



American International University- Bangladesh

COE 3103: DATA COMMUNICATION

Mid Lab Report 02 Spring 2021-2022

Section: Q
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Submitted by,

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Tasks

Class Task:

Similar task can be done where we use a composite signal instead of signals x_1 and x_2 . Suppose our composite signal is

$$\text{signal_x} = a_1 \sin(2\pi f_1 t) + a_2 \cos(2\pi f_2 t);$$

Here, $a_1 = (B + G + H)$, $a_2 = (C + E + H)$, $f_1 = (G + H + 2)$, and $f_2 = (E + F + H)$. [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,

$$x_1 = a_1 \cos(2\pi f_1 t), x_2 = a_2 \sin(2\pi f_2 t), x_3 = a_3 \cos(2\pi f_3 t)$$

$$\text{signal_x} = x_1 + x_2 + x_3$$

Select the values of the amplitude and frequency as follows: $a_1 = A + C + 1$, $a_2 = A + D + 2$, $a_3 = A + E + 1$, $f_1 = A + E + 1$, $f_2 = A + D + 2$, $f_3 = A + C + 1$.

(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

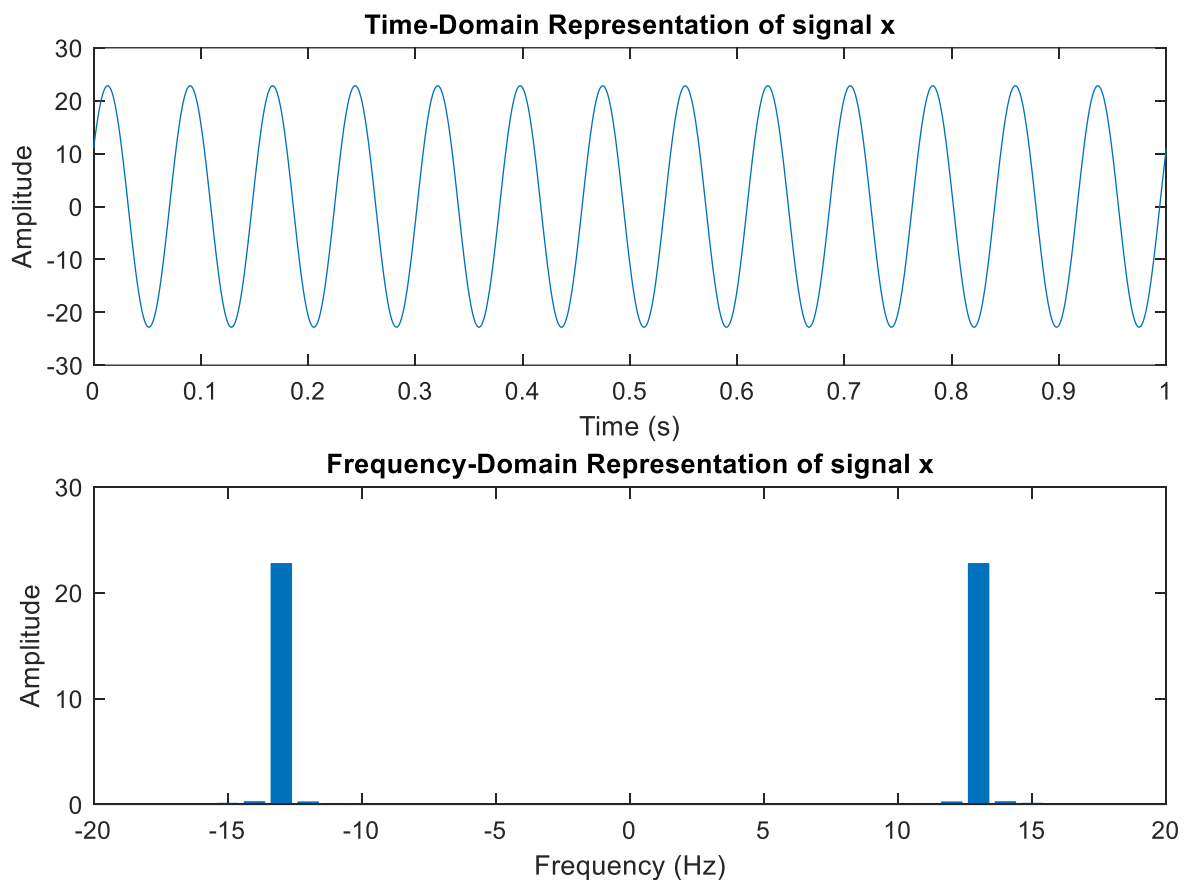
fs = 1000;
t = 0:1/fs:1;

