



AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

**FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING
DATA COMMUNICATION**

Spring 2023-2024

Section: F

Group: 03

Lab: 02

LAB REPORT ON

Study of signal frequency, spectrum, bandwidth, bit rate, quantization using MATLAB.

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Submitted By

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Title: Study of signal frequency, spectrum, bandwidth, bit rate, quantization using MATLAB.

Performance Task:

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

According to the above statement-

$$A = 2$$

$$B = 2$$

$$C = 4$$

$$D = 6$$

$$E = 5$$

$$F = 8$$

$$G = 8$$

$$H = 1$$

$$x_1(t) = A_1 \cos(2\pi(C*10) t)$$

$$x_2(t) = A_2 \cos(2\pi(F*10) t)$$

$$x_3(t) = x_1(t) + x_2(t)$$

(a) $A_1 = G + D = 8 + 6 = 14$

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

(b)

```
fs = 1000;  
t = -0.1:1/fs:0.1;  
C = 4;  
F = 8;  
A1 = 14;  
A2 = 10;
```

```
x1 = A1*cos(2*pi*(C*10)*t);  
x2 = A2*cos(2*pi*(F*10)*t);  
x3 = x1 + x2;
```

```
subplot(3,1,1);  
plot(t,x1)  
xlabel('time (t)');  
ylabel('signal (x1)');  
title('Signal (x1 / t)');
```

```
subplot(3,1,2);  
plot(t,x2)  
xlabel('time (t)');  
ylabel('signal (x2)');  
title('Signal (x2 / t)');
```

```
subplot(3,1,3);  
plot(t,x3)  
xlabel('time (t)');  
ylabel('signal (x3)');  
title('Signal (x3 / t)');
```

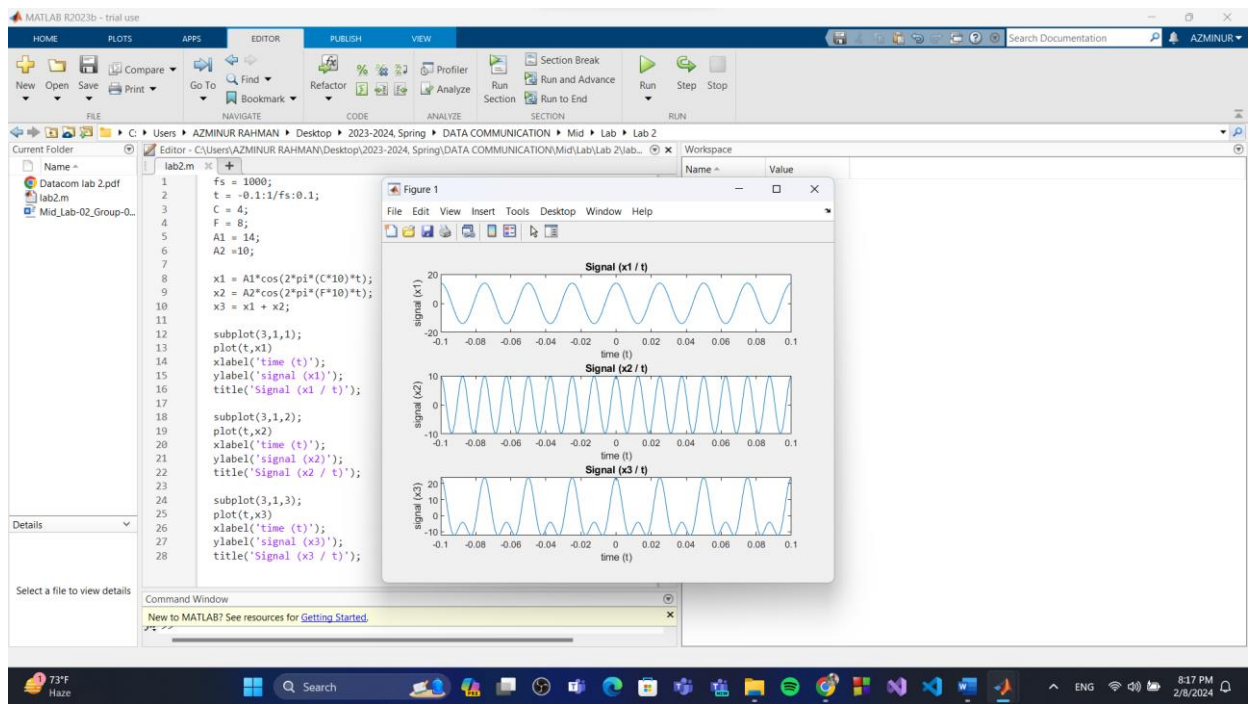


Fig 01: x_1 , x_2 & x_3

(c)

```

fs = 1000;
t = 0:1/fs:1-1/fs;
C = 4;
F = 8;
A1 = 14;
A2 = 10;

