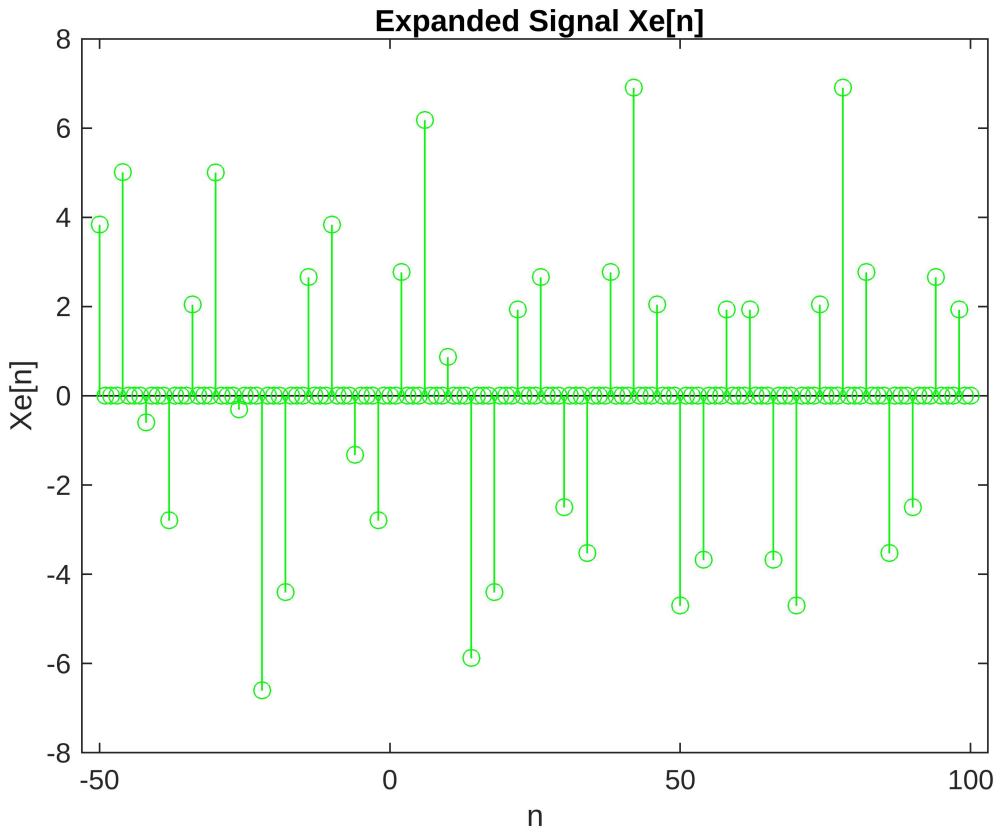
Question 1

```
% Generating the discrete time signal.
n = -50:100;
x_n = 5.*(cos((4*pi/9).*n)) + 2.*(sin((pi/5).*n)) ;
figure;
stem(n,x_n,'black');
ylabel("Signal X[n]");
xlabel("n");
title("Discrete time signal X[n]");
```