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;

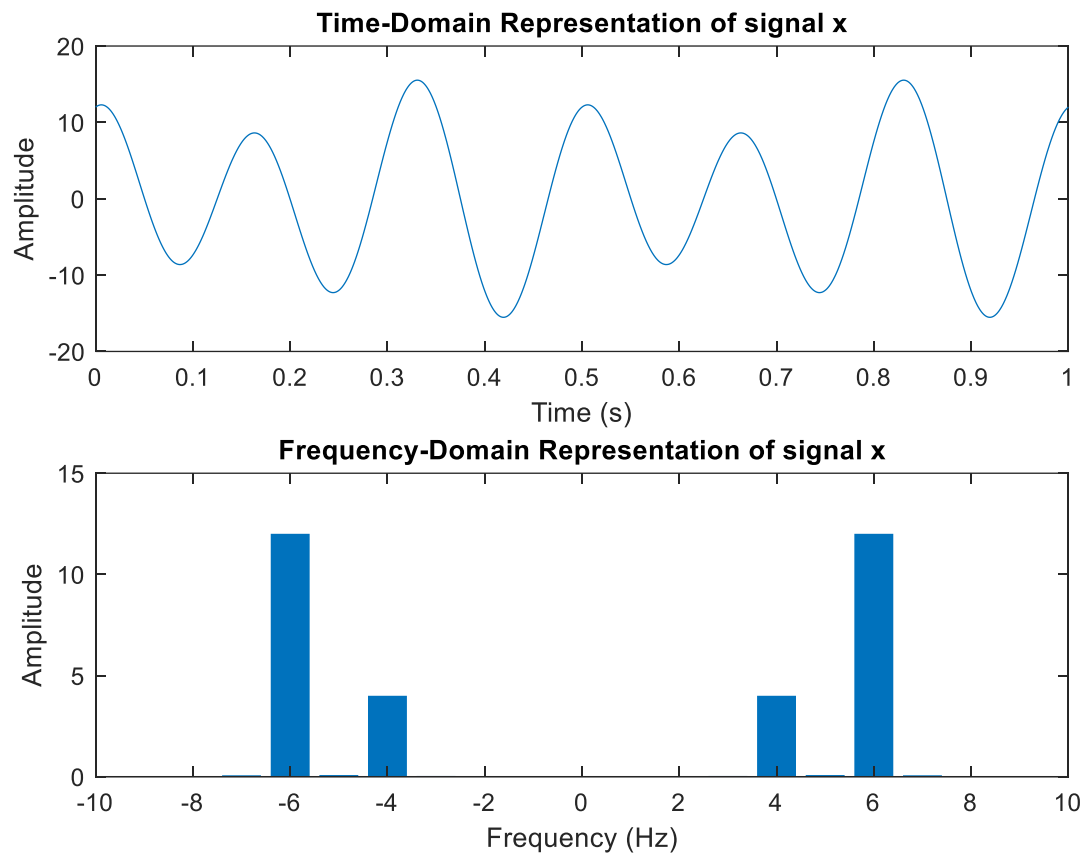
x1 = a1*cos(2*pi*f1*t);
x2 = a2*sin(2*pi*f2*t);
x3 = a3*cos(2*pi*f3*t);

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');
```

