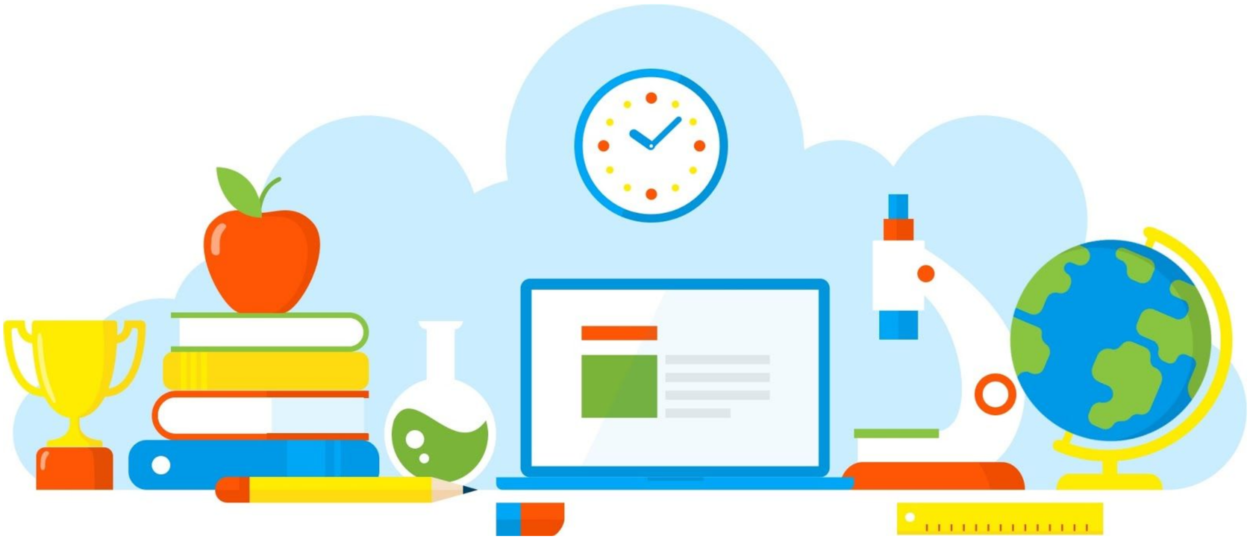
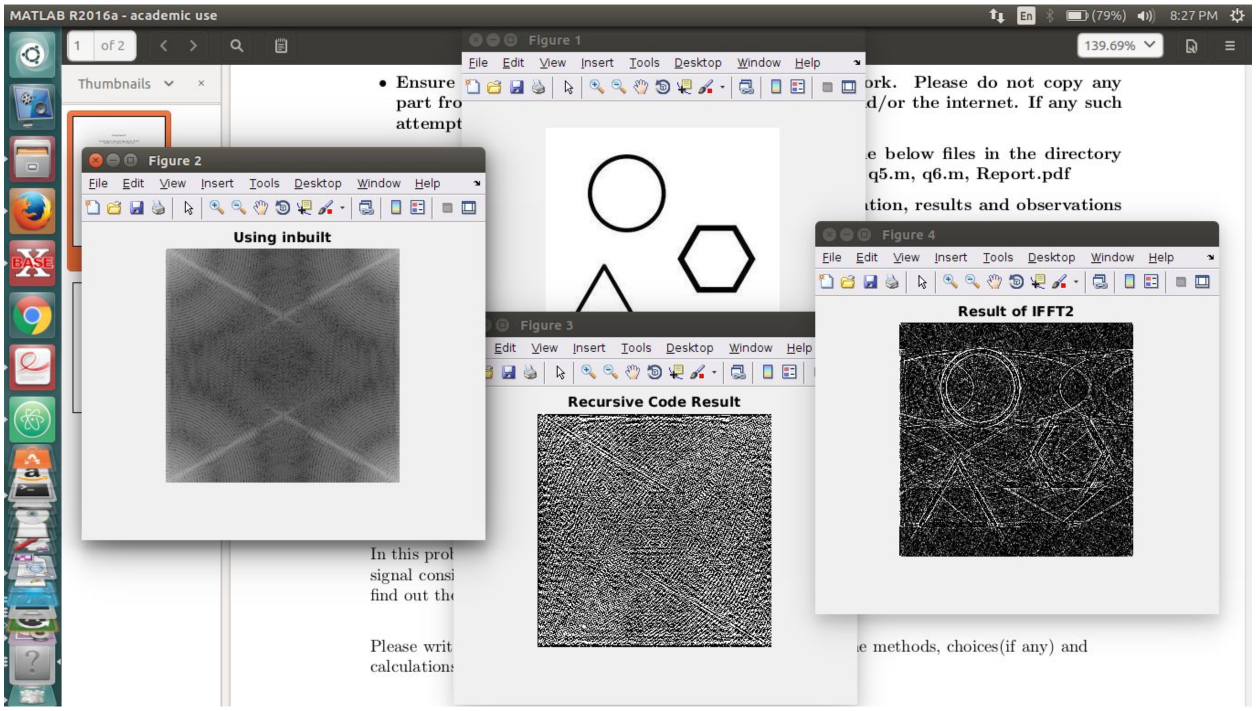