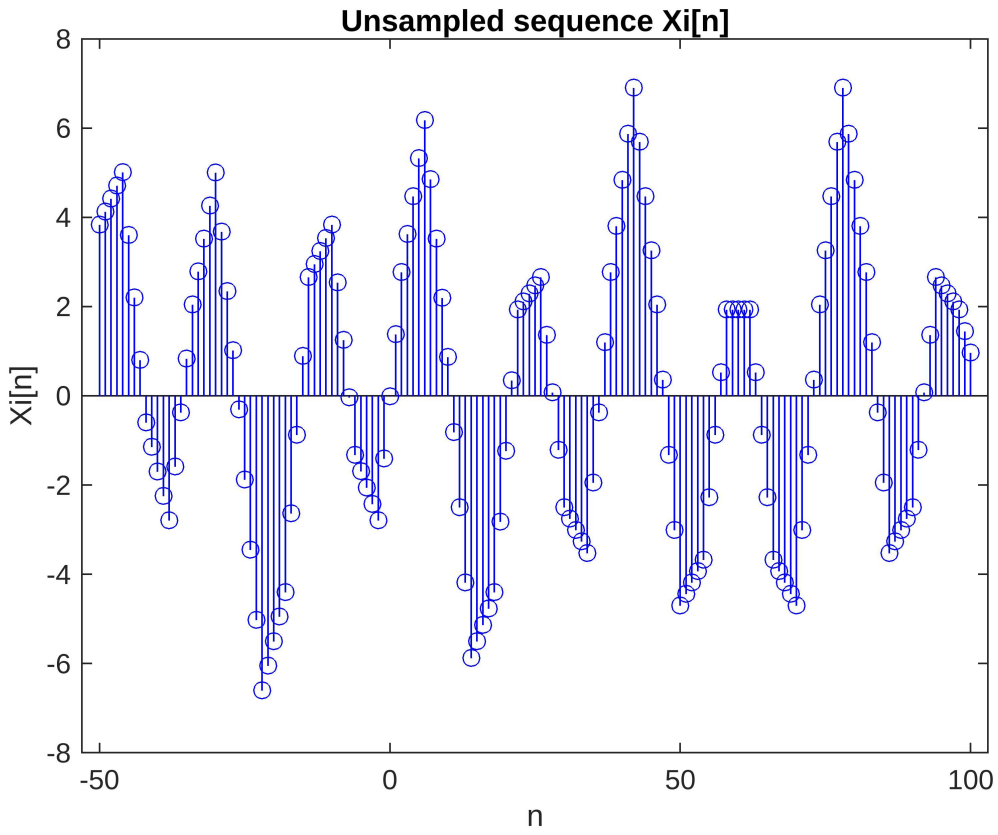
Question 2

```
% Passing the signaL through an expander with factor L = 4.
L = 4;
xe_n = zeros(size(n));
xe_n(1:L:end) = x_n(1:floor(length(x_n)/L) + 1);
stem(n, xe_n,'green')
xlabel("n");
ylabel("Xe[n]");
title(" Expanded Signal Xe[n]");
```



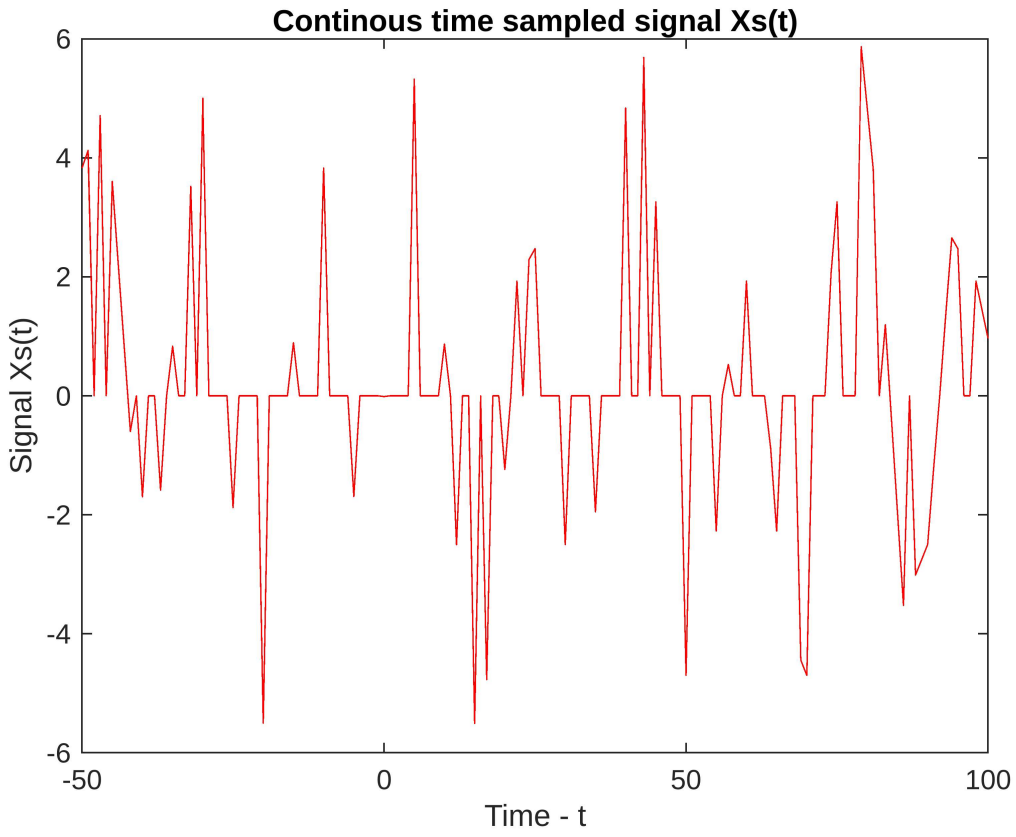
Question 3

```
% Passing the Expanded signal Xe[n] through a linear interpolator with
% impulse response hlin[n] to obtain Xi[n].
h_n = @(n) (1 - abs(n) / L) .* (abs(n) <= L);
n_h = -L:L;
h = h_n(n_h);
xi_n = conv(xe_n,h,'same');
stem(n,xi_n,'blue');
xlabel("n");
ylabel("Xi[n]");
title("Unsampled sequence Xi[n]");
```



