



AMERICAN INTERNATIONAL UNIVERSITY-
BANGLADESH (AIUB)

Data Communication Laboratory

LAB REPORT

ON

Introduction to MATLAB.

Experiment No: 4

Section: G

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Performance Task for Lab Report –

ID = 18-36445-1

here, $A = 1$, $B = 8$, $C = 3$, $D = 6$, $E = 4$, $F = 4$, $G = 5$, $H = 1$

now,

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

$$x = A1 \sin(2\pi(C*100)t) + A2 \cos(2\pi(G*100)t) + s*\text{randn}(\text{size}(t))$$

$$x = A1 \sin(2\pi(3*100)t) + A2 \cos(2\pi(5*100)t) + s*\text{randn}(\text{size}(t))$$

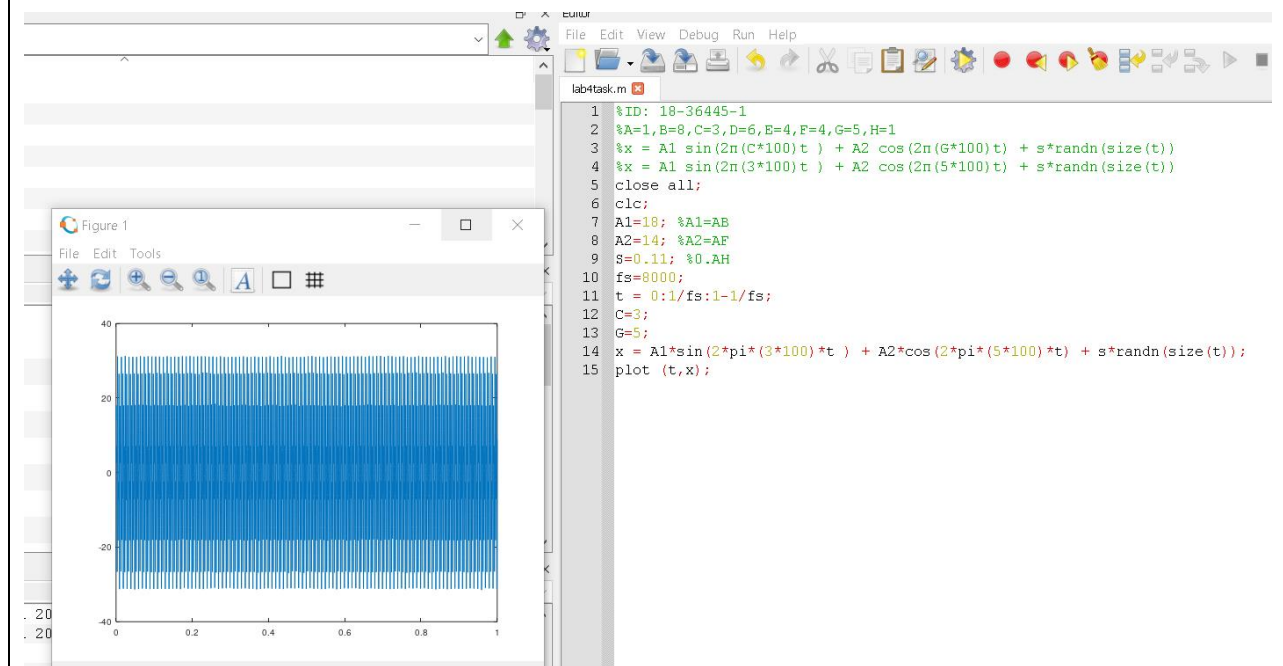
QUES: (a) Select the value of the amplitudes as follows: let $A1 = AB$, $A2 = AF$ and $s=AH$.

