My ID = 17-34465-2
Here,
A=1,B=7,C=3,D=4, E=4, F=6, G=5, H=2
Generate a composite signal using two simple signals as,
X1 = V1 sin(2π(FH*100) t)
= 74 sin (2π(62*100) t)
X2 = V2 sin(2π(BG*100) t)
= 3 sin(2π(75*100) t)
The amplitudes as follows: let **V1 = BD=74, V2 = 3**

(a) Consider gaussian noise with intensity S=AH*0.01 and calculate the SNR value of the composite signal.

Here,**S=AH*0.01=12*0.01= 0.12**

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

labtestA.m | labtestB.m

```
1 -    V1=74;
2 -    V2=3;
3 -    FH=62;
4 -    BG=75;
5 -    AH=12;
6 -    intensity=AH*0.01;
7 -    fs=10000;
8 -    t=0:1/fs:1-1/fs;
9 -    x=V1*sin(2*pi*(FH*100)*t)+V2*sin(2*pi*(BG*100)*t)+intensity*randn(size(t));
10 -   noise=intensity*randn(size(t));
11 -   s_power=(V1^2)/2+(V2^2)/2;
12 -   n_power=intensity^2;
13 -   SNR=snr(x)
14 -   noise=intensity
15 -   defSNR= 10*log10 (s_power/n_power)
```

Command Window

```
SNR =

   27.8499


noise =

    0.1200


defSNR =

   52.7978
```

(b) Find the maximum capacity and what will be the signal level to achieve the data rate?

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

labtestA.m | labtestB.m

```
1 -    bandwidth = obw(x, fs)
2 -    capacity1 = bandwidth*log2(1+SNR)
3 -    capacity2 = bandwidth*log2(1+defSNR)
4      % Asssume bit_rate = capacity1, where capacity1 is normal%
5 -    bit_rate = 4.8076;
6 -    Signal_Level = 2^(bit_rate/(2*bandwidth))
```

Command Window

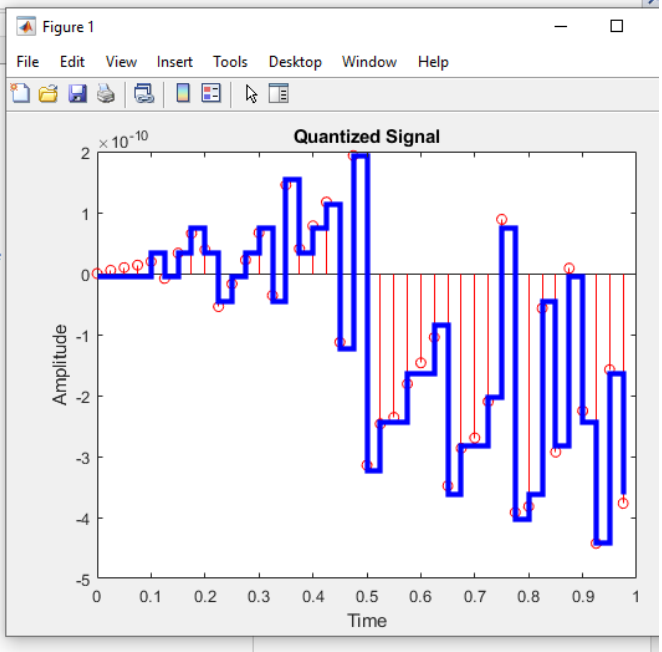
```
>> labtestB

bandwidth =

    0.9916


capacity1 =

    4.8099


capacity2 =

    5.7014


Signal_Level =

    5.3669
```

(c) Show the quantized signal and find the binary code words.

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

labtestA.m | labtestB.m | labtestC.m

```
1 -  V1=74;
2 -  V2=3;
3 -  FH=62;
4 -  BG=75;
5 -  AH=12;
6 -  intensity=AH*0.01;
7 -  fs=40;
8 -  t=0:1/fs:1-1/fs;
9 -  x=V1*sin(2*pi*(FH*100)*t)+V2*sin(2*pi*(BG*100)*t);
10 - n=4;
11 - L=(2^n);
12 - delta=(max(x)-min(x))/L;
13 - delta;
14 - binl=dec2bin(round((x-min(x))/delta),n);
15 - x_qua=min(x)+(round((x-min(x))/delta)).*delta;
16 - figure;
17 - stem(t,x,'R');
18 - hold on;
19 - stairs(t,x_qua,'b','linewidth',3.2);
20 - hold off;
21 - title('Quantized Signal')
22 - xlabel('Time')
23 - ylabel('Amplitude')
24 - binl
```



