AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

DATA COMMUNICATION

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Section: F

Group: 03

Lab: 03

LAB REPORT ON

Study of Nyquist bit rate and Shannon capacity using MATLAB.

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

Performance Task:

ID = AB-CDEFG-H = 22-46588-1

According to the above statement-

A = 2

B = 2

C = 4

D = 6

E = 5

F = 8

G = 8

H = 1

$x = A_1 \sin(2\pi(C*10)\, t) + A_2 \cos(2\pi(G*10)\, t) + s*randn(size(t));$

(a) $A_1 = A + B = 2 + 2 = 4$

$A_2 = A + F = 2 + 8 = 10$

$s = (A + H)*0.1 = (2 + 1)*0.1 = 3$

(b)

```
fs = 1000;
t = 0:1/fs:1-1/fs;
A1 = 4;
A2 = 10;
s = 0.3;
C = 4;
G = 8;
x1 = A1*sin(2*pi*C*10*t);
x2 = A2*sin(2*pi*G*10*t);
x3 = x1 + x2;
n = s*randn(size(t));
x = x3 + n;
SNR = snr(x);
```

Fig 01: The SNR value of the composite signal x.

(c)

```
fs = 1000;
t = 0:1/fs:1-1/fs;
A1 = 4;
A2 = 10;
s = 0.3;
C = 4;
G = 8;
x1 = A1*sin(2*pi*C*10*t);
```

```
x2 = A2*sin(2*pi*G*10*t);
x3 = x1 + x2;
n = s*randn(size(t));
x = x3 + n;
SNR = snr(x);
bw = obw(x,fs);
c = bw*log2(1+SNR);
```

Fig 02: The bandwidth of the signal is ‘bw’ and the maximum capacity of the channel is ‘c’.

(d)

```
fs = 1000;
t = 0:1/fs:1-1/fs;
A1 = 4;
A2 = 10;
s = 0.3;
C = 4;
G = 8;
x1 = A1*sin(2*pi*C*10*t);
x2 = A2*sin(2*pi*G*10*t);
x3 = x1 + x2;
n = s*randn(size(t));
x = x3 + n;
SNR = snr(x);
bw = obw(x,fs);
c = bw*log2(1+SNR);
L = 2^(c\2*bw);
```

Fig 03: Signal level

Composite signal , Noise, Composite signal with noise:

```
fs = 1000;
t = 0:1/fs:1-1/fs;
A1 = 4;
A2 = 10;
s = 0.3;
C = 4;
G = 8;
x1 = A1*sin(2*pi*C*10*t);
x2 = A2*sin(2*pi*G*10*t);
x3 = x1 + x2;
n = s*randn(size(t));
x = x3 + n;
SNR = snr(x);
bw = obw(x,fs);
c = bw*log2(1+SNR);
L = 2^(c\2*bw);

subplot(3,1,1);
plot(t,x3,'R');
title('Composite signal')
```

```
subplot(3,1,2);
plot(t,n,'G');
title('Noise')
subplot(3,1,3);
plot(t,x,'B');
title('Composite signal with noise')
```