ANS:a

$$A1=18; \%A1=AB$$

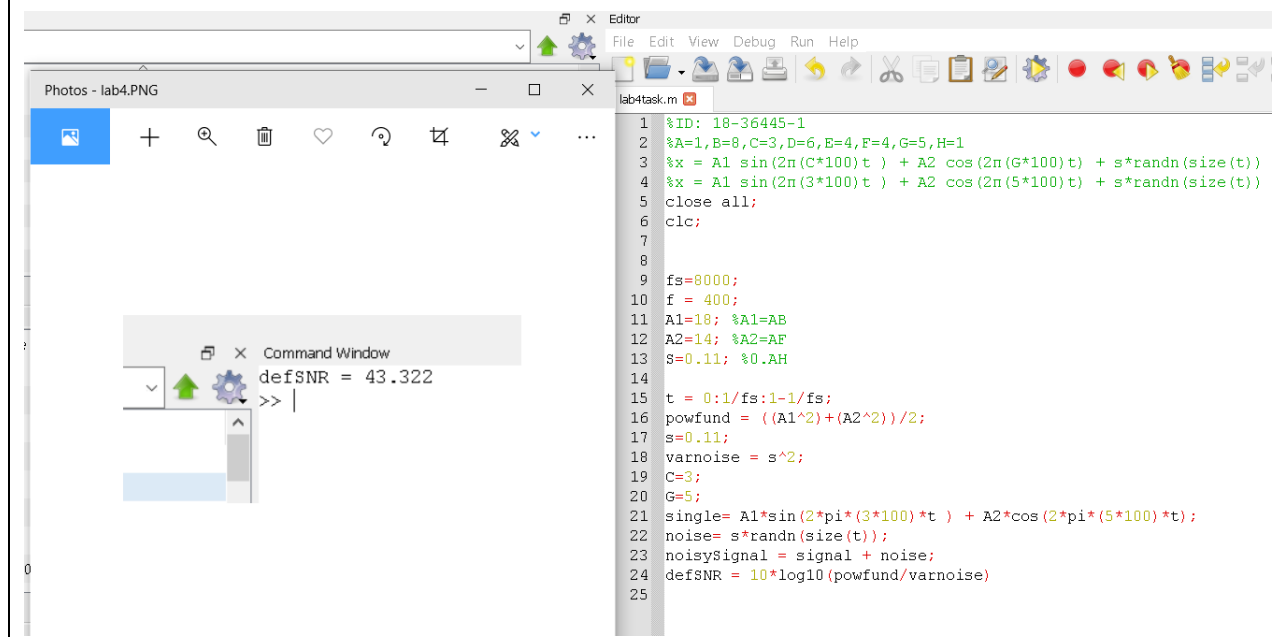
$$A2=14; \%A2=AF$$

$$s=0.11; \%0.AH$$



Ques: (b) Calculate the SNR value of the composite signal.

