```
% 19ucc023
% Mohit Akhouri
% Experiment 1 - Observation 3

clc;
clear all;
close all;

A = 1; % defining amplitude
n_cycles = 5; % defining number of cycles
fs_ideal = 100000; % defining ideal frequency
f = 3000; % defining message signal frequency

% generating ideal signal

n_ideal = 0:1:floor(n_cycles*(fs_ideal/f))-1;
x_ideal = A*cos(2*pi*f*n_ideal*(1/fs_ideal));

% generating sampled signals
fs1 = 10000;
ns1 = 0:1:floor(n_cycles*(fs1/f))-1;
x_sampled_1 = A*cos(2*pi*f*ns1*(1/fs1));

fs2 = 6000;
ns2 = 0:1:floor(n_cycles*(fs2/f))-1;
x_sampled_2 = A*cos(2*pi*f*ns2*(1/fs2));

fs3 = 12000;
ns3 = 0:1:floor(n_cycles*(fs3/f))-1;
x_sampled_3 = A*cos(2*pi*f*ns3*(1/fs3));

fs4 = 4000;
ns4 = 0:1:floor(n_cycles*(fs4/f))-1;
x_sampled_4 = A*cos(2*pi*f*ns4*(1/fs4));

fs5 = 5000;
ns5 = 0:1:floor(n_cycles*(fs5/f))-1;
x_sampled_5 = A*cos(2*pi*f*ns5*(1/fs5));

% generating the parameters x and xq for use in interp1 function for
% different sampling rates
x_s1 = 0:1:max(ns1);