DSAA Assignment 2

Abhishek Nalla

20161115

1. On a 2D black and white image:



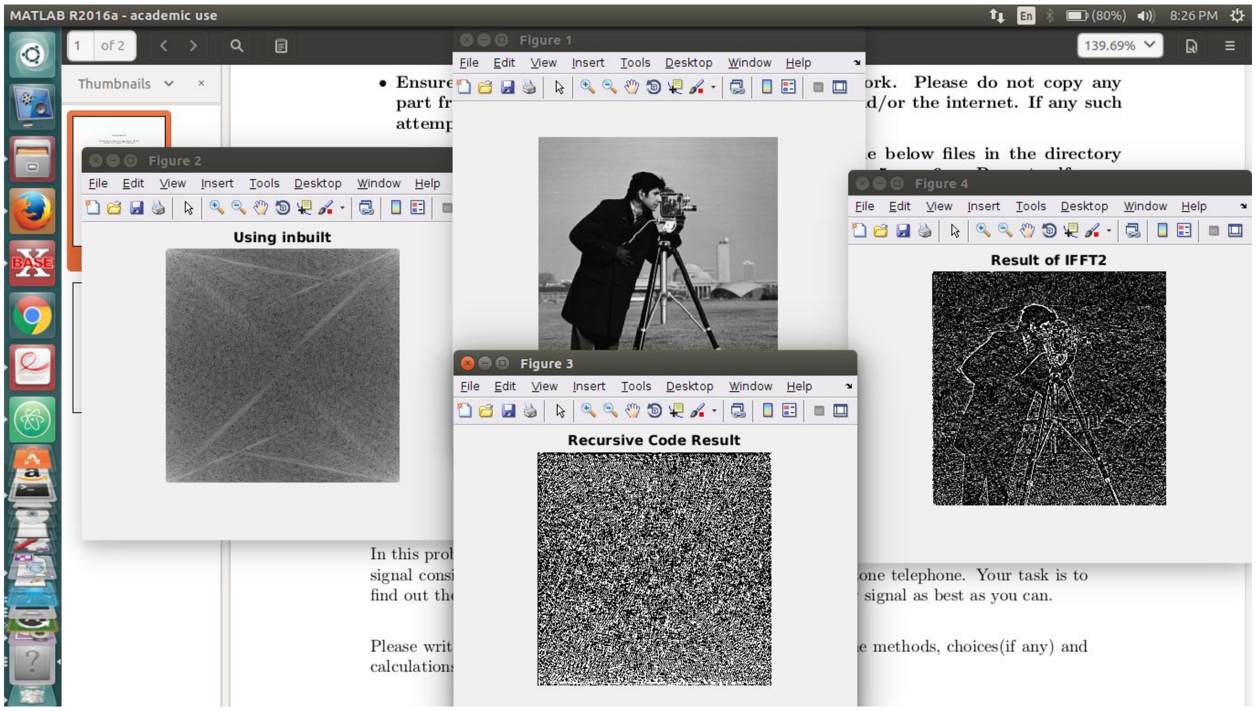
• Ensure … ork. Please do not copy any part fro… d/or the internet. If any such attempt…

…e below files in the directory …q5.m, q6.m, Report.pdf …ation, results and observations

In this prob… signal consi… find out th…

Please writ… …e methods, choices(if any) and calculation…

On ‘cameraman.tif’:



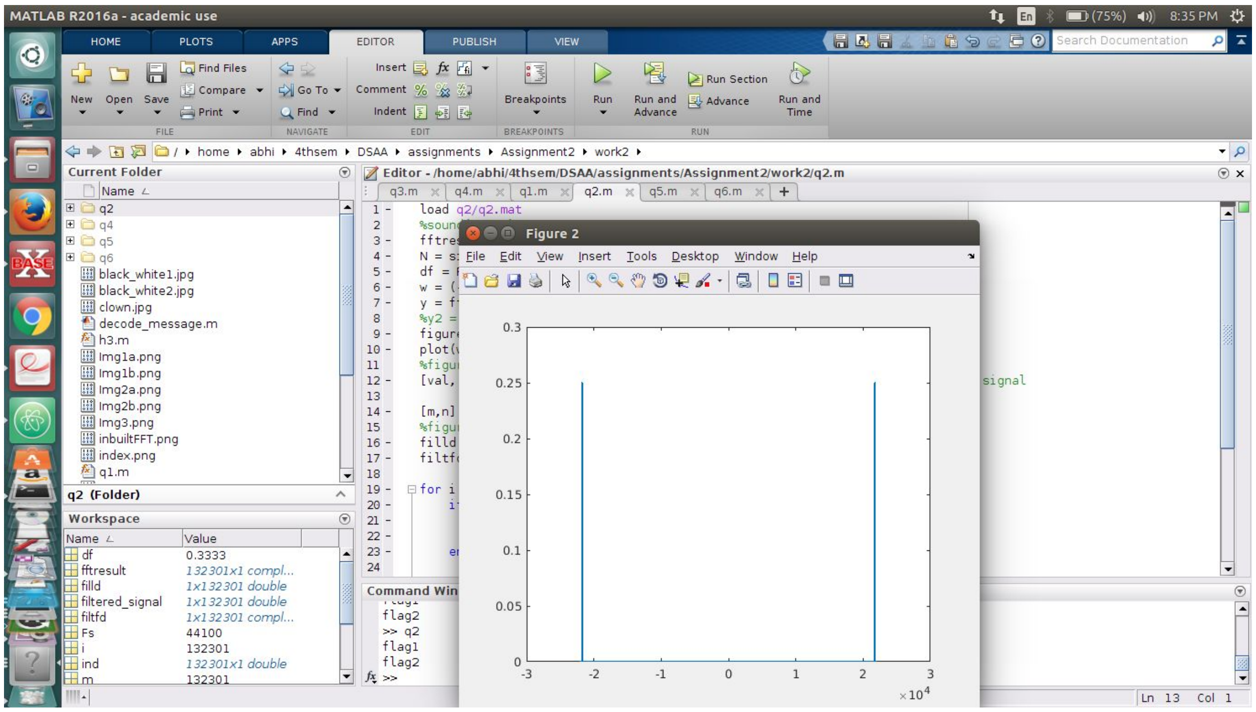
• Ensure … ork. Please do not copy any part fr… d/or the internet. If any such attemp…

