**DEPARTMENT OF COMPUTER & SOFTWARE ENGINEERING**

**COLLEGE OF E&ME, NUST, RAWALPINDI**

**Subject Name**

**Digital Signal Processing**

**Lab Number**

**4**

**SUBMITTED TO:**

**LE Sundas Ashraf**

**SUBMITTED BY:**

**Student Name**

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**Objectives:**

Processing in MATLab

**Related Topic/Chapter in theory class:**

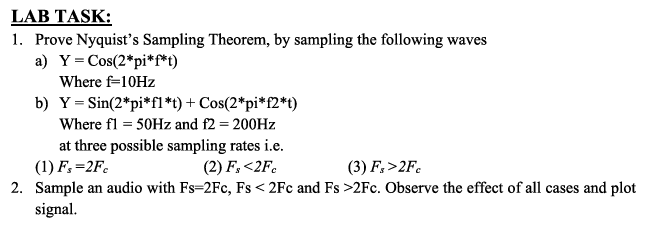
Basics Of Digital Signal Processing

**Hardware/Software required:**

Hardware: PC

Software Tool: MATLab

**Task :**

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**(1)**

**(a)**

**Solution:**

%%

t = 0:0.01:1;

y1 = cos(2 .\* pi .\* 10 .\* t);

% For y1

fs\_1\_1 = 20;

fs\_1\_2 = 5;

fs\_1\_3 = 40;

t1\_1 = 0:1/fs\_1\_1:1;

t1\_2 = 0:1/fs\_1\_2:1;

t1\_3 = 0:1/fs\_1\_3:1;

y1\_1 = cos(2 .\* pi .\* 10 .\* t1\_1);

y1\_2 = cos(2 .\* pi .\* 10 .\* t1\_2);

y1\_3 = cos(2 .\* pi .\* 10 .\* t1\_3);

subplot(4, 1, 1)

stem(t, y1)

xlabel('Samples')

ylabel('Amplitude')

title('Original Function')

subplot(4, 1, 2)

stem(t1\_1, y1\_1)

xlabel('Samples')

ylabel('Amplitude')

title('Fs = 2Fm')

subplot(4, 1, 3)

stem(t1\_2, y1\_2)

xlabel('Samples')

ylabel('Amplitude')

title('Fs < 2Fm')

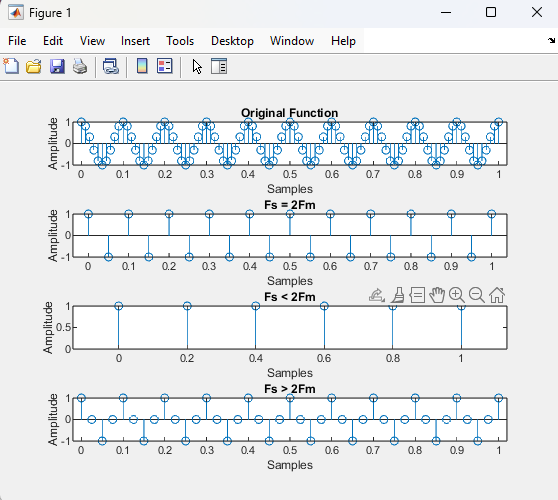
subplot(4, 1, 4)

stem(t1\_3, y1\_3)

xlabel('Samples')

ylabel('Amplitude')

title('Fs > 2Fm')

****

**(b)**

**Solution**

%%

t = 0:0.001:1;

y2 = sin(2 .\* pi .\* 50 .\* t) + cos(2 .\* pi .\* 200 .\* t);

% For y2

fs\_2\_1 = 400;

fs\_2\_2 = 200;

fs\_2\_3 = 800;

t2\_1 = 0:1/fs\_2\_1:1;

t2\_2 = 0:1/fs\_2\_2:1;

t2\_3 = 0:1/fs\_2\_3:1;

y2\_1 = cos(2 .\* pi .\* 200 .\* t2\_1);

y2\_2 = cos(2 .\* pi .\* 200 .\* t2\_2);

y2\_3 = cos(2 .\* pi .\* 200 .\* t2\_3);

subplot(4, 1, 1)

plot(t, y2)

xlabel('Samples')

ylabel('Amplitude')

title('Original Function')

subplot(4, 1, 2)

plot(t2\_1, y2\_1)

xlabel('Samples')

ylabel('Amplitude')

title('Fs = 2Fm')

subplot(4, 1, 3)

plot(t2\_2, y2\_2)

xlabel('Samples')

ylabel('Amplitude')

title('Fs < 2Fm')

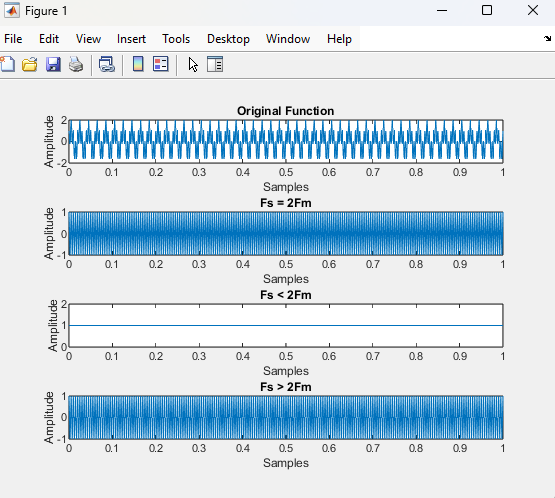
subplot(4, 1, 4)

plot(t2\_3, y2\_3)

xlabel('Samples')

ylabel('Amplitude')

title('Fs > 2Fm')



**Task 2:**



**Solution**

%

recorder = audiorecorder(8000, 8, 1);

fs = 8000

disp("Start Recording");

recordblocking(recorder, 2);

disp("Stop Recording");

play(recorder)

myVoice = getaudiodata(recorder);

Fc = fs/2;

eq = Fc \* 2;

less = 0.5 \* Fc;

more = 4 \* Fc;

Fs\_equal = resample(myVoice, eq, fs)

Fs\_less = resample(myVoice, less, fs)

Fs\_more = resample(myVoice, more, fs)

subplot(4, 1, 1)

plot(myVoice)

title('Original')

subplot(4, 1, 2)

plot(Fs\_equal)

title('Fs = 2Fm')

subplot(4, 1, 3)

plot(Fs\_less)

title('Fs < 2Fm')

subplot(4, 1, 4)

plot(Fs\_more)

title('Fs > 2Fm')

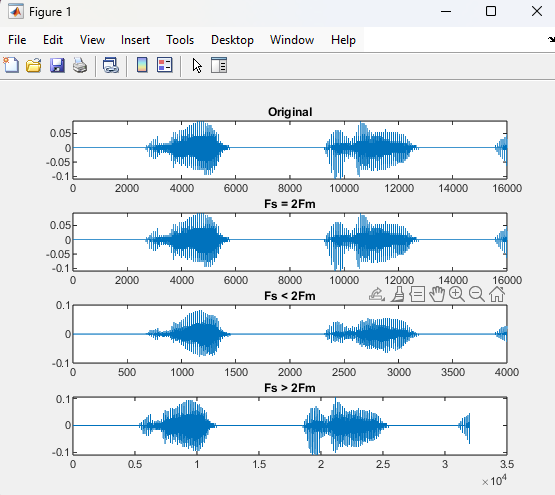
sound(Fs\_equal)

pause(3)

sound(Fs\_less)

pause(3)

sound(Fs\_more)

****