American International University- Bangladesh

COE 3103: DATA COMMUNICATION

Mid Lab Report 02

Spring 2021-2022

Section: **Q**
Date: **17/02/2022**

Submitted by,

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Tasks

Class Task:

Similar task can be done where we use a composite signal instead of signals x1 and x2. Suppose our composite signal is

```
signal_x = a1*sin(2*pi*f1*t) + a2*cos(2*pi*f2*t);
```

Here, a1 = (B + G + H), a2 = (C + E + H), f1 = (G + H + 2), and f2 = (E + F+ H). [Assume your ID is AB-CDEFG-H]

*****Show this signal both in time domain and frequency domain.**

Performance Task for Lab Report: (your ID = AB-CDEFG-H)

**Generate a composite signal using three simple signals as,

x1 = a1*cos(2*pi*f1*t), x2 = a2*sin(2*pi*f2*t), x3 = a3*cos(2*pi*f3*t)

signal_x = x1 + x2 + x3

Select the values of the amplitude and frequency as follows: a1 = A + C + 1, a2 = A + D + 2, a3 = A + E + 1, f1 = A + E + 1, f2 = A + D + 2, f3 = A + C + 1.

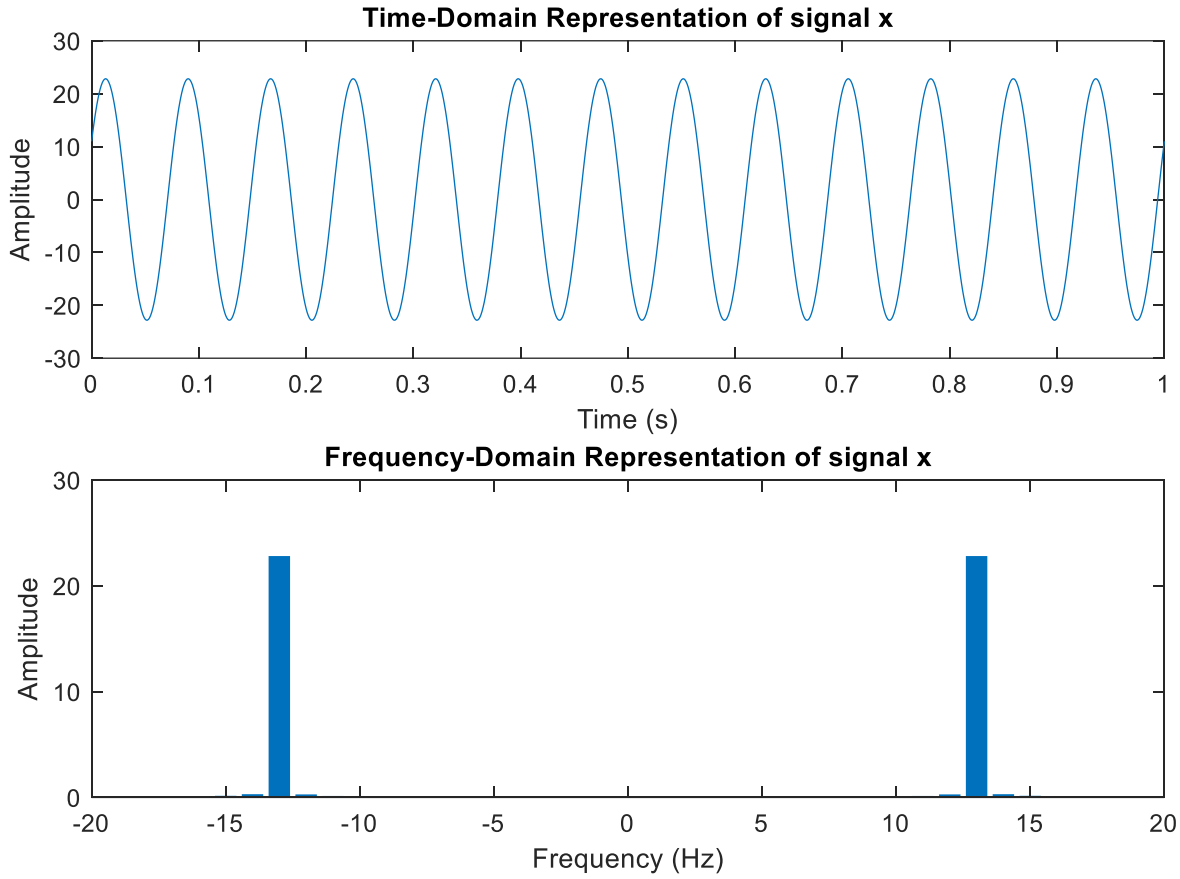
(a) Show time domain and frequency domain representations of **signal_x** in a single figure window using subplot. Use **axis**, or **xlim**, or **ylim** to appropriately represent the signal.

(b) Quantize **signal_x** in 8 equally distributed levels and provide image for **one cycle** of the original signal and quantized signal. Use **axis**, or **xlim**, or **ylim** to appropriately represent the signal.

