Name: Nafinur Leo

Id: 20-42195-1

Course Name: Data Communication

Section: D

Lab Exam: 01

Semester: 2021-2022 Fall

Submission Date: 29-11-2021

ID = AB-CDEFG-H

Here, my id is: 20-42195-1

A = 2, B = 0, C = 4, D = 2, E = 1, F = 9, G = 5, H = 1

a1 = F+4 = 9+4 = 13

f1 = G+3 = 5+3 = 8

a2 = F+2 = 9+2 = 11

f2 = G+5 = 5+5 = 10

Start range = (G+1)*70 = (5+1)*70 = 420 Hz

End range = (G+1)*110 = (5+1)*110 = 660 Hz

Code:

```
clc

clear all

close all

fs = 4001;

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

a1 = 13;

f1 = 8;

s1 = a1*cos(2*pi*f1*t);

a2 = 11;

f2 = 10;

s2 = a2*cos(2*pi*f2*t);

Cm1 = 1;

fc1 = 460;

c1 = Cm1*cos(2*pi*fc1*t);

Cm2 = 1;
```

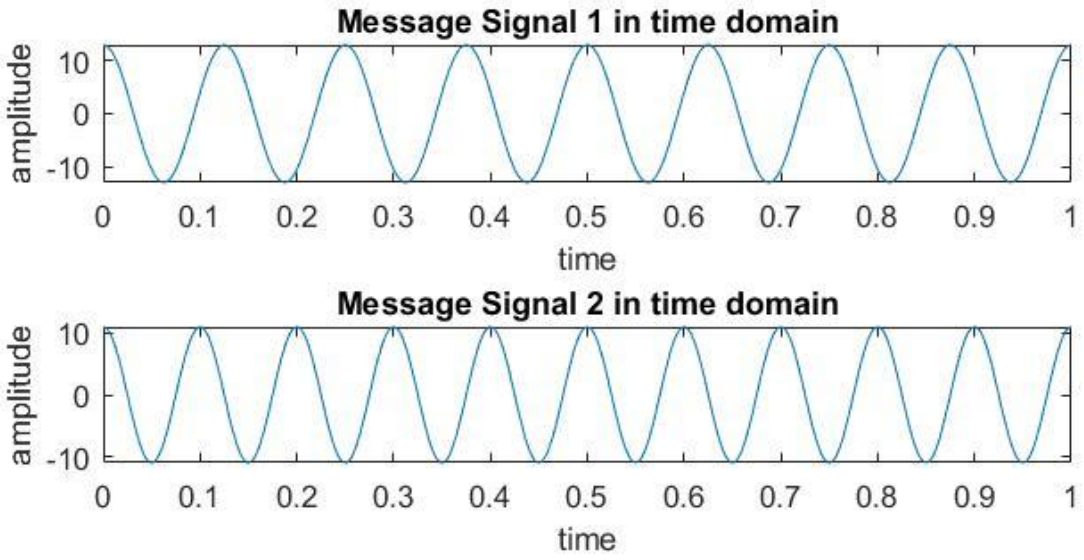
```
fc2 = 500;
c2 = Cm2*cos(2*pi*fc2*t);
x = (s1).*c1+(s2).*c2;
figure
subplot(3,1,1)
plot(t,s1)
xlabel('time')
ylabel('amplitude')
title('Message Signal 1 in time domain')
ylim([-a1 a1])
subplot(3,1,2)
plot(t,s2)
xlabel('time')
ylabel('amplitude')
title('Message Signal 2 in time domain')
ylim([-a2 a2])
M1 = abs(fftshift(fft(s1)))/(fs/2);
M2 = abs(fftshift(fft(s2)))/(fs/2);
X = abs(fftshift(fft(x)))/(fs/2);
f = fs/2*linspace(-1,1,fs);
figure
subplot(3,1,1)
stem(f,M1)
xlabel('frequency')
ylabel('amplitude')
```

```
title('Message Signal 1 in frequency domain')
axis([-10 10 0 10])
subplot(3,1,2)
stem(f,M2)
xlabel('frequency')
ylabel('amplitude')
title('Message Signal 2 in frequency Domain')
axis([-12 12 0 20])
figure
subplot(2,1,1)
plot(t,x)
xlabel('time')
ylabel('amplitude')
title('Composite/multiplexed signal in time domain')
subplot(2,1,2)
stem(f,X)
xlabel('frequency')
ylabel('amplitude')
title('Composite/multiplexed signal in frequency domain')
axis([-660 660 0 10])
[num1, den1] = butter(5, [(fc1-f1-6)/(fs/2),(fc1+f1+6)/(fs/2)]);
bpf1 = filter(num1,den1,x);
[num2, den2] = butter(5, [(fc2-f2-6)/(fs/2),(fc2+f2+6)/(fs/2)]);
bpf2 = filter(num2,den2,x);
z1 = 2*bpf1.*c1;
```