xq_s1 = 0:max(ns1)/max(n_ideal):max(ns1);

x_s2 = 0:1:max(ns2);
xq_s2 = 0:max(ns2)/max(n_ideal):max(ns2);

x_s3 = 0:1:max(ns3);
xq_s3 = 0:max(ns3)/max(n_ideal):max(ns3);

x_s4 = 0:1:max(ns4);
xq_s4 = 0:max(ns4)/max(n_ideal):max(ns4);
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x_s5 = 0:1:max(ns5);
xq_s5 = 0:max(ns5)/max(n_ideal):max(ns5);

inter_method = 'linear'; % using linear interpolation method

inter_s1 = interp1(x_s1,x_sampled_1,xq_s1,inter_method); %
 interpolated signal for Fs = 10000 Hz
inter_s2 = interp1(x_s2,x_sampled_2,xq_s2,inter_method); %
 interpolated signal for Fs = 6000 Hz
inter_s3 = interp1(x_s3,x_sampled_3,xq_s3,inter_method); %
 interpolated signal for Fs = 12000 Hz
inter_s4 = interp1(x_s4,x_sampled_4,xq_s4,inter_method); %
 interpolated signal for Fs = 4000 Hz
inter_s5 = interp1(x_s5,x_sampled_5,xq_s5,inter_method); %
 interpolated signal for Fs = 5000 Hz

mse_s1 = mean((x_ideal - inter_s1).^2); % MSE for Fs = 10000 Hz
