MARKS:

AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Data Communication Laboratory

LAB REPORT

ON

Study of Nyquist bit rate and Shannon capacity using MATLAB

Experiment No: 4

Section: [G]

Semester: Spring 20-21

Course Teacher: MD MEHEDI HASAN

Date of Performance: 16-Feb-21

Date of Submission: 23-Feb-21

Student Name: DEBORAJ ROY

Student ID: 19-40158-1

1. Working Procedure:

Given,
ID = **AB-CDEFG-H**

Now, my id = 19-40158-1

A=1, B=9, C=4, D=0, E=1, F=5, G=8, H=1

$X = A1 \sin(2\pi(C*100)t) + A2 \cos(2\pi(G*100)t) + s*randn(size(t));$

$X = A1 \sin(2\pi(4*100)t) + A2 \cos(2\pi(8*100)t) + s*randn(size(t));$

(a) Select the value of the amplitudes as follows: let A1 = AB, A2 = AF and s = 0.AH

Ans (a):

A1= AB= 19;

A2=AF=15;

S=0.AH=0.11

So, $x = A1 \sin(2\pi(C*100)t) + A2 \cos(2\pi(G*100)t) + s*randn(size(t));$

$X = A1 \sin(2\pi(4*100)t) + A2 \cos(2\pi(8*100)t) + s*randn(size(t));$

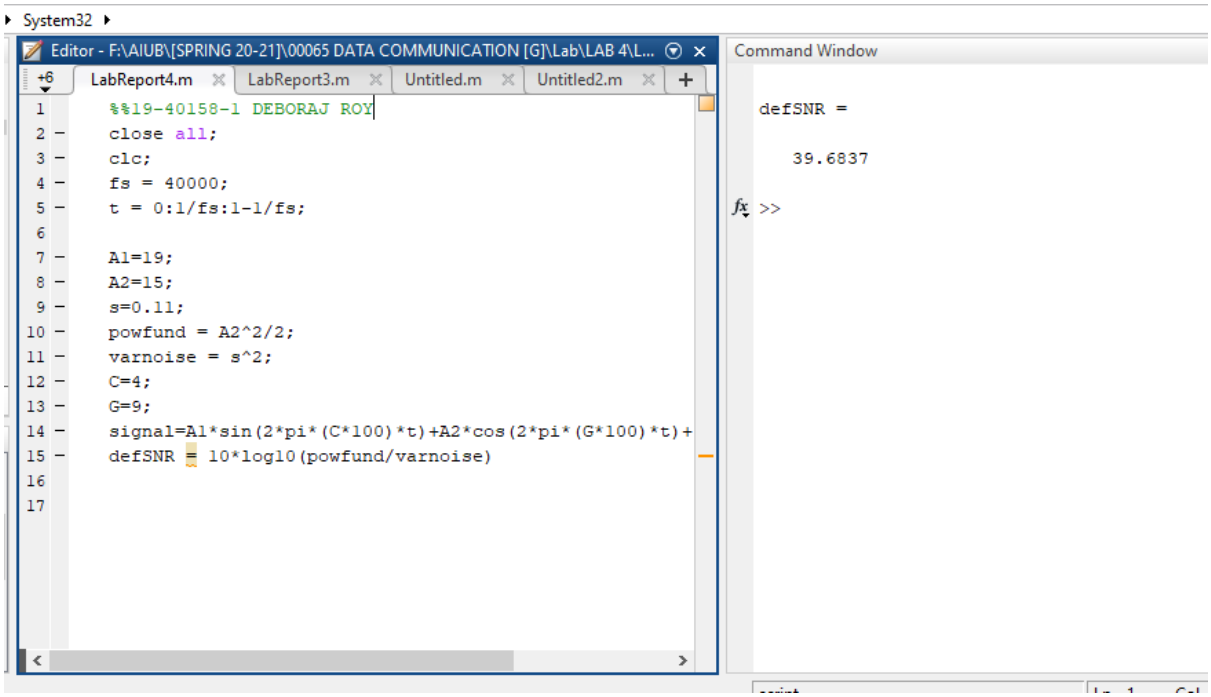
(b) Calculate the SNR value of the composite signal.