Question 4

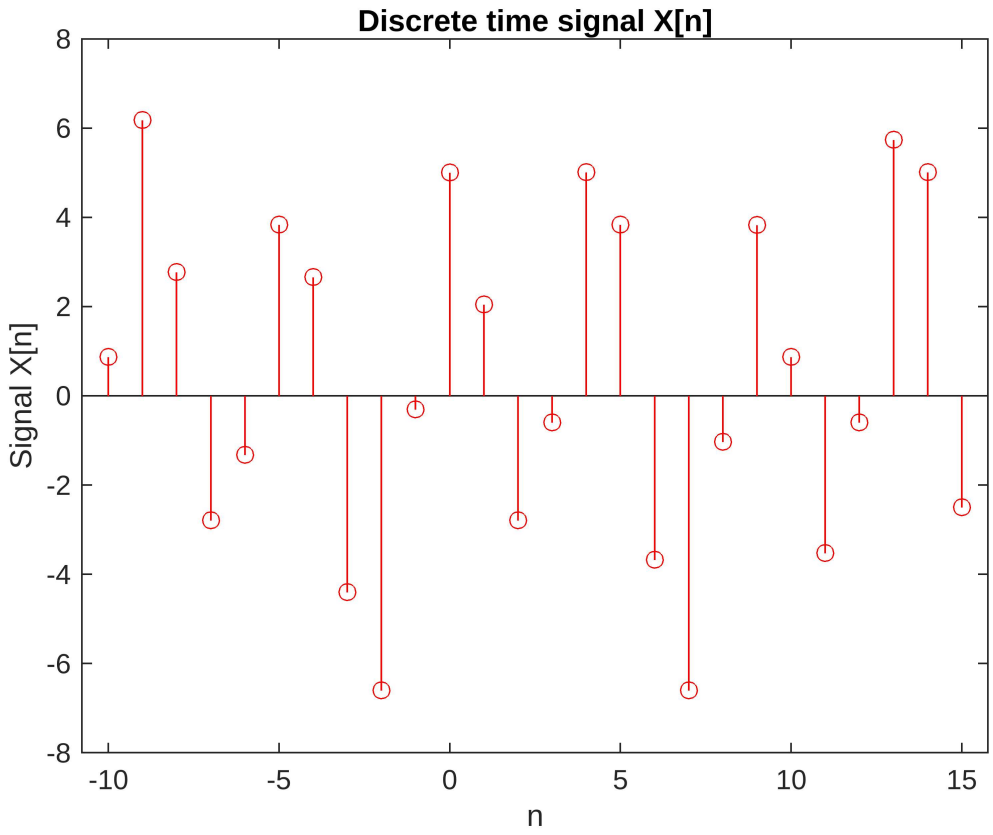
```
% Constructing continuous time signal Xs(t).
T = 0.1;
t = -5:0.1:10;
x_s = zeros(size(n));
for i = 1:length(n)
    if t(i) == n(i)*T
        x_s(i) = xi_n(i);
    end
end
figure;
plot(n,x_s,'r');
title("Continous time sampled signal Xs(t)");
xlabel("Time - t");
ylabel("Signal Xs(t)");
```