…e below files in the directory

In this prob… …one telephone. Your task is to signal consi… …signal as best as you can. find out th…

Please writ… …e methods, choices(if any) and calculation…

2. Frequencies detected:



```
load q2/q2.mat
%sound
fftres
N = s
df = F
w = (
y = f
%y2 =
figure
plot(
%figu
[val,

[m,n]
%figu
filld
filtf

for i
    i


    e
```

Workspace

Name	Value
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	44100
i	132301
ind	132301x1 double
m	132301

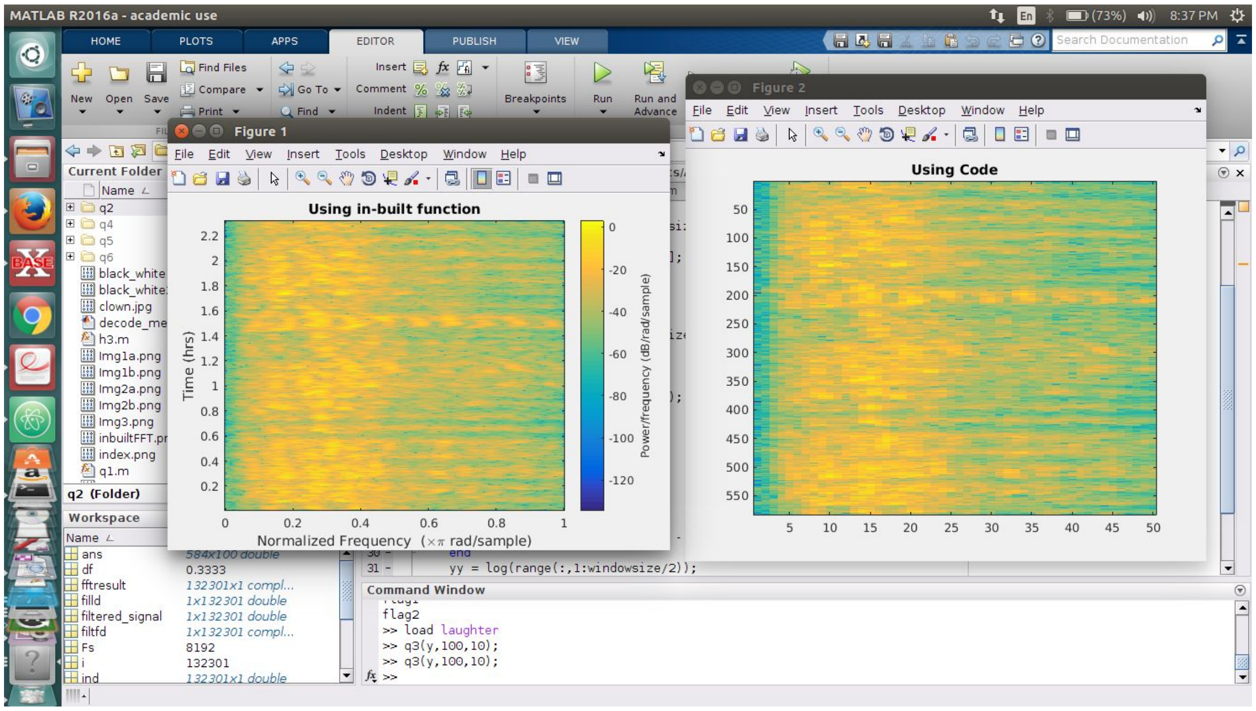
Command Window

```
flag2
>> q2
flag1
flag2
>>
```

A telephone tone has 2 dominant frequencies and other frequencies which are considered noise.

