Course Name:	Data Communication	Course Code:	COE 3103
Semester:	Spring 2022	Sec:	A
Faculty:	ABIR AHMED		

Lab Report No	04
Lab Report title:	Study of Nyquist bit rate and Shannon capacity using MATLAB

Submitted by:	Fahim Mahmud Bhuiyan	Student ID:	20-42970-1

Lab Report 4

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

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

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

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

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

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

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

Ans to the question no (a)

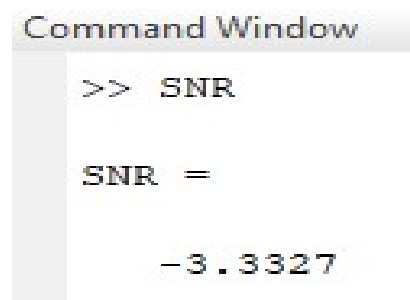Given that, ID = AB-CDEFG-H

$\qquad$ = 20-42970-1

A1 = AB = 20

A2 = AF = 27

S = AH = 21

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

$\quad$ = 20 sin(2π(**4***100)t) + 27 cos(2π(**0***100)t) + 21*randn(size(t));

Ans to the question no (b)

```
clc;
clear all;
close all;
fs = 48000;
t = 0:1/fs:1-1/fs;
x = 20*sin(2*pi*(4*100)*t) + 27*cos(2*pi*(0*100)*t) + 21*randn(size(t));
SNR = snr(x);
```

```
Command Window
>> SNR

SNR =

   -3.3327
```

Ans to the question no (c)

```
clc;
clear all;
close all;
fs = 48000;
t = 0:1/fs:1-1/fs;
x = 20*sin(2*pi*(4*100)*t) + 27*cos(2*pi*(0*100)*t) + 21*randn(size(t));
SNR = snr(x);
bandwidth = obw(x,fs);
Capacity = bandwidth*log2 (1+SNR);
```

```
Command Window
>> bandwidth

bandwidth =

   2.3617e+04

>> Capacity

Capacity =

   3.0340e+04 + 1.0704e+05i
```

Ans to the question no (d)

```
clc;
clear all;
close all;
fs = 48000;
t = 0:1/fs:1-1/fs;
x = 20*sin(2*pi*(4*100)*t) + 27*cos(2*pi*(0*100)*t) + 21*randn(size(t));
SNR = snr(x);
bandwidth = obw(x,fs);
Capacity = bandwidth*log2 (1+SNR);
n = Capacity/(2*bandwidth);
signalLevel = 2^(Capacity/(2*bandwidth));
```

```
Command Window
>> n

n =

   0.6615 + 2.2662i

>> signalLevel

signalLevel =

   -0.0000 + 1.5817i
```