Question 5

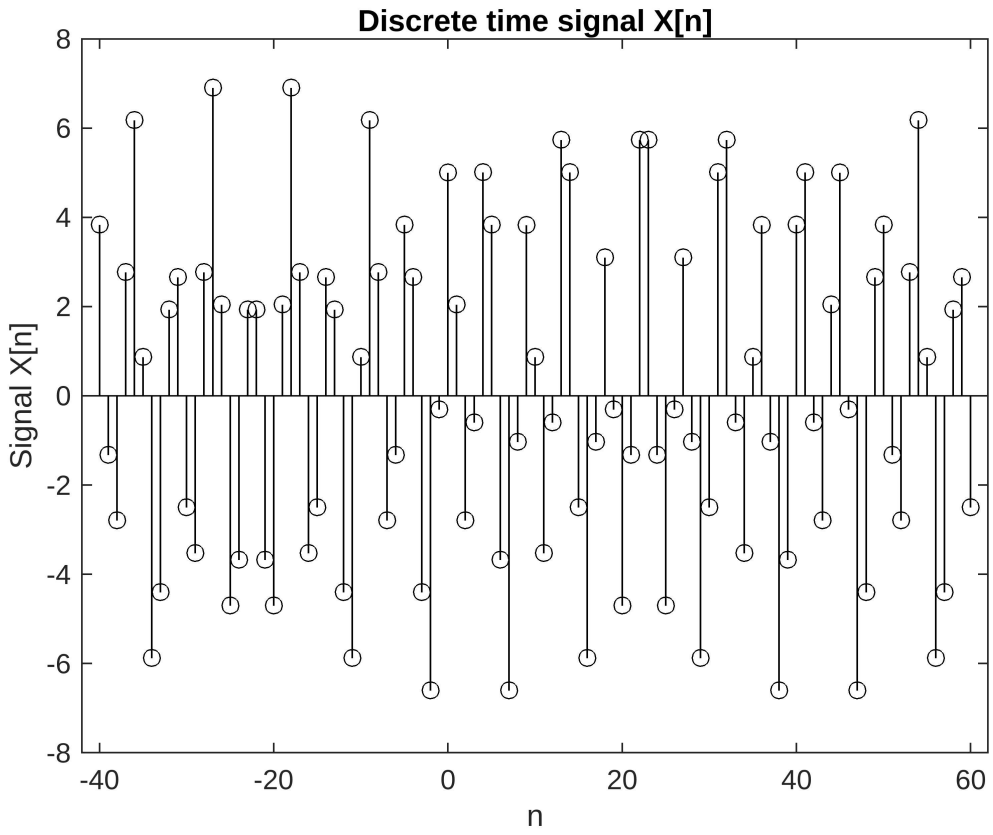
Part a

```
% X[n] for -10 <= n <= 15
n = -10:15;
x_n = 5.*(cos((4*pi/9).*n)) + 2.*(sin((pi/5).*n)) ;
figure;
stem(n,x_n,'red');
ylabel("Signal X[n]");
xlabel("n");
title("Discrete time signal X[n]");
```