```

```

x1 = A1*cos(2*pi*(C*10)*t);
x2 = A2*cos(2*pi*(F*10)*t);
x3 = x1 + x2;

```

```

fx1=fft(x3);
fx1=fftshift(fx1)/(fs/2);
f=fs/2* linspace(-1,1, fs);
plot(f,abs(fx1));
xlabel('Frequency');
ylabel('Amplitude in volts');
title ('Magnitude FFT of cos');

```

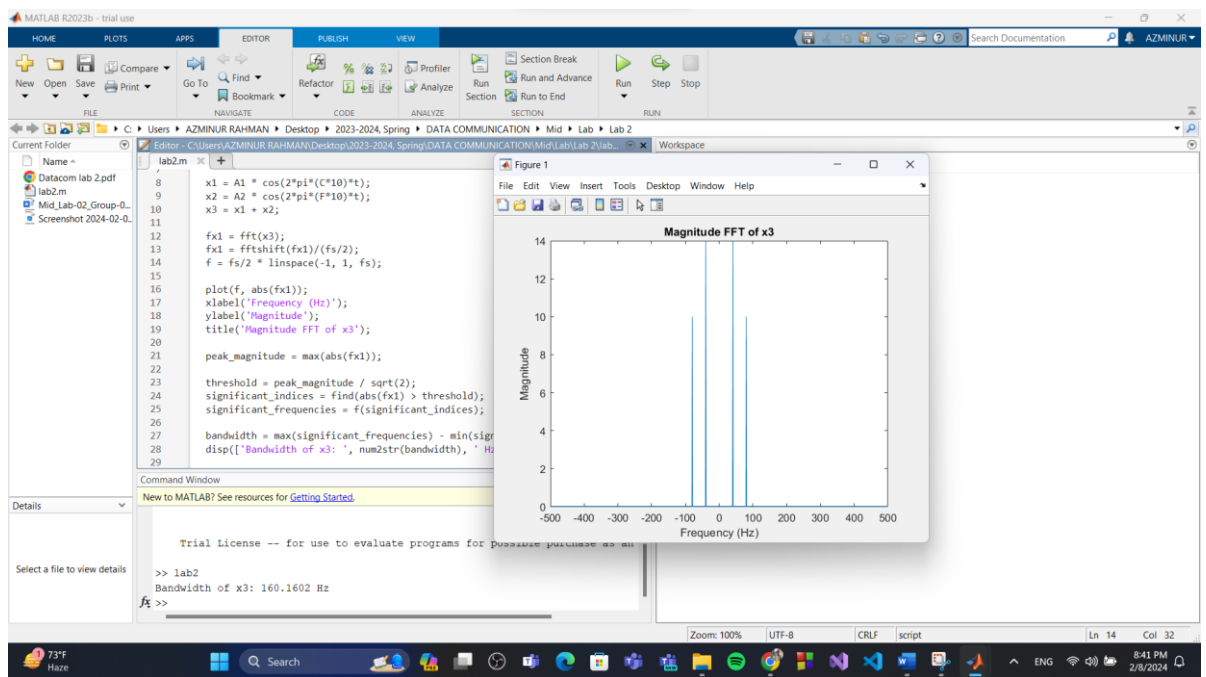


Fig 03: x_1 & x_2

Bandwidth of x_3 : 160.1602 Hz

(d)

```

fs = 1000;
t = 0:1/fs:1-1/fs;
C = 4;
F = 8;
A1 = 14;
A2 = 10;

x1 = A1 * cos(2*pi*(C*10)*t);
x2 = A2 * cos(2*pi*(F*10)*t);
x3 = x1 + x2;

num_levels = 6;
quantized_x3 = quantiz(x3, linspace(min(x3), max(x3), num_levels));

figure;
plot(t, x3, 'b', t, quantized_x3, 'r');
xlabel('Time');
ylabel('Amplitude');
title('Original Signal (blue) vs Quantized Signal (red)');
legend('Original Signal', 'Quantized Signal');

xlim([0, 1/(min(C,F))]);

