



American International University-Bangladesh (AIUB)

Department of Computer Science

Lab Report-04

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SECTION : **G**

COURSE NAME : DATA COMMUNICATION

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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.

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

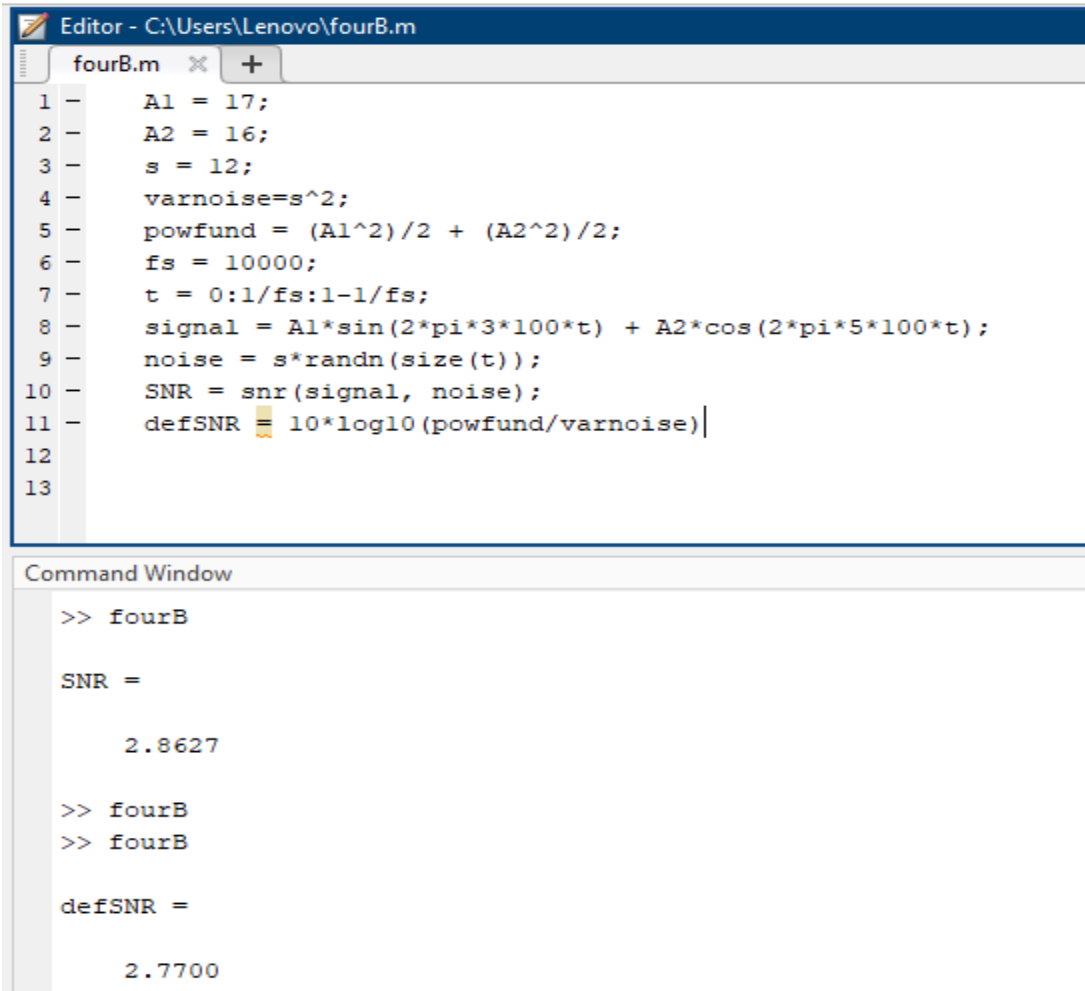
(a) Select the value of the amplitudes as follows: let $A_1 = AB$, $A_2 = AF$ and $s=AH$