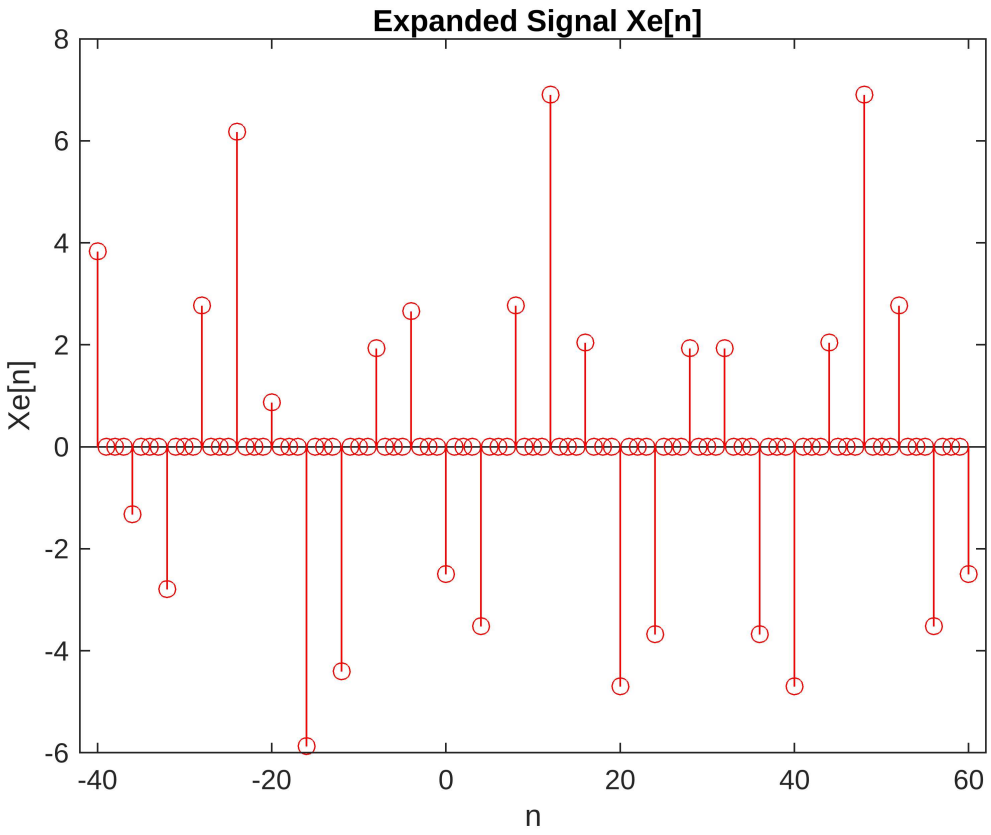


Part b

```
% Xe[n] for -40 <= n <= 60
n = -40:60;
x_n = 5.*(cos((4*pi/9).*n)) + 2.*(sin((pi/5).*n)) ;
figure;
stem(n,x_n,'black');
ylabel("Signal X[n]");
xlabel("n");
title("Discrete time signal X[n]");
```

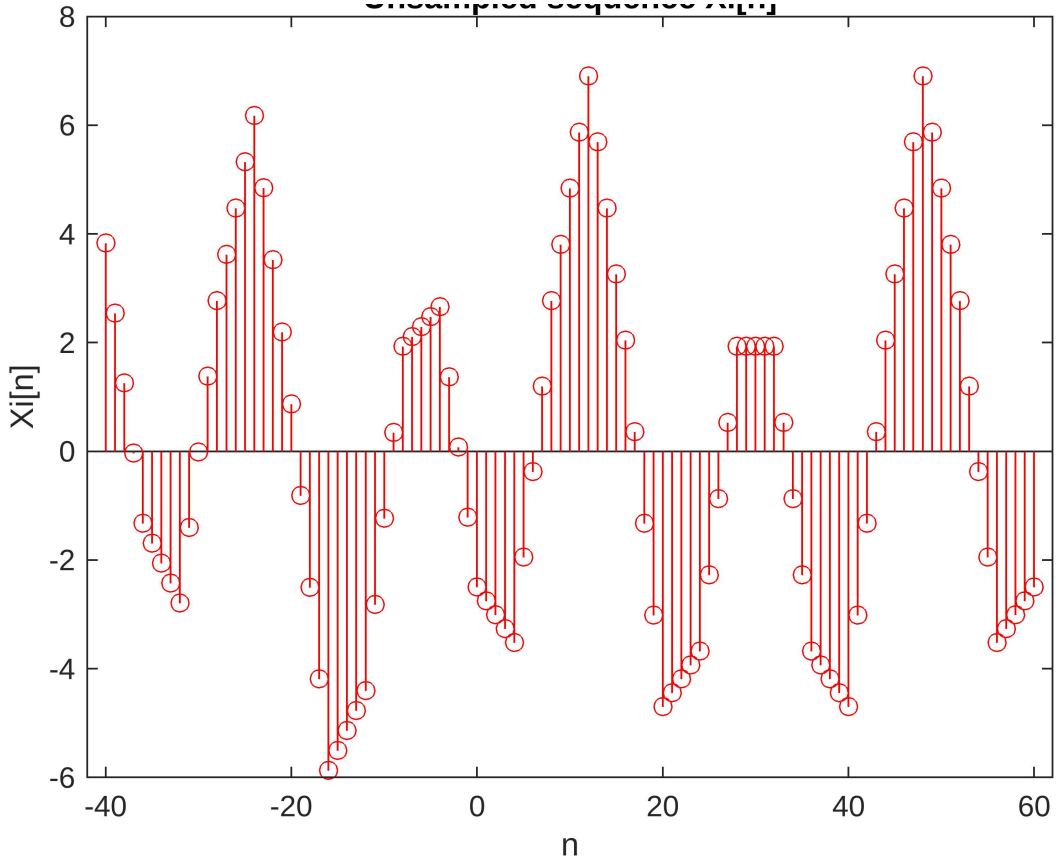



```
L = 4;
xe_n = zeros(size(n));
xe_n(1:L:end) = x_n(1:floor(length(x_n)/L) + 1);
figure;
stem(n, xe_n,'red')
xlabel("n");
ylabel("Xe[n]");
title(" Expanded Signal Xe[n]");
```