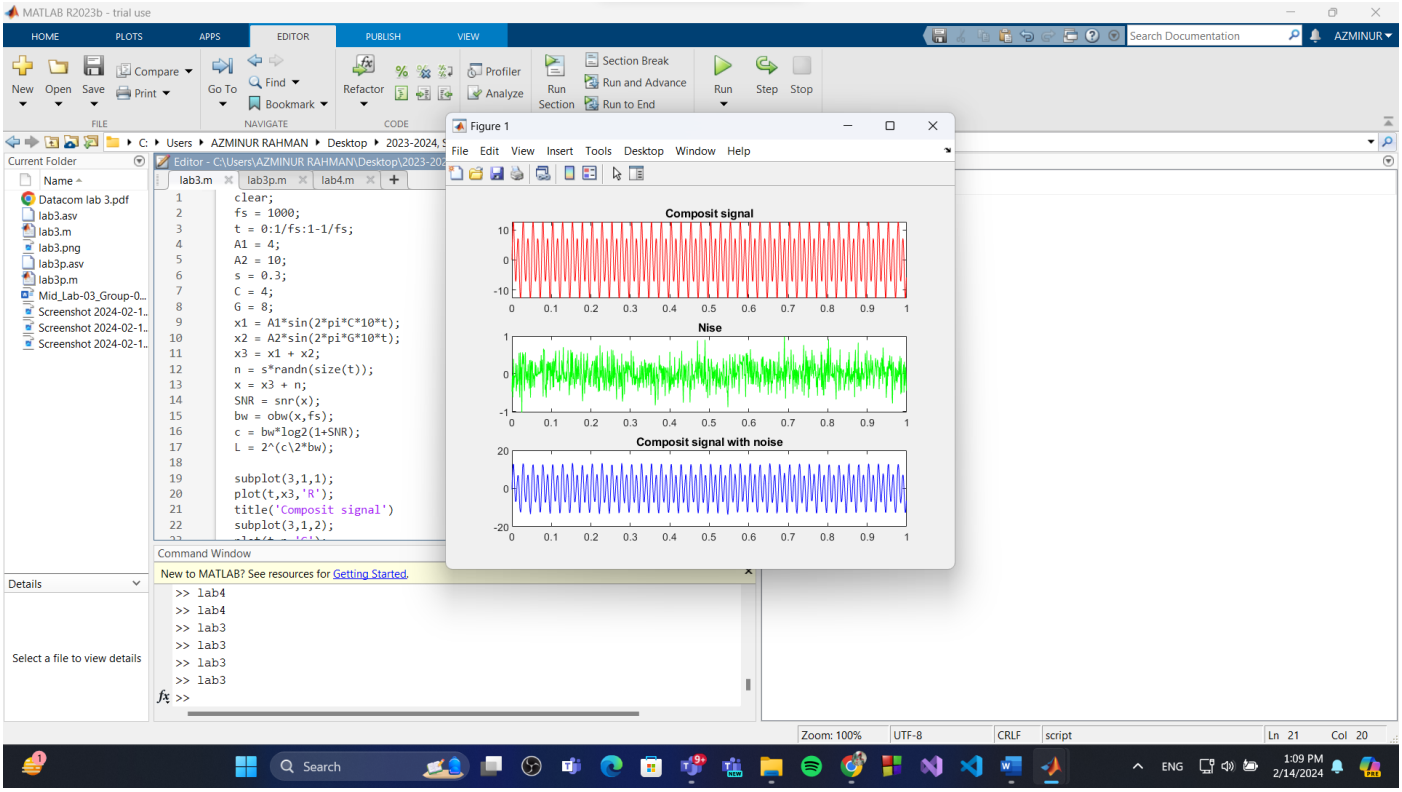

Fig 04: Composite signal, Noise & Composite signal with noise.

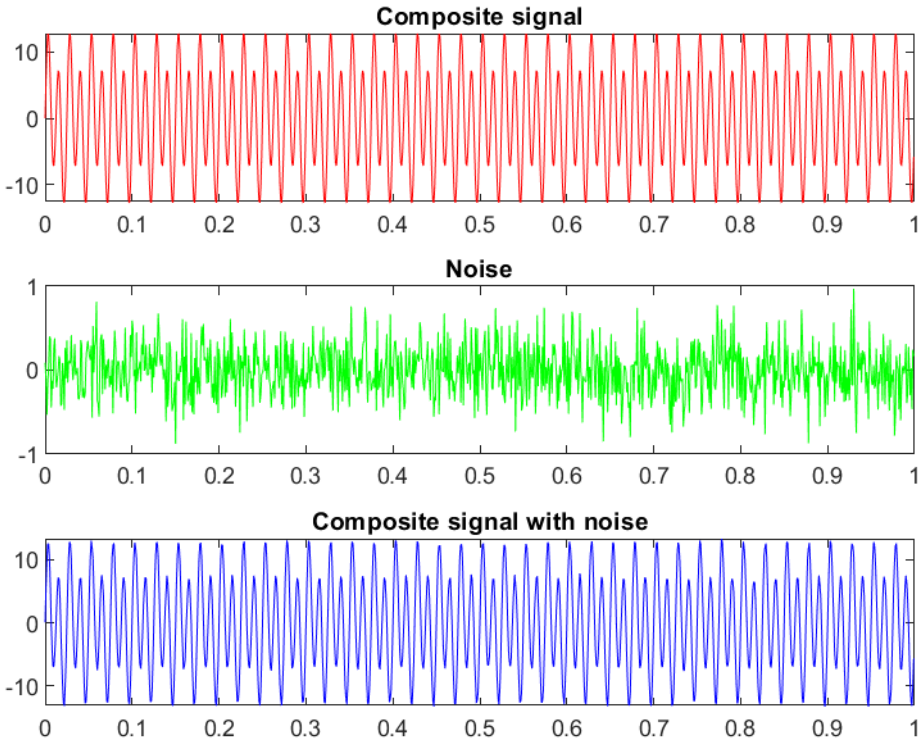

Fig 05: Composite signal, noise & Composite signal with noise.