Ans (b):

```
%%19-40158-1 DEBORAJ ROY
close all;
clc;
fs = 40000;
t = 0:1/fs:1-1/fs;

A1=19;
A2=15;
s=0.11;
powfund = A2^2/2;
varnoise = s^2;
C=4;
G=9;
signal=A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+s*randn(s
ize(t));
defSNR = 10*log10(powfund/varnoise)
```

So, value of SNR = 39.6837 ;



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

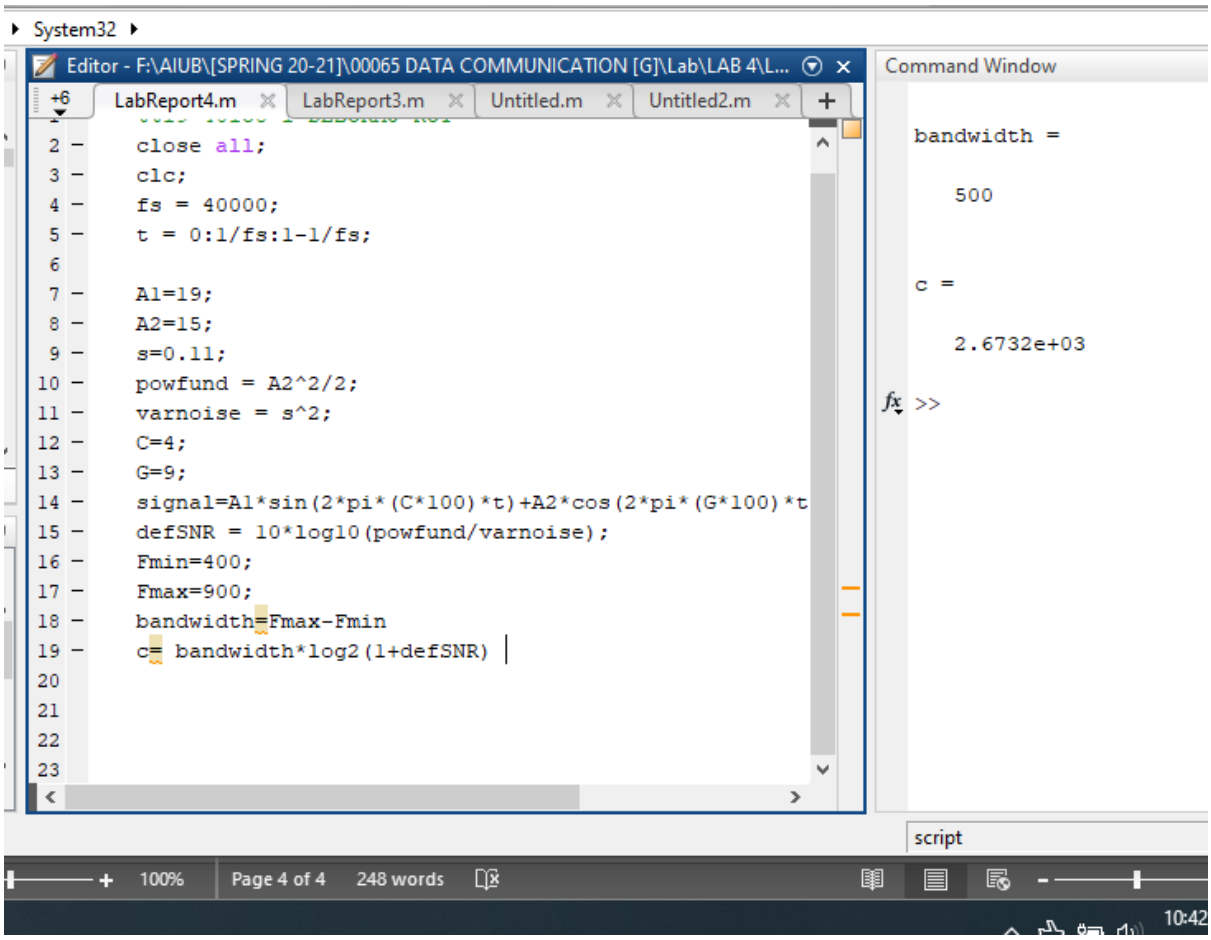
Ans (c):

```
%%19-40158-1 DEBORAJ ROY
close all;
clc;
fs = 40000;
t = 0:1/fs:1-1/fs;

A1=19;
A2=15;
s=0.11;
powfund = A2^2/2;
varnoise = s^2;
C=4;
G=9;
signal=A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+s*randn(size(t));
defSNR = 10*log10(powfund/varnoise);
```

```
Fmin=400;
Fmax=900;
bandwidth=Fmax-Fmin
c= bandwidth*log2(1+defSNR) %capacity
```