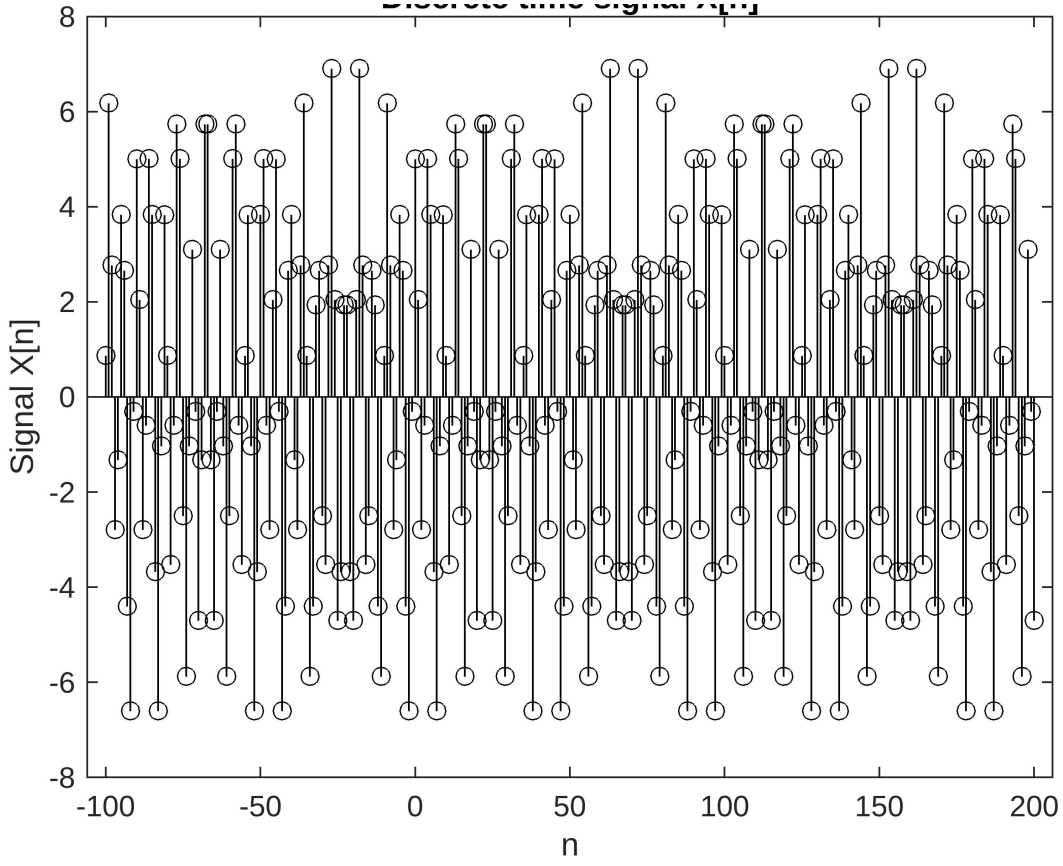
Part c

```
%Xi[n] for -40 <= n <= 60
h_n = @(n) (1 - abs(n) / L) .* (abs(n) <= L);
n_h = -L:L;
h = h_n(n_h);
xi_n = conv(xe_n,h,'same');
figure;
stem(n,xi_n,'red');
xlabel("n");
ylabel("Xi[n]");
title("Unsampled sequence Xi[n]");
```