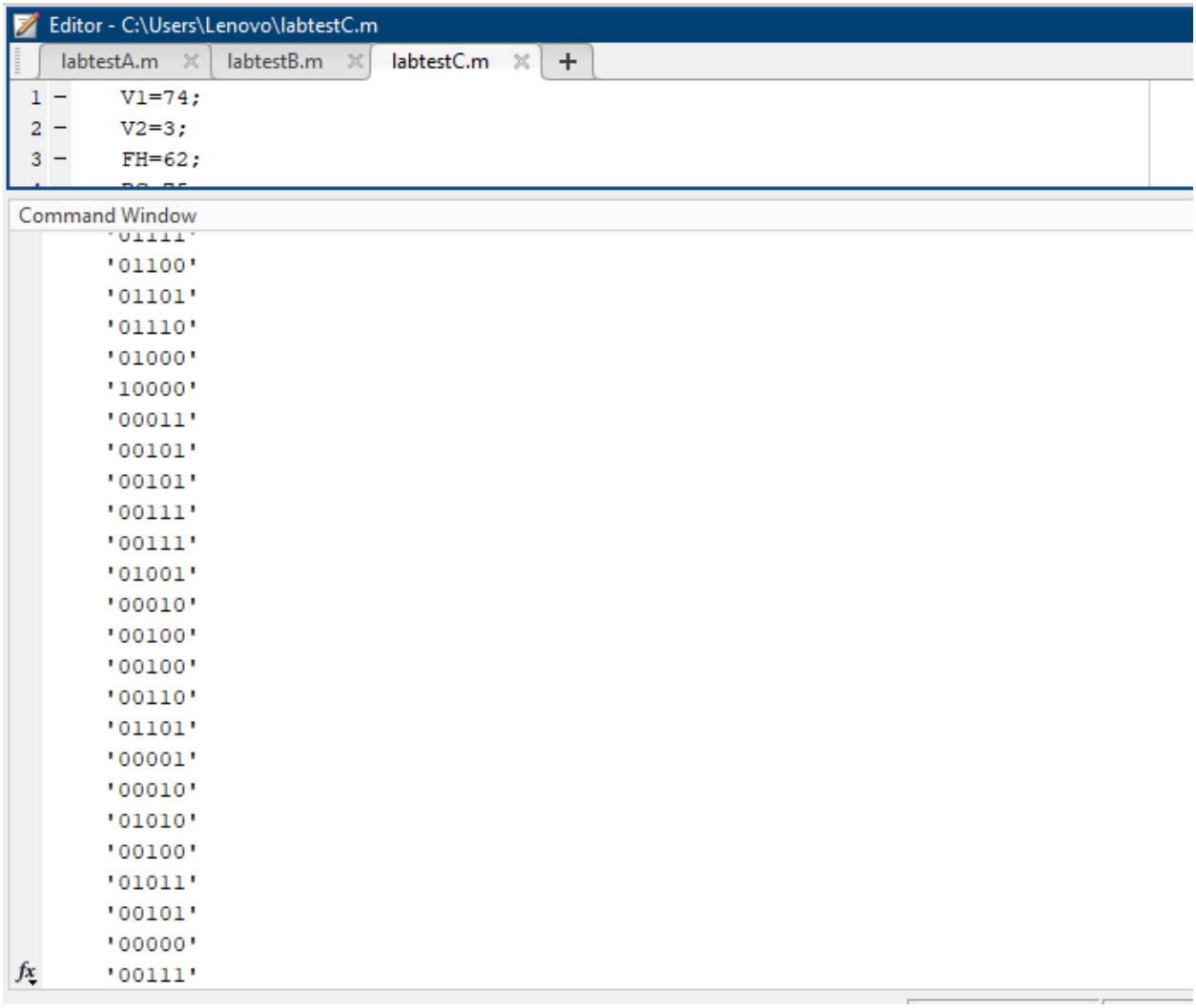
Editor - C:\Users\Lenovo\labtestC.m

labtestA.m | labtestB.m | labtestC.m

```
1 -  V1=74;
2 -  V2=3;
3 -  FH=62;
```

Command Window

```
binl =

  40×5 char array

    '01011'
    '01011'
    '01011'
    '01011'
    '01100'
    '01011'
    '01100'
    '01101'
    '01100'
    '01010'
    '01011'
    '01100'
    '01101'
    '01010'
    '01111'
    '01100'
    '01101'
    '01110'
    '01000'
```


Editor - C:\Users\Lenovo\labtestC.m
labtestA.m
labtestB.m
labtestC.m
1 - V1=74;
2 - V2=3;
3 - FH=62;
Command Window
'01100'
'01101'
'01110'
'01000'
'10000'
'00011'
'00101'
'00101'
'00111'
'00111'
'01001'
'00010'
'00100'
'00100'
'00110'
'01101'
'00001'
'00010'
'01010'
'00100'
'01011'
'00101'
'00000'
'00111'