$A_1 = AB = 17,$

$A_2 = AF = 16,$

$s = AH = 12.$

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



The image shows a MATLAB Editor window with a script named 'fourB.m' and a Command Window below it. The script defines parameters A1, A2, and s, calculates the power of the signal components, generates a composite signal with noise, and calculates the SNR. The Command Window shows the execution of the script, displaying the calculated SNR values.

```
Editor - C:\Users\Lenovo\fourB.m
fourB.m
1 - A1 = 17;
2 - A2 = 16;
3 - s = 12;
4 - varnoise=s^2;
5 - powfund = (A1^2)/2 + (A2^2)/2;
6 - fs = 10000;
7 - t = 0:1/fs:1-1/fs;
8 - signal = A1*sin(2*pi*3*100*t) + A2*cos(2*pi*5*100*t);
9 - noise = s*randn(size(t));
10 - SNR = snr(signal, noise);
11 - defSNR = 10*log10(powfund/varnoise);
12
13

Command Window
>> fourB

SNR =

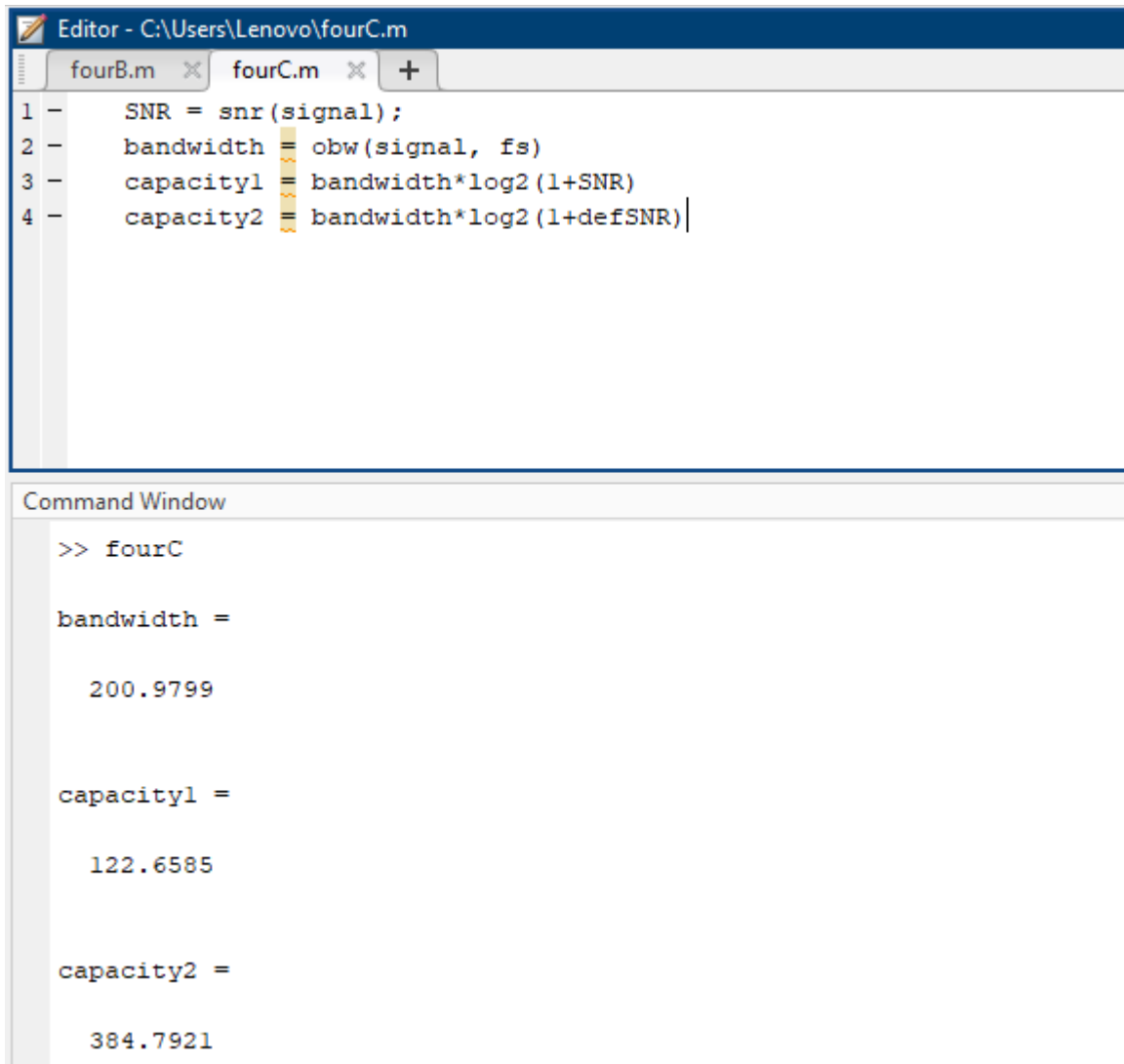
    2.8627

>> fourB
>> fourB

defSNR =

    2.7700
```