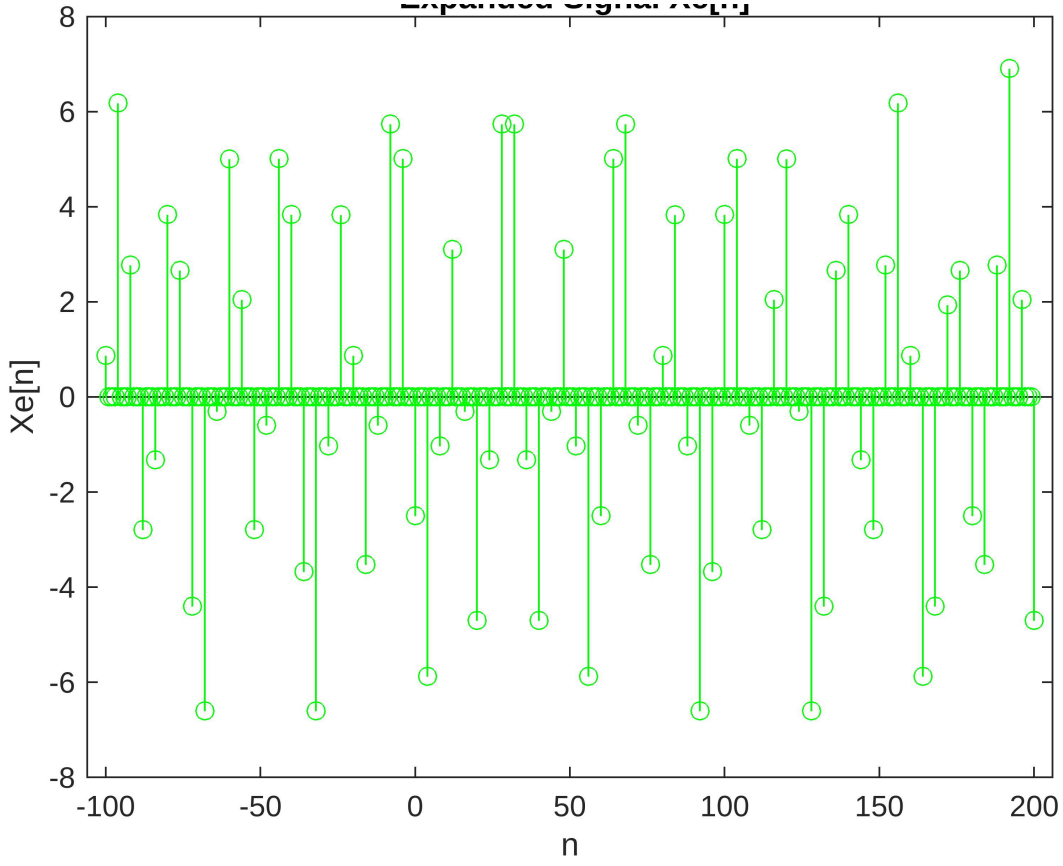


Part D

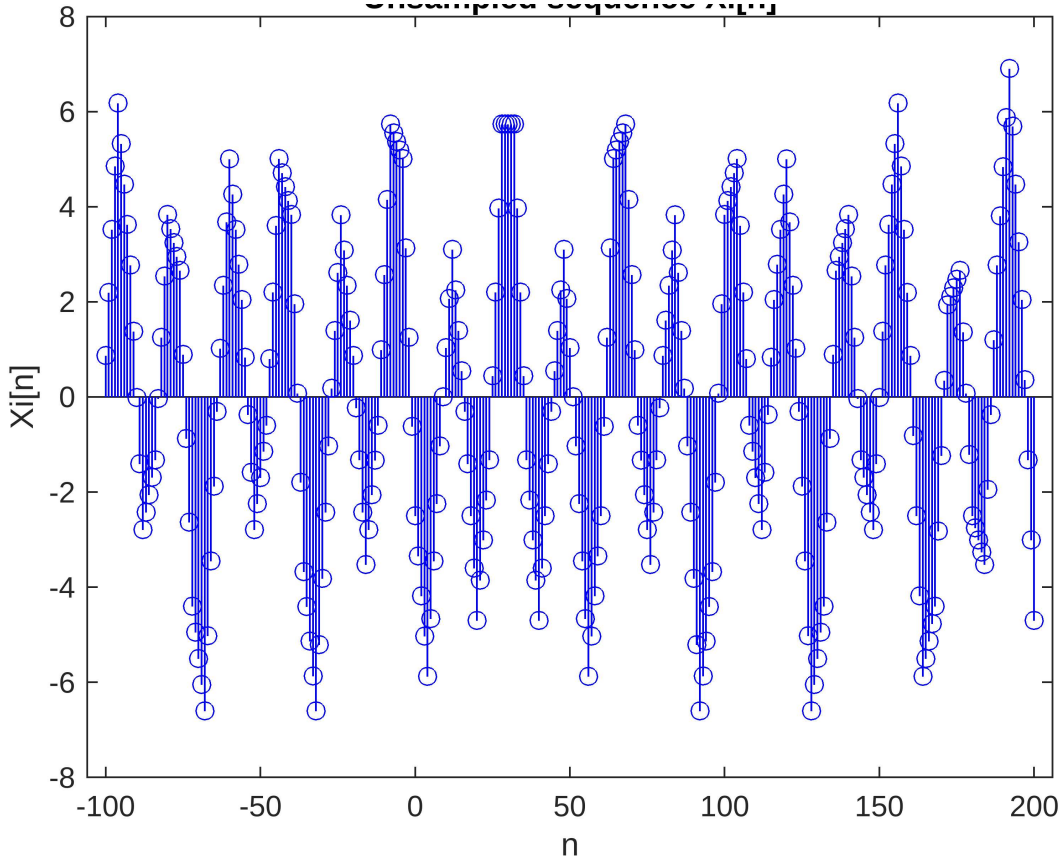
```
% Xs(t) for -10 <= t <= 20
n = -100:200;
x_n = 5.*(cos((4*pi/9).*n)) + 2.*(sin((pi/5).*n)) ;
figure;
stem(n,x_n,'black');
ylabel("Signal X[n]");
xlabel("n");
title("Discrete time signal X[n]");
```