```

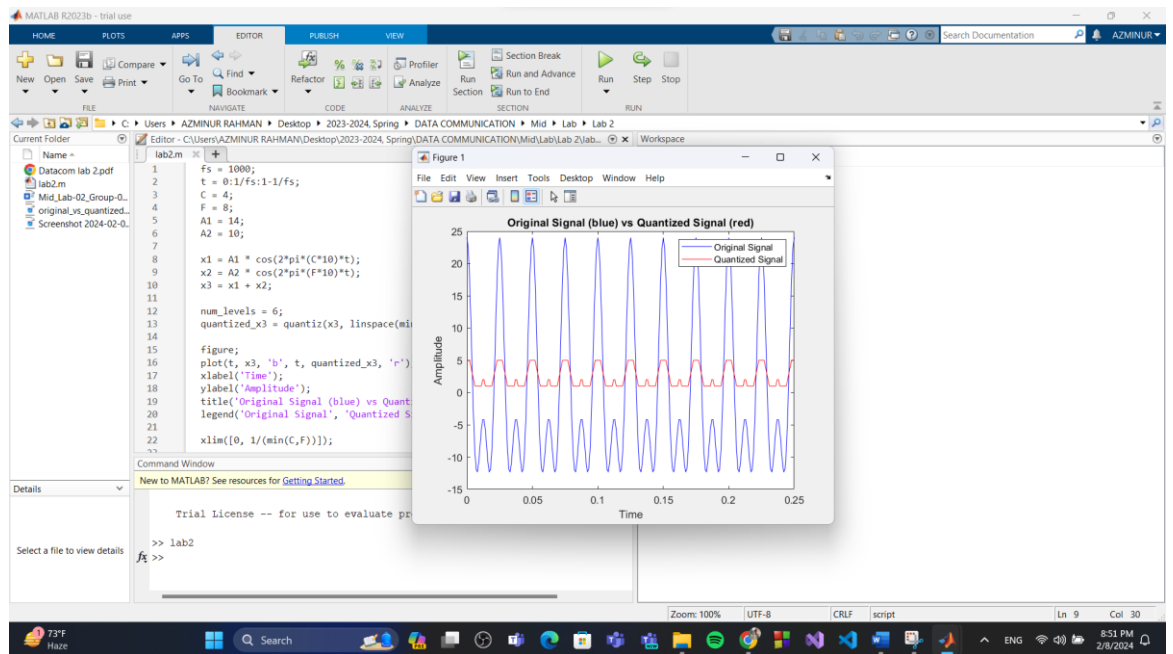


Fig 04: The original signal and quantized signal.

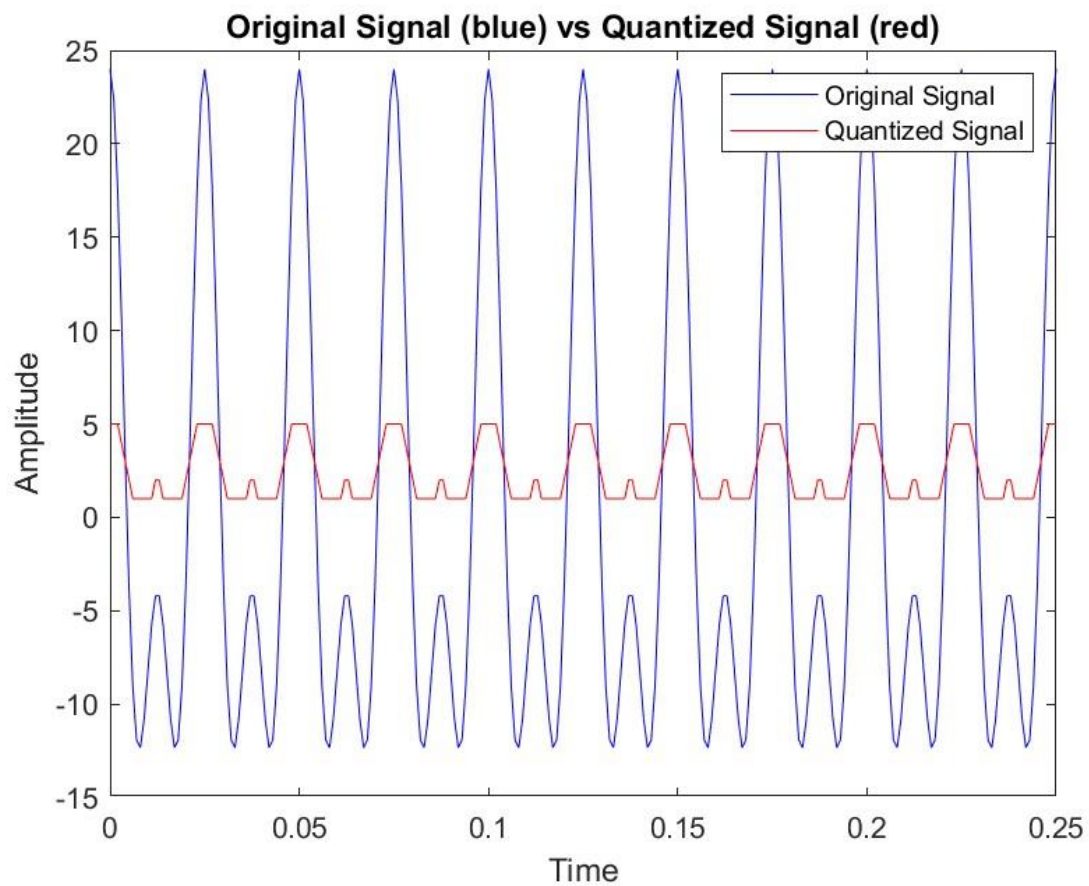


Fig 05: The original signal and quantized signal.