American International University- Bangladesh

COE 3103: DATA COMMUNICATION

Mid Lab Report 04

Spring 2021-2022

Section: **Q**
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Submitted by,

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Tasks

Class Task:

signal = 1.5*sin(2*pi*2*t)+0.9*cos(2*pi*10*t)+1.1*sin(2*pi*20*t) + 0.13*randn(size(t));

*****Calculate the SNR value of the signal.**

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

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

$x = A_1 \sin(2\pi((C+D+H)*100)t) + A_2 \cos(2\pi((D+E+H)*100)t) + s*randn(size(t));$

(a) Select the value of the amplitudes as follows: let A_1 = (A+B+H), A_2 = (B+C+H) and s = (C+D+H)/30

(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?

Solution of Class Task

```
fs = 8000; % Sampling frequency
%Define signal
t = 0:1/fs:1-1/fs;
signal = 1.5*sin(2*pi*2*t)+0.9*cos(2*pi*10*t)+1.1*sin(2*pi*20*t) + 0.13*randn(size(t));
%snr
SNR = snr(signal)
```

Output:

SNR =

1.4244

Solution of Performance Task (a)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

A1 = (A+B+H)
A2 = (B+C+H)
s =(C+D+H)/30
```

Output:

A1 =

13

A2 =

16

s =

0.2667

Solution of Performance Task (b)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

A1 = (A+B+H); %A1 = 13
A2 = (B+C+H); %A2 = 16
s =(C+D+H)/30; %s = 0.2667

fs = 8000; % Sampling frequency
%Define signal
```

```
t = 0:1/fs:1-1/fs;
x = A1*sin(2*pi*((C+D+H)*100)*t) + A2*cos(2*pi*((D+E+H)*100)*t) + s*randn(size(t));
%snr
SNR = snr(x)
```

Output:

SNR =

34.6128

Solution of Performance Task (c)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

A1 = (A+B+H); %A1 = 13
A2 = (B+C+H); %A2 = 16
s =(C+D+H)/30; %s = 0.2667

fs = 8000; % Sampling frequency
%Define signal
t = 0:1/fs:1-1/fs;
x = A1*sin(2*pi*((C+D+H)*100)*t) + A2*cos(2*pi*((D+E+H)*100)*t) + s*randn(size(t));
%snr
SNR = snr(x);

Bandwidth = obw(x,fs) % Bandwidth of the signal
Capacity = Bandwidth*log2(1+SNR) % Capacity of the channel
```

Output:

Bandwidth =

0.9903

Capacity =

5.1103

Solution of Performance Task (d)

```
%ID: 19-41468-3
A = 1;
B = 9;
C = 4;
D = 1;
E = 4;
F = 6;
G = 8;
H = 3;

A1 = (A+B+H); %A1 = 13
A2 = (B+C+H); %A2 = 16
s =(C+D+H)/30; %s = 0.2667

fs = 8000; % Sampling frequency
%Define signal
t = 0:1/fs:1-1/fs;
x = A1*sin(2*pi*((C+D+H)*100)*t) + A2*cos(2*pi*((D+E+H)*100)*t) + s*randn(size(t));
%snr
SNR = snr(x);

Bandwidth = obw(x,fs); % Bandwidth of the signal
Capacity = Bandwidth*log2(1+SNR); % Capacity of the channel

Level = floor(2^(Capacity/(2*Bandwidth))) %signal level to achieve the data rate
```

Output:

Level =

5