Solution of Class Task (1)

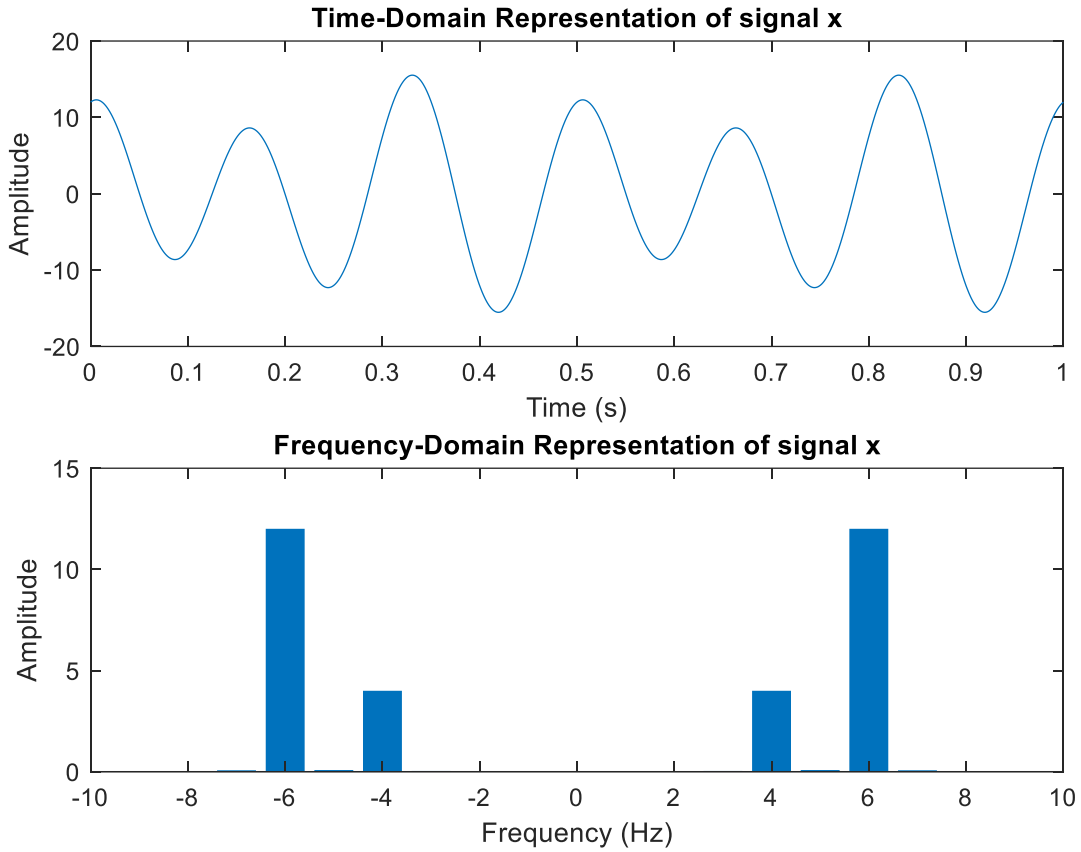
```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;
```

```
a1 = B+G+H; %a1 = 20
a2 = C+E+H; %a2 = 11
f1 = G+H+2; %f1 = 13
f2 = E+F+H; %f2 = 13

fs = 1000;
t = 0:1/fs:1;

signal_x = (a1*sin(2*pi*f1*t)) + (a2*cos(2*pi*f2*t));

subplot(2,1,1)
plot(t,signal_x)
axis([0 1 -30 30])
title('Time-Domain Representation of signal x')
xlabel('Time (s)')
ylabel('Amplitude')

fx = abs(fftshift(fft(signal_x)))/(length(signal_x)/2);
freq = linspace(-fs/2, fs/2, length(signal_x));
subplot(2,1,2)
bar(freq, fx,'linewidth',3)
axis([-20 20 0 30])
title('Frequency-Domain Representation of signal x')
xlabel('Frequency (Hz)')
ylabel('Amplitude')
```



Solution of Performance Task (a)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

a1 = A+C+1; %a1 = 6
a2 = A+D+2; %a2 = 4
a3 = A+E+1; %a3 = 6
f1 = A+E+1; %f1 = 6
f2 = A+D+2; %f2 = 4
f3 = A+C+1; %f3 = 6

fs = 1000;
t = 0:1/fs:1;

x1 = a1*cos(2*pi*f1*t);
x2 = a2*sin(2*pi*f2*t);
x3 = a3*cos(2*pi*f3*t);

signal_x = x1+x2+x3;

subplot(2,1,1)
plot(t,signal_x)
axis([0 1 -20 20])
title('Time-Domain Representation of signal x')
xlabel('Time (s)')
ylabel('Amplitude')

fx = abs(fftshift(fft(signal_x)))/(length(signal_x)/2);
freq = linspace(-fs/2, fs/2, length(signal_x));
subplot(2,1,2)
bar(freq, fx,'linewidth',3)
axis([-10 10 0 15])
title('Frequency-Domain Representation of signal x')
xlabel('Frequency (Hz)')
ylabel('Amplitude')
```



Solution of Performance Task (b)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

a1 = A+C+1; %a1 = 6
a2 = A+D+2; %a2 = 4
a3 = A+E+1; %a3 = 6
f1 = A+E+1; %f1 = 6
f2 = A+D+2; %f2 = 4
f3 = A+C+1; %f3 = 6

fs = 1000;
t = 0:1/fs:1;
```

```
x1 = a1*cos(2*pi*f1*t);
x2 = a2*sin(2*pi*f2*t);
x3 = a3*cos(2*pi*f3*t);

signal_x = x1+x2+x3;

p = linspace(-14,14,7);
c = linspace(-15.53,15.53,8);
[i,q] = quantiz(signal_x,p,c);
plot(t,signal_x,'x',t,q,'.')
axis([0 0.5 -16 16])
title('Quantization of signal x');
legend('Original signal','Quantized signal');
xlabel('Time (s)');
ylabel('Amplitude');
```