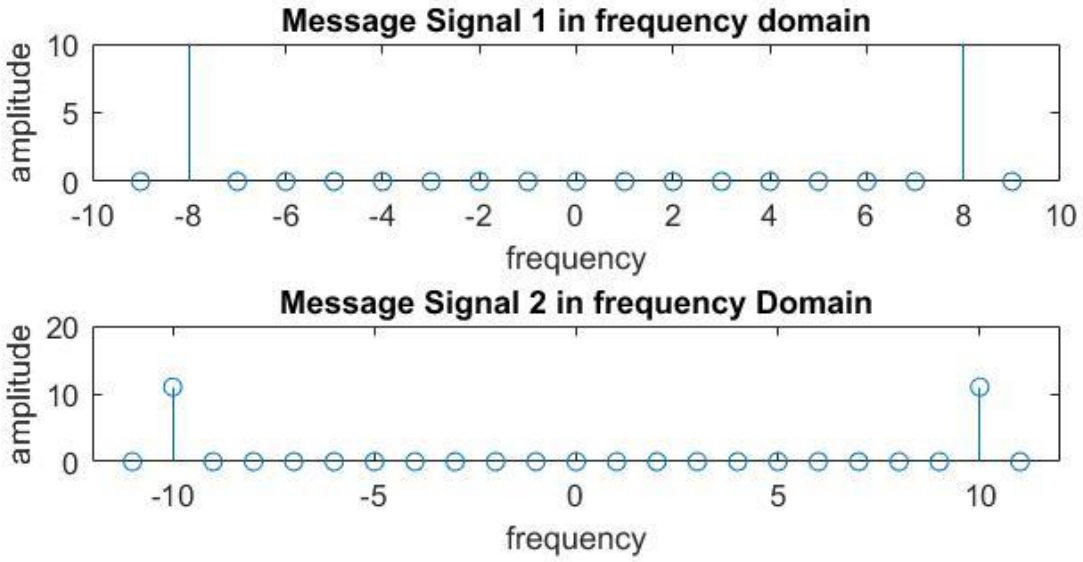
```
z2 = 2*bpf2.*c2;
[num4, den4] = butter(5, (f1+3)/(fs/2));
rec1 = filter(num4,den4,z1);
[num5, den5] = butter(5, (f2+3)/(fs/2));
rec2 = filter(num5,den5,z2);
figure
subplot(3,1,1)
plot(t,rec1)
xlabel('time')
ylabel('amplitude')
title('Received signal 1 in time domain')
ylim([-a1 a1])
subplot(3,1,2)
plot(t,rec2)
xlabel('time')
ylabel('amplitude')
title('Received signal 2 in time domain')
ylim([-a2 a2])
R1 = abs(fftshift(fft(rec1)))/(fs/2);
R2 = abs(fftshift(fft(rec2)))/(fs/2);
figure
subplot(3,1,1)
stem(f,R1)
xlabel('frequnecy')
ylabel('amplitude')
```

```
title('Received signal 1 in frequency domain')
xlim([-10 10])
subplot(3,1,2)
stem(f,R2)
xlabel('frequnecy')
ylabel('amplitude')
title('Received signal 2 in frequency domain')
xlim([-10 10])
```