What was done to filter out the noise and to get the frequencies of the sound was to do FFT on the input signal to transfer it to frequency domain and then sort the frequencies according to their amplitudes. Now the two highest frequencies would be located at the end of the array. Then I would take the values of the signals at these final 2 indices and perform IFFT on them to get the signal without noise back to time domain. Then I would play the sound with only these 2 frequencies.

3. On loading laughter:

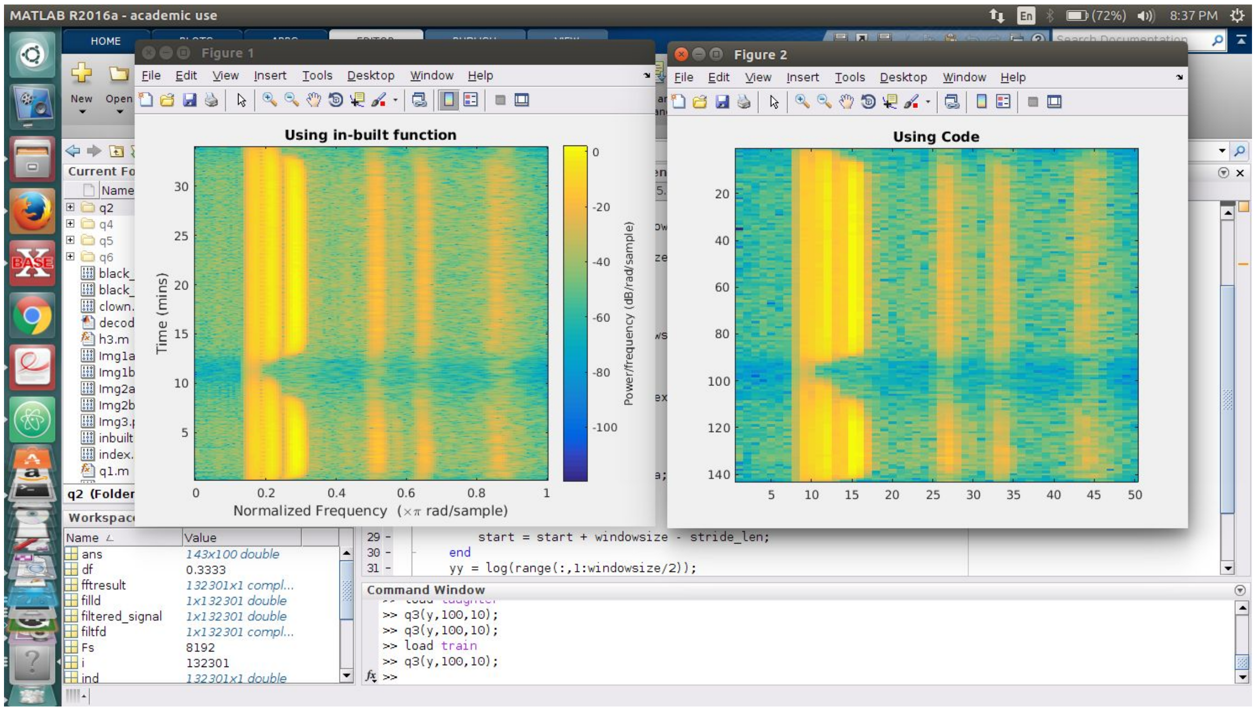


Name	Value
ans	584x100 double
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

```
        end
        yy = log(range(:,1:windowsize/2));
```

```
flag2
>> load laughter
>> q3(y,100,10);
>> q3(y,100,10);
fx >>
```

On loading train:


MATLAB R2016a - academic use
Figure 1
Using in-built function
Time (mins)
Normalized Frequency (×π rad/sample)
Power/frequency (dB/rad/sample)
Figure 2
Using Code
Current Fo
Workspace
Command Window

Name	Value
ans	143x100 double
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

```
            start = start + windowsize - stride_len;
        end
        yy = log(range(:,1:windowsize/2));
```

