American International University-Bangladesh (AIUB)

Department of Computer Science

Lab Report-04

NAME : Din Mohammad Dohan

ID : **17-34465-2**

SECTION : **G**

COURSE NAME : DATA COMMUNICATION

SEMESTER : 2020-2021, FALL

Title: Study of Nyquist bit rate and Shannon capacity using MATLAB

Performance Task:

My ID = 17-34465-2

Here,

A= 1, B= 7, C= 3, D= 4, E= 4, F= 6, G= 5, H= 2.

$x = A_1 \sin(2\pi(C*100)t) + A_2 \cos(2\pi(G*100)t) + s*randn(size(t));$
$= A_1 \sin(2\pi(3*100)t) + A_2 \cos(2\pi(5*100)t) + s*randn(size(t));$

(a) Select the value of the amplitudes as follows: let *A*1 = AB, *A*2 = AF and s=AH

$A_1 = AB = 17,$
$A_2 = AF = 16,$
$s = AH = 12.$

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

Editor - C:\Users\Lenovo\fourB.m

fourB.m

```
A1 = 17;
A2 = 16;
s = 12;
varnoise=s^2;
powfund = (A1^2)/2 + (A2^2)/2;
fs = 10000;
t = 0:1/fs:1-1/fs;
signal = A1*sin(2*pi*3*100*t) + A2*cos(2*pi*5*100*t);
noise = s*randn(size(t));
SNR = snr(signal, noise);
defSNR = 10*log10(powfund/varnoise)
```

Command Window

```
>> fourB

SNR =

    2.8627

>> fourB
>> fourB

defSNR =

    2.7700
```

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

Editor - C:\Users\Lenovo\fourC.m

fourB.m | fourC.m

```
1 -    SNR = snr(signal);
2 -    bandwidth = obw(signal, fs)
3 -    capacity1 = bandwidth*log2(1+SNR)
4 -    capacity2 = bandwidth*log2(1+defSNR)
```

Command Window

```
>> fourC

bandwidth =

  200.9799


capacity1 =

  122.6585


capacity2 =

  384.7921
```

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

Editor - C:\Users\Lenovo\fourD.m

fourB.m | fourC.m | fourD.m

```
1     %Lets Assume normal capacity. so,bit_rate = capacityl value%
2 -   bit_rate = 122.6585;
3 -   Signal_Level = 2^(bit_rate/(2*bandwidth))
4
```

Command Window

```
>> fourD

Signal_Level =

    1.2355
```