mse_s2 = mean((x_ideal - inter_s2).^2); % MSE for Fs = 6000 Hz
mse_s3 = mean((x_ideal - inter_s3).^2); % MSE for Fs = 12000 Hz
mse_s4 = mean((x_ideal - inter_s4).^2); % MSE for Fs = 4000 Hz
mse_s5 = mean((x_ideal - inter_s5).^2); % MSE for Fs = 5000 Hz

% plotting the interpolated signals for different sampling frequencies
figure;
plot(inter_s1);
xlabel('samples(n)->');
ylabel('amplitude->');
title('19ucc023 - Mohit Akhouri','interpolated signal for F_{s}=10000
 Hz');
grid on;

figure;
plot(inter_s2);
xlabel('samples(n)->');
ylabel('amplitude->');
title('19ucc023 - Mohit Akhouri','interpolated signal for F_{s}=6000
 Hz');
grid on;

figure;
plot(inter_s3);
xlabel('samples(n)->');
ylabel('amplitude->');
title('19ucc023 - Mohit Akhouri','interpolated signal for F_{s}=12000
 Hz');
grid on;

figure;
plot(inter_s4);
xlabel('samples(n)->');
ylabel('amplitude->');
title('19ucc023 - Mohit Akhouri','interpolated signal for F_{s}=4000
 Hz');