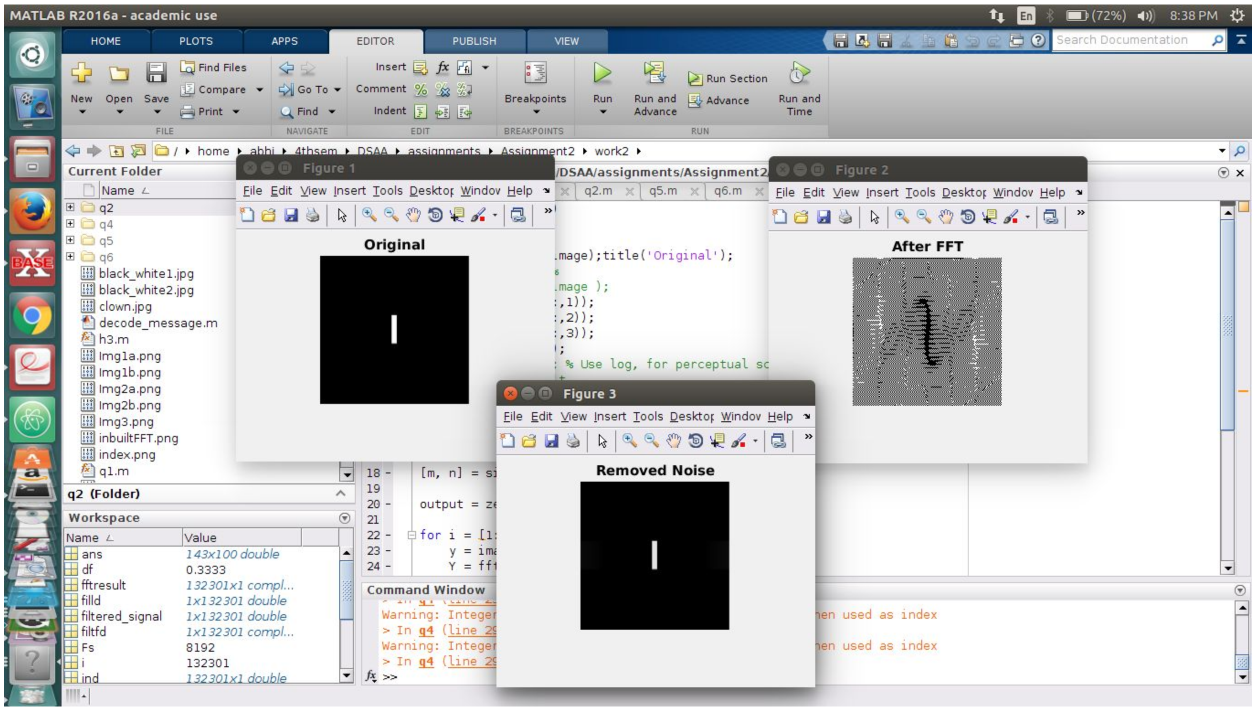
```
>> q3(y,100,10);
>> q3(y,100,10);
>> load train
>> q3(y,100,10);
fx >>
```

The time-frequency resolution of the spectrogram is dependent upon the chosen window size. A larger size will result in higher spectral, but lower temporal resolution, whereas the opposite will result in a lower spectral, but higher temporal resolution. If your application is such that you need time domain information to be more accurate, reduce the size of your windows. If the application demands frequency domain information to be more specific, then increase the size of the windows.

Step size (which is window length minus overlap) controls the horizontal scale of the spectrogram. Decrease it to stretch, or increase it to compress. Increasing step size will reduce time resolution, but decreasing it will not improve it much beyond the limits imposed by the window size (you do gain a little bit, depending on the shape of your window, as the peak of the window slides over peaks in the signal energy). The range 1-5 msec is good for speech.

On comparing the in-built spectrogram and the STFT result it is clear that there is some distortion in the coded one because we are considering each small window and thus compromising on frequency resolution.

4. On running FFT on Img1a.png

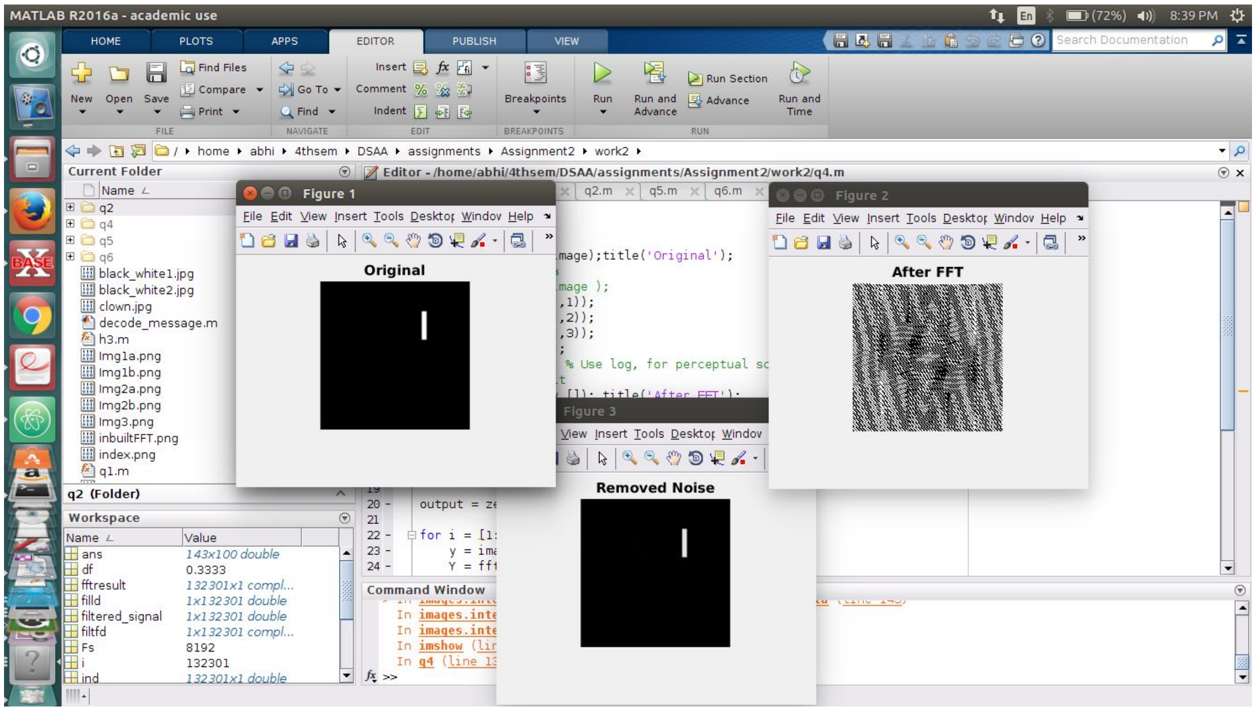


```
.mage);title('Original');
.mage );
:,1));
:,2));
:,3));
;
: % Use log, for perceptual sc

    [m, n] = si

    output = ze

    for i = [1:
        y = ima
        Y = fft
```