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



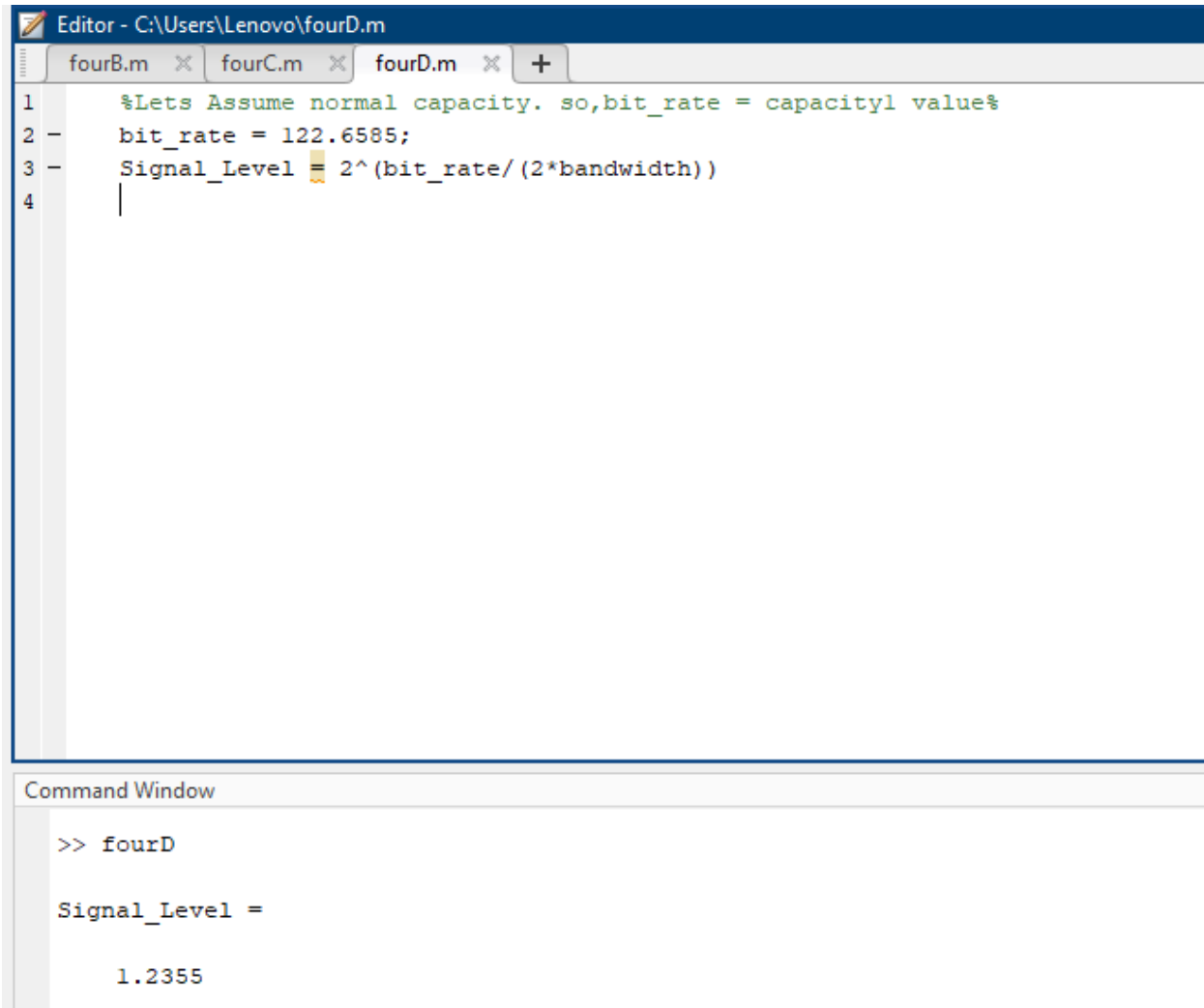
The image shows a MATLAB environment with two windows. The top window is the Editor, titled 'Editor - C:\Users\Lenovo\fourC.m', showing a script with four lines of code. The bottom window is the Command Window, titled 'Command Window', showing the output of the script.

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

The Command Window shows the following output:

```
>> fourC  
  
bandwidth =  
  
    200.9799  
  
capacity1 =  
  
    122.6585  
  
capacity2 =  
  
    384.7921
```

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



The image shows a MATLAB Editor window with three tabs: fourB.m, fourC.m, and fourD.m. The fourD.m tab is active, displaying the following code:

```
1 %Lets Assume normal capacity. so,bit_rate = capacity1 value%
2 - bit_rate = 122.6585;
3 - Signal_Level = 2^(bit_rate/(2*bandwidth))
4 |
```

Below the editor is the Command Window, which shows the execution of the script:

```
>> fourD

Signal_Level =

    1.2355
```