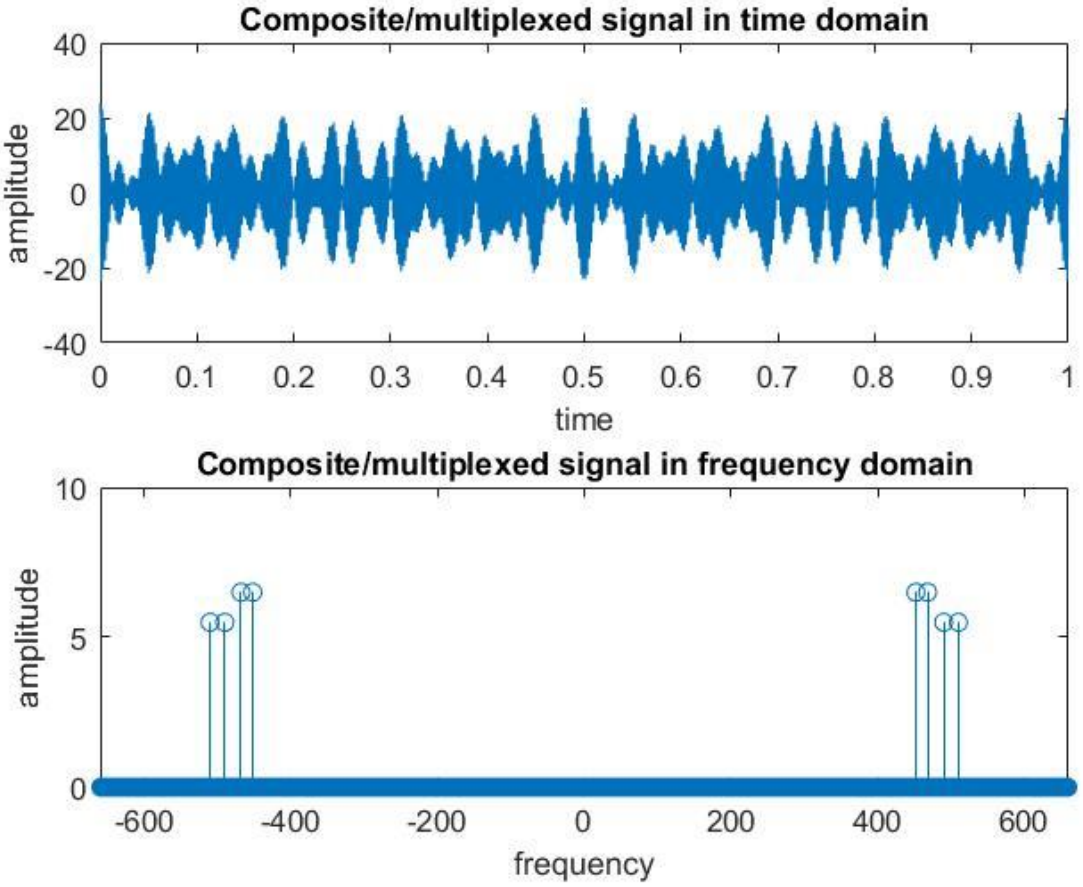
(i)