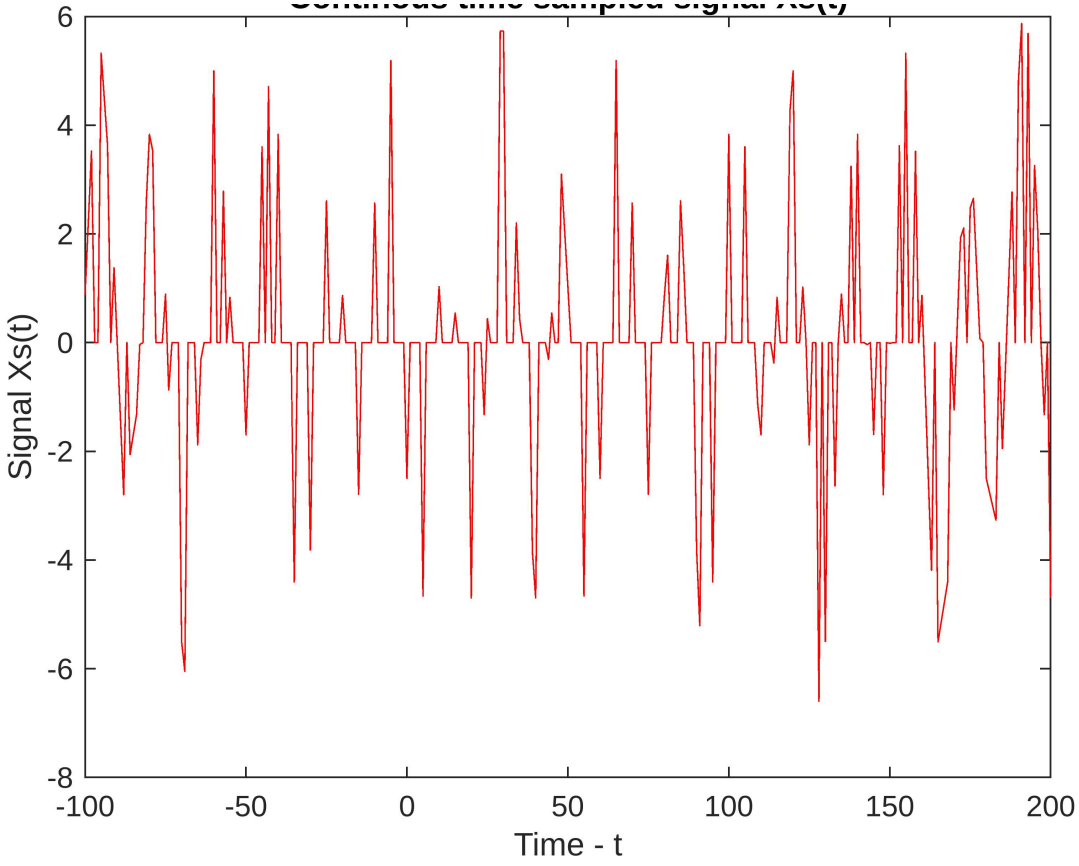

```
L = 4;
xe_n = zeros(size(n));
xe_n(1:L:end) = x_n(1:floor(length(x_n)/L) + 1);
figure;
stem(n, xe_n,'green')
xlabel("n");
ylabel("Xe[n]");
title(" Expanded Signal Xe[n]");
```




```
h_n = @(n) (1 - abs(n) / L) .* (abs(n) <= L);
n_h = -L:L;
h = h_n(n_h);
xi_n = conv(xe_n,h,'same');
figure;
stem(n,xi_n,'blue');
xlabel("n");
ylabel("Xi[n]");
title("Unsampled sequence Xi[n]");
```




```
T = 0.1;
t = -10:0.1:20;
x_s = zeros(size(n));
for i = 1:length(n)
    if t(i) == n(i)*T
        x_s(i) = xi_n(i);
    end
end
figure;
plot(n,x_s,'r');
title("Continous time sampled signal Xs(t)");
xlabel("Time - t");
ylabel("Signal Xs(t)");
```


6
4
2
0
-2
-4
-6
-8
Signal Xs(t)
-100
-50
0
50
100
150
200
Time - t