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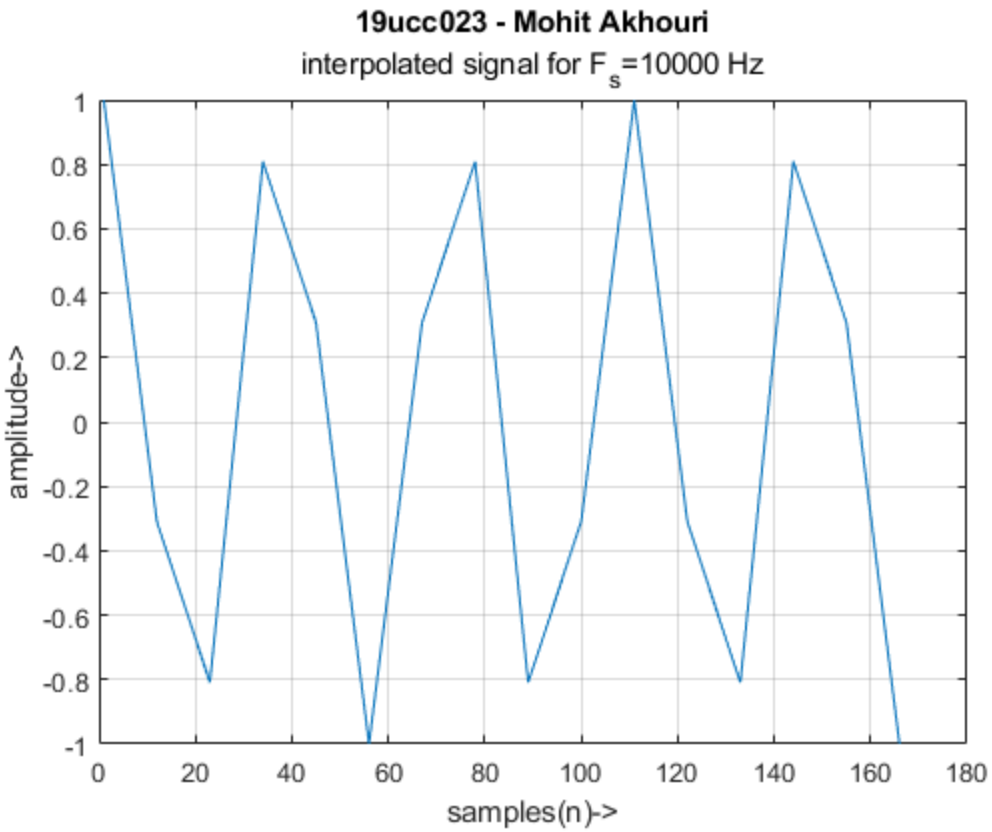
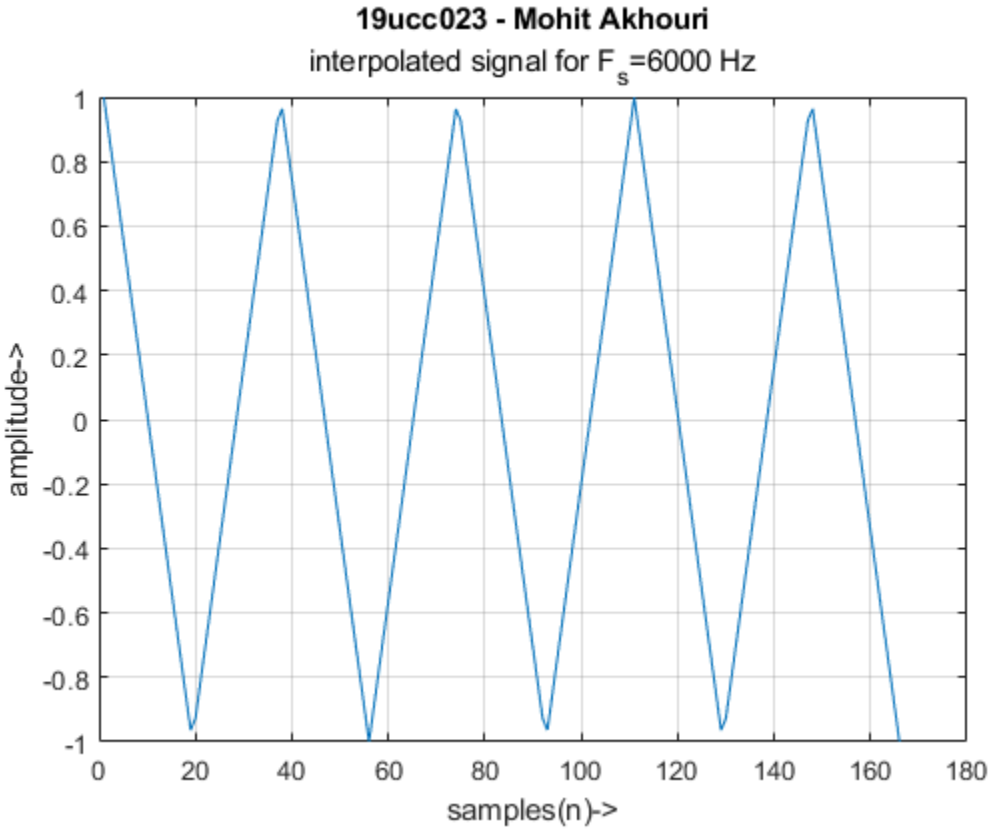
```
grid on;

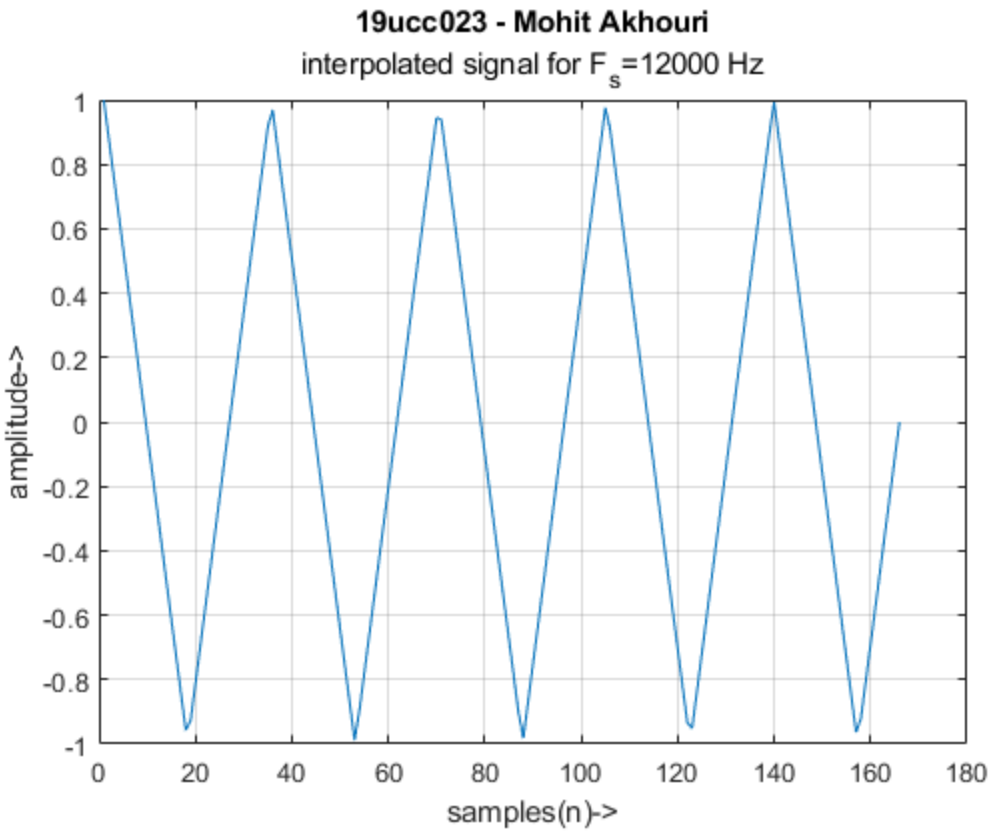
figure;
plot(inter_s5);
xlabel('samples(n)->');
ylabel('amplitude->');
title('19ucc023 - Mohit Akhouri','interpolated signal for F_{s}=5000
 Hz');
grid on;

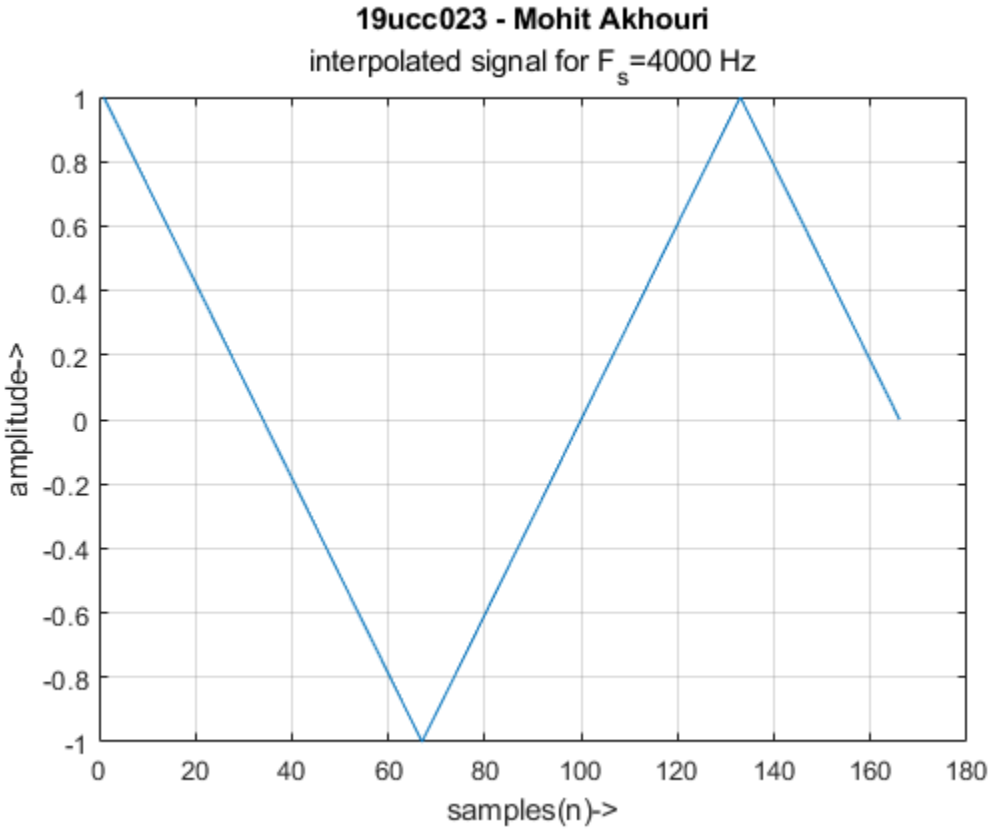
% plotting the MSE vs. Fs graph for LINEAR INTERPOLATION METHOD
figure;
stem(fs1,mse_s1,'Linewidth',1.5);
hold on;
stem(fs2,mse_s2,'Linewidth',1.5);
hold on;
stem(fs3,mse_s3,'Linewidth',1.5);
hold on;
stem(fs4,mse_s4,'Linewidth',1.5);
hold on;
stem(fs5,mse_s5,'Linewidth',1.5);

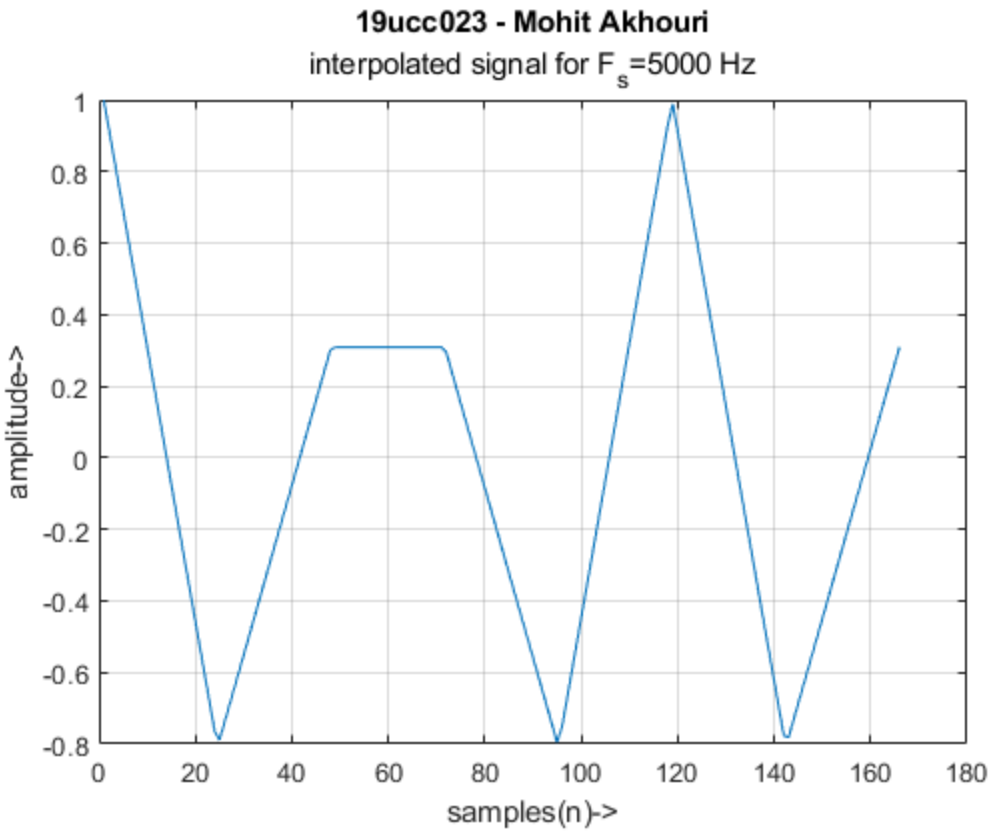
xlabel('F_{s} ->');
ylabel('MSE->');
title('19ucc023 - Mohit Akhouri','MSE vs. F_{s} for different sampling
 rates');
grid on;
```

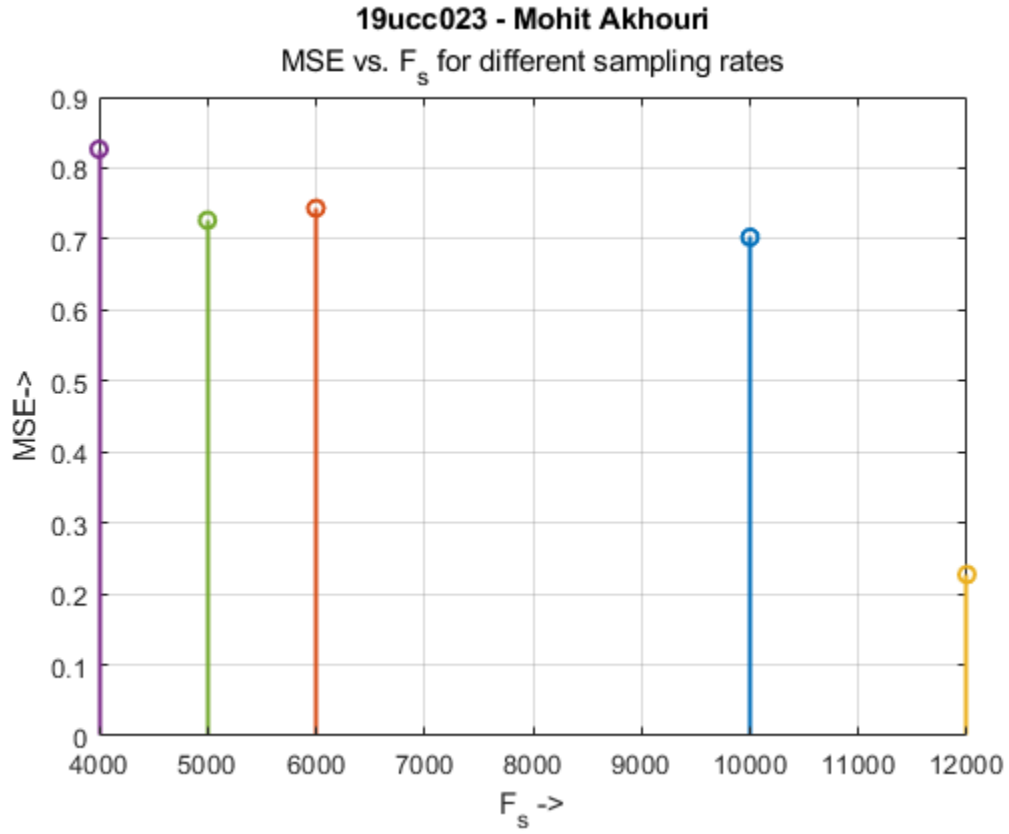

19ucc023 - Mohit Akhouri
interpolated signal for F_s=10000 Hz
amplitude->
samples(n)->
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
20
40
60
80
100
120
140
160
180


19ucc023 - Mohit Akhouri
interpolated signal for F_s=6000 Hz
amplitude->
samples(n)->
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
20
40
60
80
100
120
140
160
180


19ucc023 - Mohit Akhouri
interpolated signal for F_s=12000 Hz
amplitude->
samples(n)->
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
20
40
60
80
100
120
140
160
180


19ucc023 - Mohit Akhouri
interpolated signal for F_s=4000 Hz
amplitude->
samples(n)->
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
20
40
60
80
100
120
140
160
180


19ucc023 - Mohit Akhouri
interpolated signal for F_s=5000 Hz
amplitude->
samples(n)->
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
20
40
60
80
100
120
140
160
180


19ucc023 - Mohit Akhouri
MSE vs. F_s for different sampling rates
MSE->
F_s ->
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4000
5000
6000
7000
8000
9000
10000
11000
12000

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