ANS:b



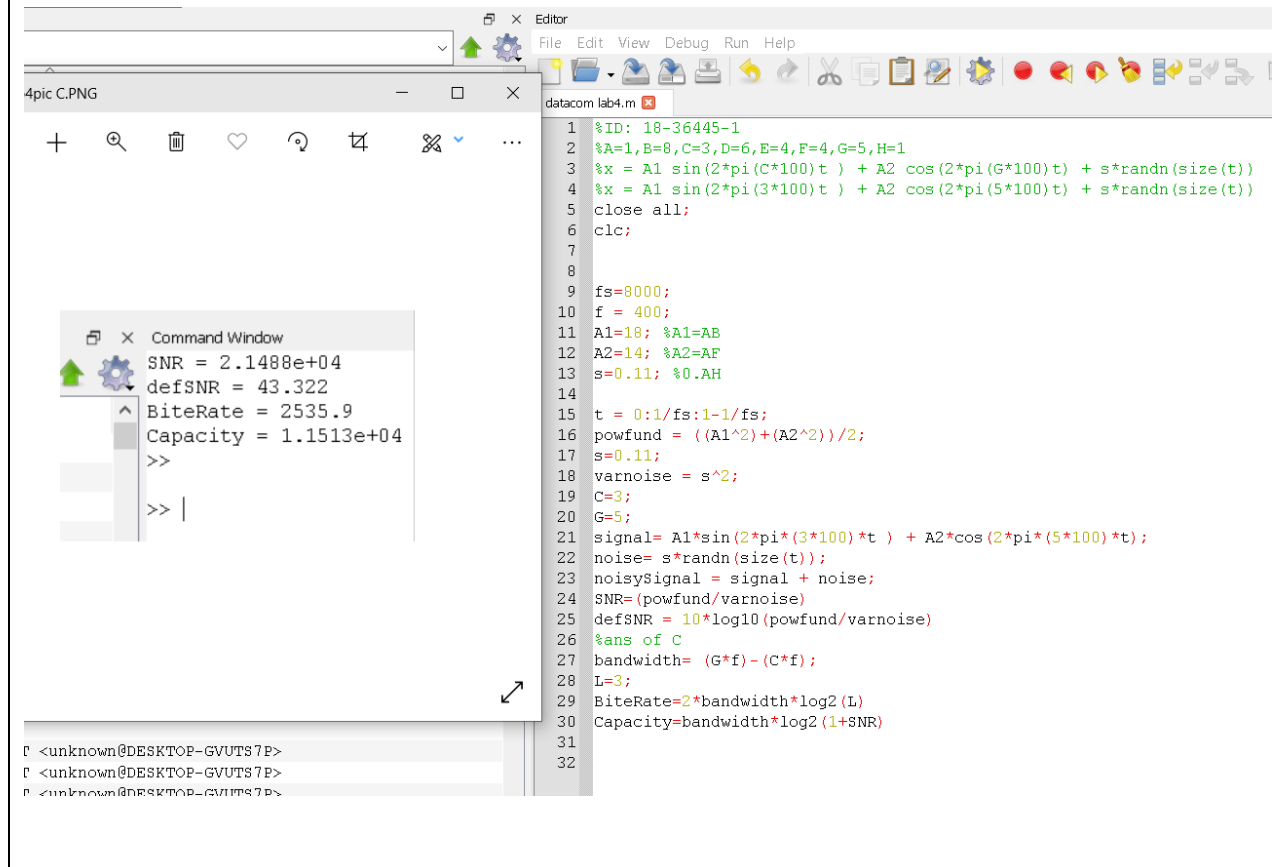
The image shows a MATLAB environment with an Editor window and a Command Window. The Editor window contains a script named 'lab4task.m' with the following code:

```
1 %ID: 18-36445-1
2 %A=1,B=8,C=3,D=6,E=4,F=4,G=5,H=1
3 %x = A1 sin(2pi(C*100)t ) + A2 cos(2pi(G*100)t) + s*randn(size(t))
4 %x = A1 sin(2pi(3*100)t ) + A2 cos(2pi(5*100)t) + s*randn(size(t))
5 close all;
6 clc;
7
8
9 fs=8000;
10 f = 400;
11 A1=18; %A1=AB
12 A2=14; %A2=AF
13 s=0.11; %0.11
14
15 t = 0:1/fs:1-1/fs;
16 powfund = ((A1^2)+(A2^2))/2;
17 s=0.11;
18 varnoise = s^2;
19 C=3;
20 G=5;
21 single= A1*sin(2*pi*(3*100)*t ) + A2*cos(2*pi*(5*100)*t);
22 noise= s*randn(size(t));
23 noisySignal = signal + noise;
24 defSNR = 10*log10(powfund/varnoise)
25
```

The Command Window shows the execution of the script, resulting in the command 'defSNR = 43.322' and the prompt '>>'.

Ques: (c) Find the bandwidth of the signal and calculate the maximum capacity of the channel.

ANS: c



The screenshot shows a MATLAB environment with an Editor window and a Command Window. The Editor window contains a script named 'datacom lab4.m' with the following code:

```
1 %ID: 18-36445-1
2 %A=1,B=8,C=3,D=6,E=4,F=4,G=5,H=1
3 %x = A1 sin(2*pi*(C*100)t ) + A2 cos(2*pi*(G*100)t) + s*randn(size(t))
4 %x = A1 sin(2*pi*(3*100)t ) + A2 cos(2*pi*(5*100)t) + s*randn(size(t))
5 close all;
6 clc;
7
8
9 fs=8000;
10 f = 400;
11 A1=18; %A1=AB
12 A2=14; %A2=AF
13 s=0.11; %0.11
14
15 t = 0:1/fs:1-1/fs;
16 powfund = ((A1^2)+(A2^2))/2;
17 s=0.11;
18 varnoise = s^2;
19 C=3;
20 G=5;
21 signal= A1*sin(2*pi*(3*100)*t ) + A2*cos(2*pi*(5*100)*t);
22 noise= s*randn(size(t));
23 noisysignal = signal + noise;
24 SNR=(powfund/varnoise)
25 defSNR = 10*log10(powfund/varnoise)
26 %ans of C
27 bandwidth= (G*f)-(C*f);
28 L=3;
29 BiteRate=2*bandwidth*log2(L)
30 Capacity=bandwidth*log2(1+SNR)
31
32
```

The Command Window shows the output of the script:

```
SNR = 2.1488e+04
defSNR = 43.322
BiteRate = 2535.9
Capacity = 1.1513e+04
>>
>> |
```

Ques: (d) What will be the signal level to achieve the data rate?