So, bandwidth= 500 and capacity = 2.6732e+03



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

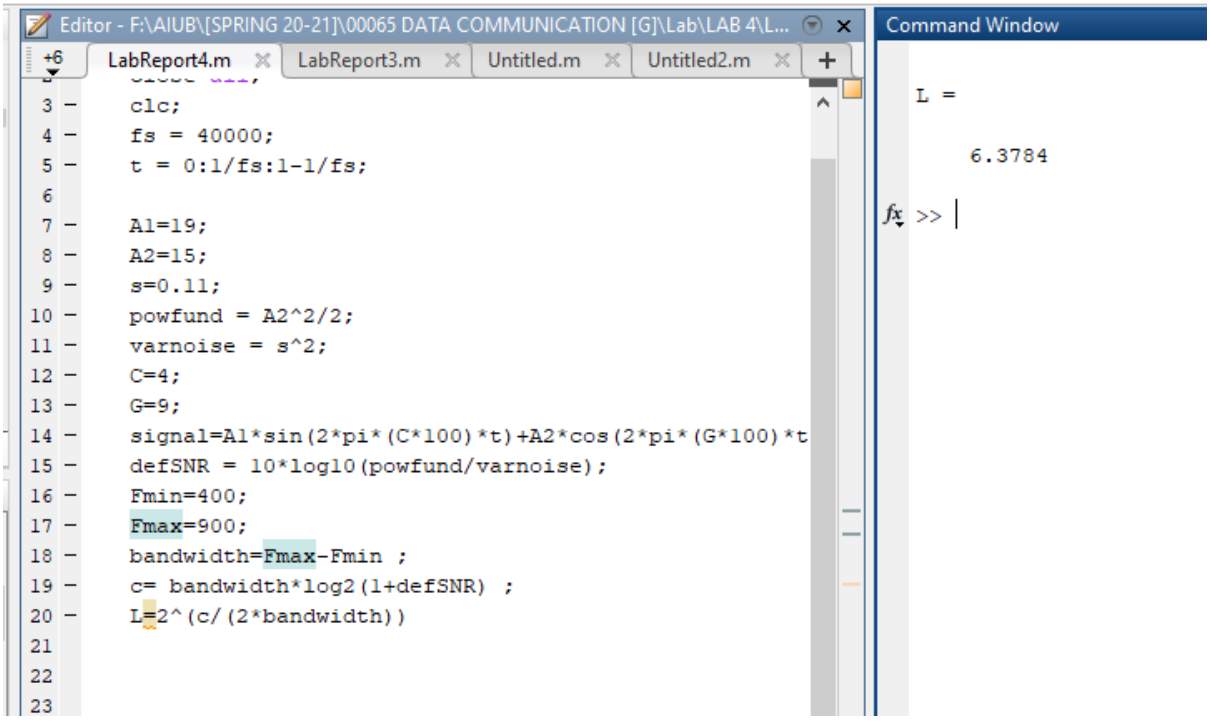
Ans (d):