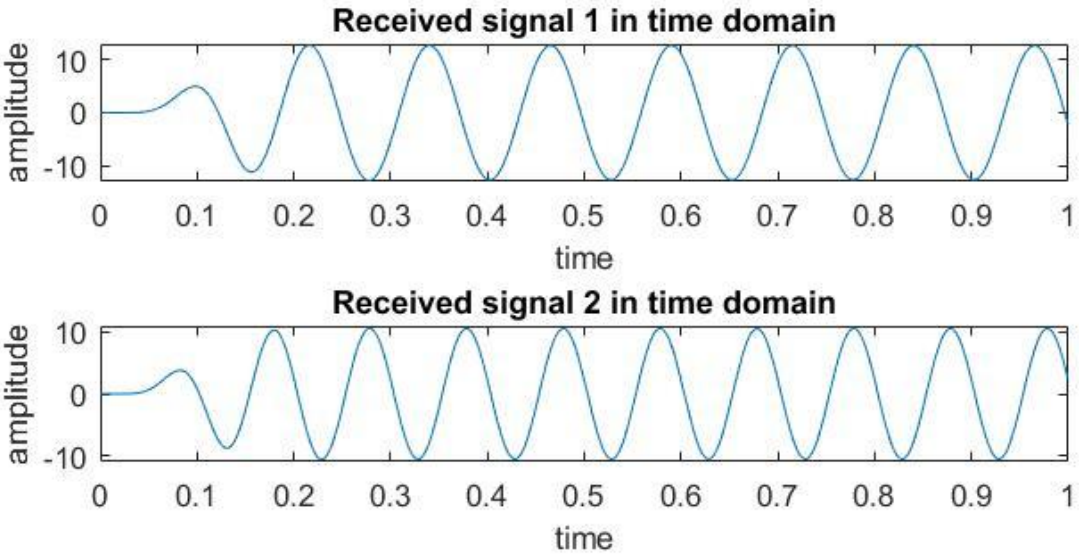
(ii)


Message Signal 1 in frequency domain
amplitude
10
5
0
-10
-8
-6
-4
-2
0
2
4
6
8
10
frequency
Message Signal 2 in frequency Domain
amplitude
20
10
0
-10
-5
0
5
10
frequency

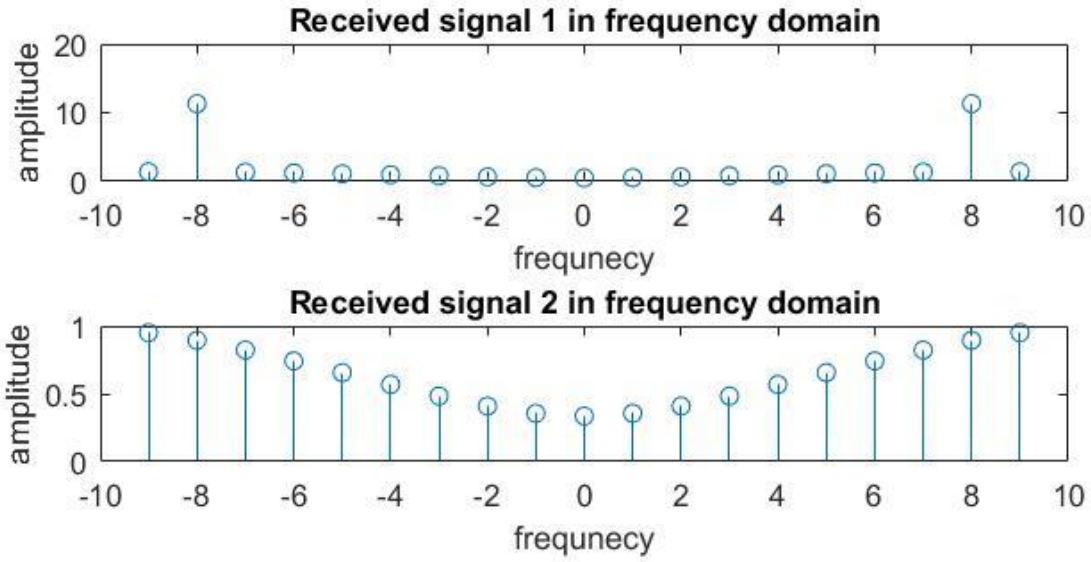
(iii)


Composite/multiplexed signal in time domain
amplitude
time
Composite/multiplexed signal in frequency domain
amplitude
frequency

(iv)


Received signal 1 in time domain
amplitude
10
0
-10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
time
Received signal 2 in time domain
amplitude
10
0
-10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
time

(v)


Received signal 1 in frequency domain
amplitude
20
10
0
-10
-8
-6
-4
-2
0
2
4
6
8
10
frequnecy
Received signal 2 in frequency domain
amplitude
1
0.5
0
-10
-8
-6
-4
-2
0
2
4
6
8
10
frequnecy