Name	Value
ans	143x100 double
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

```
Warning: Integer                 hen used as index
> In q4 (line 29
Warning: Integer                 hen used as index
> In q4 (line 29
fx >>
```

On running FFT on Img1b.png

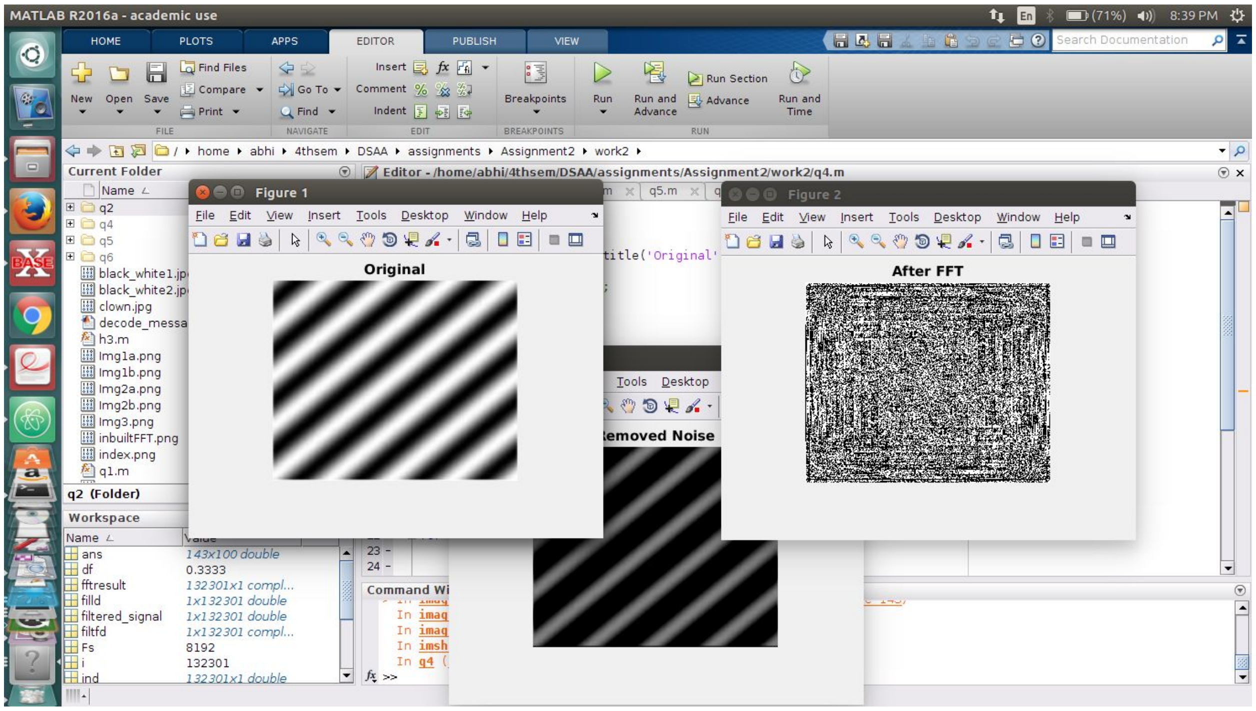

MATLAB R2016a - academic use
Editor - /home/abhi/4thsem/DSAA/assignments/Assignment2/work2/q4.m
Figure 1
Original
Figure 2
After FFT
Figure 3
Removed Noise

```
mage);title('Original');
mage );
,1));
,2));
,3));
;
% Use log, for perceptual sc
[]); title('After FFT');

    output = ze

    for i = [1:
        y = ima
        Y = fft
```

Name	Value
ans	143x100 double
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