ANS: d

Output:

apprxDatarate1 = 11513

apprxDatarate2 = 4375

compareDatarate =

11513 4375

apprxlevel1 = 146

apprxlevel2 = 6

compareLevel =

146 6

The screenshot shows the MATLAB environment. The Command Window on the left displays the following output:

```
SNR = 2.1488e+04
defSNR = 43.322
BiteRate = 2535.9
Capacity = 1.1513e+04
apprxDatarate1 = 11513
apprxDatarate2 = 4375
compareDatarate =
    11513    4375
apprxlevel1 = 146
apprxlevel2 = 6
compareLevel =
    146     6
```

The script editor on the right shows the following code:

```
4  %x = A1 sin(2*pi*(3*100)t ) + A2 cos(2*pi*(5*100)t) + s*randn(size(t))
5  close all;
6  clc;
7
8
9  fs=8000;
10 f = 400;
11 A1=18; %A1=AB
12 A2=14; %A2=AF
13 s=0.11; %0.11
14
15 t = 0:1/fs:1-1/fs;
16 powfund = ((A1^2)+(A2^2))/2;
17 s=0.11;
18 varnoise = s^2;
19 C=3;
20 G=5;
21 signal= A1*sin(2*pi*(3*100)*t ) + A2*cos(2*pi*(5*100)*t);
22 noise= s*randn(size(t));
23 noisySignal = signal + noise;
24 SNR=(powfund/varnoise)
25 defSNR = 10*log10(powfund/varnoise)
26 %ans of C
27 bandwidth= (G*f)-(C*f);
28 L=3;
29 BiteRate=2*bandwidth*log2(L)
30 Capacity=bandwidth*log2(1+SNR)
31 %ans of D
32 apprxDataRate1=floor(bandwidth*log2(1+SNR))
33 apprxDataRate2=floor(bandwidth*log2(1+defSNR))
34 compareDatarate=[apprxDatarate1 apprxDataRate2]
35 apprxlevel1=floor(2^(apprxDatarate1/(2*bandwidth)))
36 apprxlevel2=floor(2^(apprxDatarate2/(2*bandwidth)))
37 compareLevel=[apprxlevel1 apprxlevel2]
38
```

%ID: 18-36445-1

%A=1,B=8,C=3,D=6,E=4,F=4,G=5,H=1

%x = A1 sin(2*pi(C*100)t) + A2 cos(2*pi(G*100)t) + s*randn(size(t))

%x = A1 sin(2*pi(3*100)t) + A2 cos(2*pi(5*100)t) + s*randn(size(t))

close all;

clc;

```

fs=8000;
f = 400;
A1=18; %A1=AB
A2=14; %A2=AF
s=0.11; %0.AH

t = 0:1/fs:1-1/fs;
powfund = ((A1^2)+(A2^2))/2;
s=0.11;
varnoise = s^2;
C=3;
G=5;
signal= A1*sin(2*pi*(3*100)*t ) + A2*cos(2*pi*(5*100)*t);
noise= s*randn(size(t));
noisySignal = signal + noise;
SNR=(powfund/varnoise)
defSNR = 10*log10(powfund/varnoise)
%ans of C
bandwidth= (G*f)-(C*f);
L=3;
BiteRate=2*bandwidth*log2(L)
Capacity=bandwidth*log2(1+SNR)
%ans of D

```

```
apprxDatarate1=floor(bandwidth*log2(1+SNR))
apprxDatarate2=floor(bandwidth*log2(1+defSNR))
compareDatarate=[apprxDatarate1 apprxDatarate2]
apprxlevel1=floor(2^(apprxDatarate1/(2*bandwidth)))
apprxlevel2=floor(2^(apprxDatarate2/(2*bandwidth)))
compareLevel=[apprxlevel1 apprxlevel2]
```