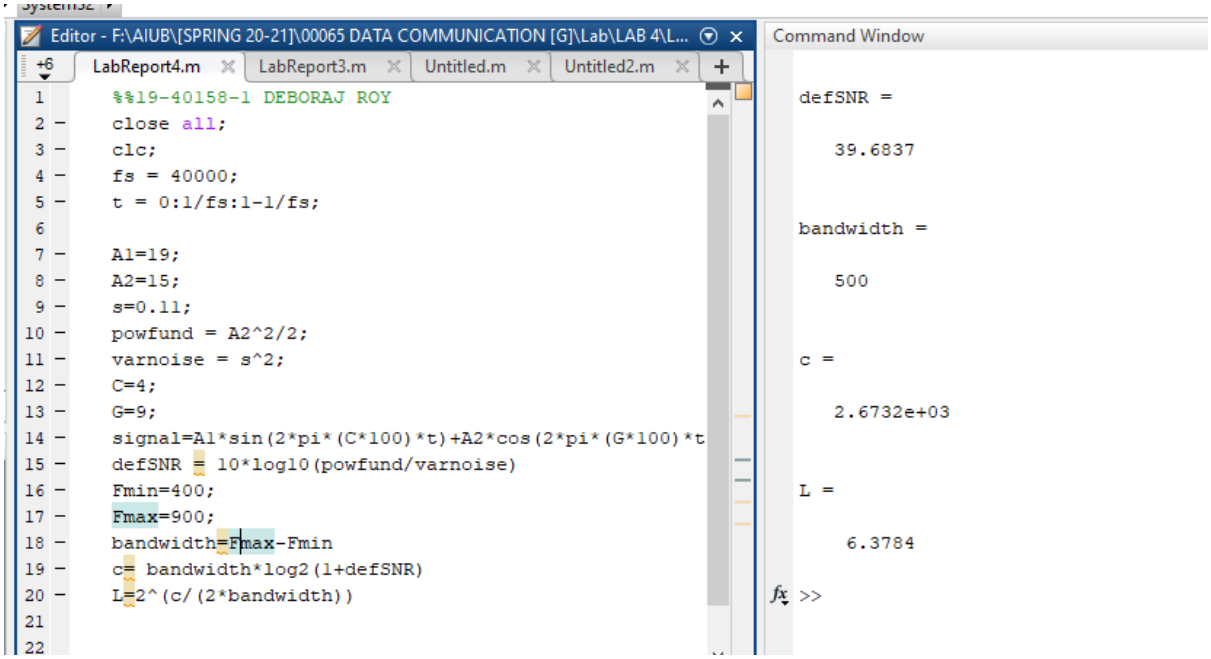
```
%%19-40158-1 DEBORAJ ROY
close all;
clc;
fs = 40000;
```

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

A1=19;
A2=15;
s=0.11;
powfund = A2^2/2;
varnoise = s^2;
C=4;
G=9;
signal=A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+s*randn(size(t));
defSNR = 10*log10(powfund/varnoise);
Fmin=400;
Fmax=900;
bandwidth=Fmax-Fmin ;
c= bandwidth*log2(1+defSNR) ;
L=2^(c/(2*bandwidth))
```

So, signal level = 6.3784 ,




Editor - F:\AIUB\[SPRING 20-21]\00065 DATA COMMUNICATION [G]\Lab\LAB 4\L...
LabReport4.m
LabReport3.m
Untitled.m
Untitled2.m
%%19-40158-1 DEBORAJ ROY
close all;
clc;
fs = 40000;
t = 0:1/fs:1-1/fs;
A1=19;
A2=15;
s=0.11;
powfund = A2^2/2;
varnoise = s^2;
C=4;
G=9;
signal=A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t
defSNR = 10*log10(powfund/varnoise)
Fmin=400;
Fmax=900;
bandwidth=Fmax-Fmin
c= bandwidth*log2(1+defSNR)
L=2^(c/(2*bandwidth))
Command Window
defSNR =
39.6837
bandwidth =
500
c =
2.6732e+03
L =
6.3784
>>