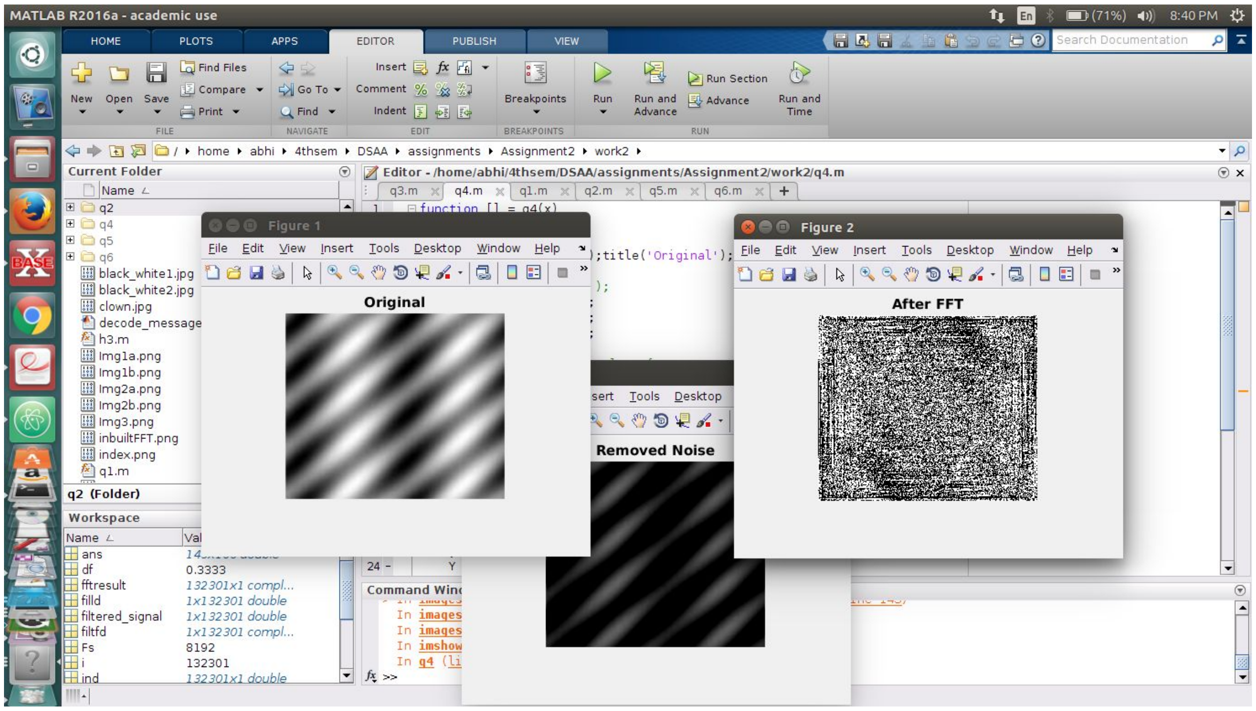
```
In images.inte
In images.inte
In imshow (lin
In q4 (line 13
fx >>
```

On running FFT on Img2a


MATLAB R2016a - academic use
Figure 1
Original
Figure 2
After FFT
Removed Noise
Editor - /home/abhi/4thsem/DSAA/assignments/Assignment2/work2/q4.m

Name	Value
ans	143x100 double
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

On running FFT on Img2b

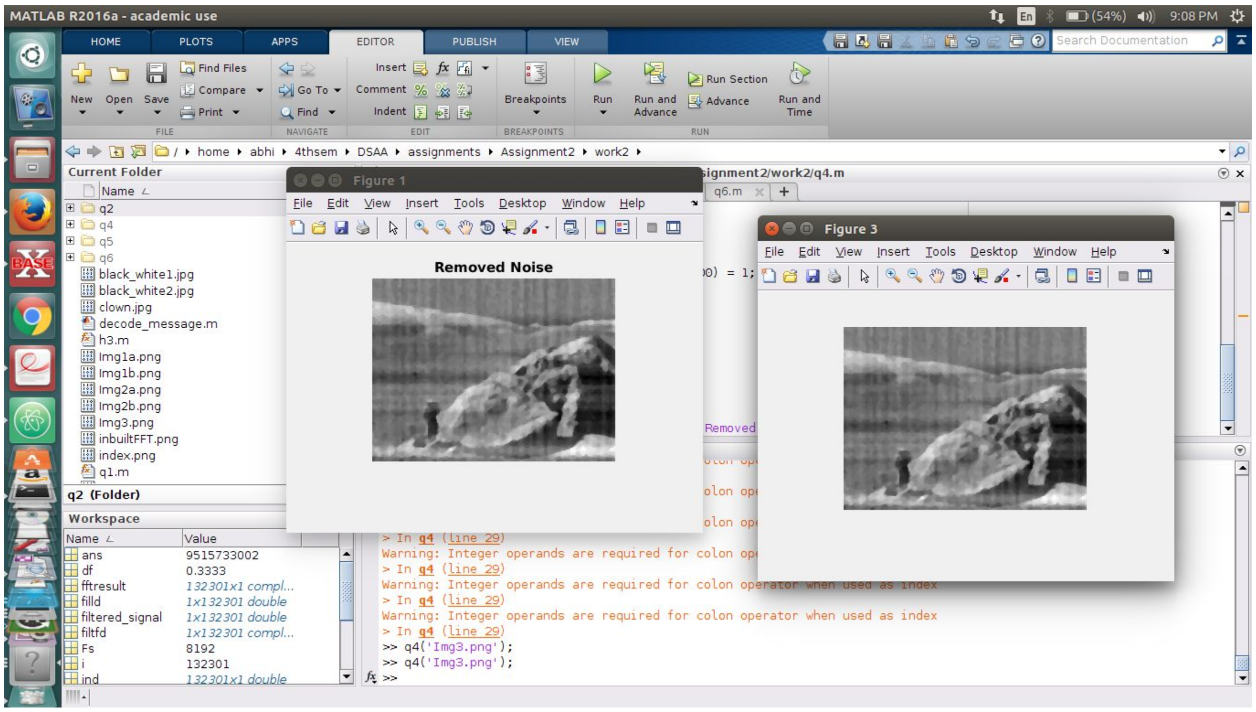

MATLAB R2016a - academic use
Figure 1
Original
Figure 2
After FFT
Removed Noise
Editor - /home/abhi/4thsem/DSAA/assignments/Assignment2/work2/q4.m

Name	Value
ans	[illegible]
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

It is clear from doing FFT over the images that the Frequency outputs depend on the position of various frequencies on the image.

Noise can be removed from the images by converting it to Frequency domain, multiplying it with a rect function(point to point) and taking the IFFT of the resultant output. This guarantees smoothening of frequencies over the entire range. The sharp frequencies are preserved while the rest are smoothened by the rect filter.

On removing noise from Img3


MATLAB R2016a - academic use
HOME
PLOTS
APPS
EDITOR
PUBLISH
VIEW
Figure 1
Removed Noise
Figure 3
File Edit View Insert Tools Desktop Window Help

/ home abhi 4thsem DSAA assignments Assignment2 work2

Current Folder

- q2
- q4
- q5
- q6
- black_white1.jpg
- black_white2.jpg
- clown.jpg
- decode_message.m
- h3.m
- Img1a.png
- Img1b.png
- Img2a.png
- Img2b.png
- Img3.png
- inbuiltFFT.png
- index.png
- q1.m

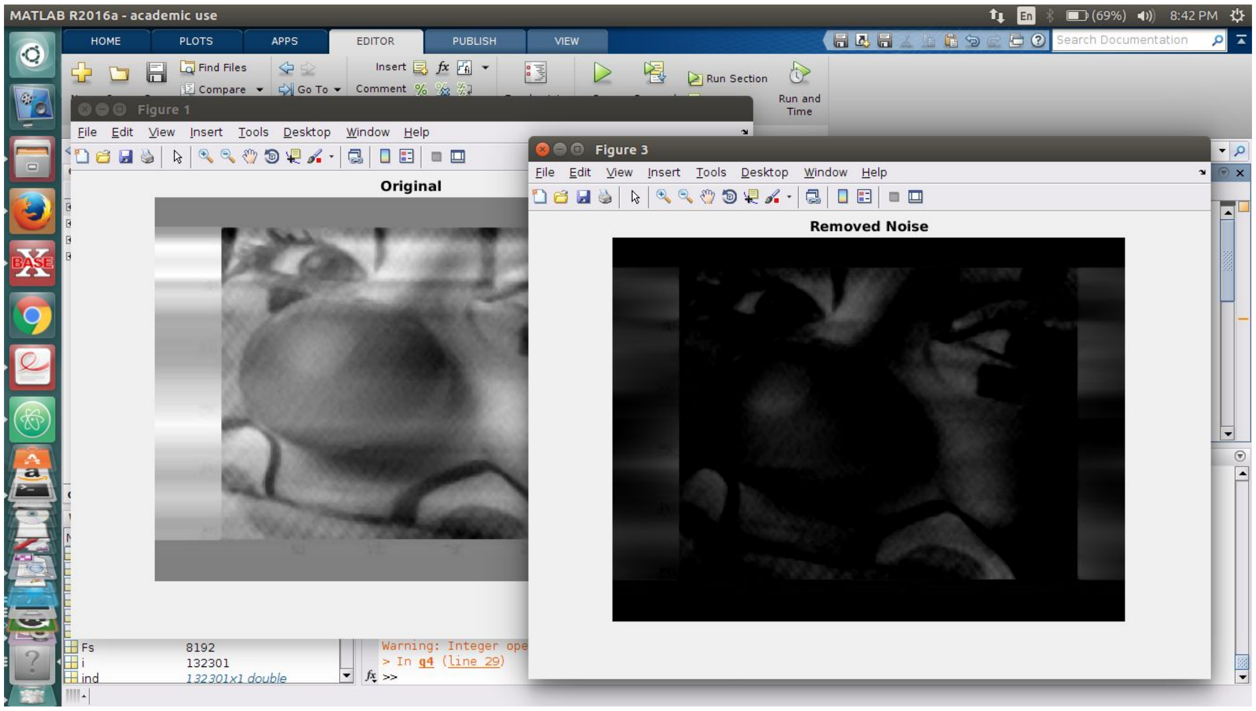
q2 (Folder)

Workspace

Name	Value
ans	9515733002
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

```
> In q4 (line 29)
Warning: Integer operands are required for colon ope
> In q4 (line 29)
Warning: Integer operands are required for colon operator when used as index
> In q4 (line 29)
Warning: Integer operands are required for colon operator when used as index
> In q4 (line 29)
>> q4('Img3.png');
>> q4('Img3.png');
>>
```

On removing noise from clown

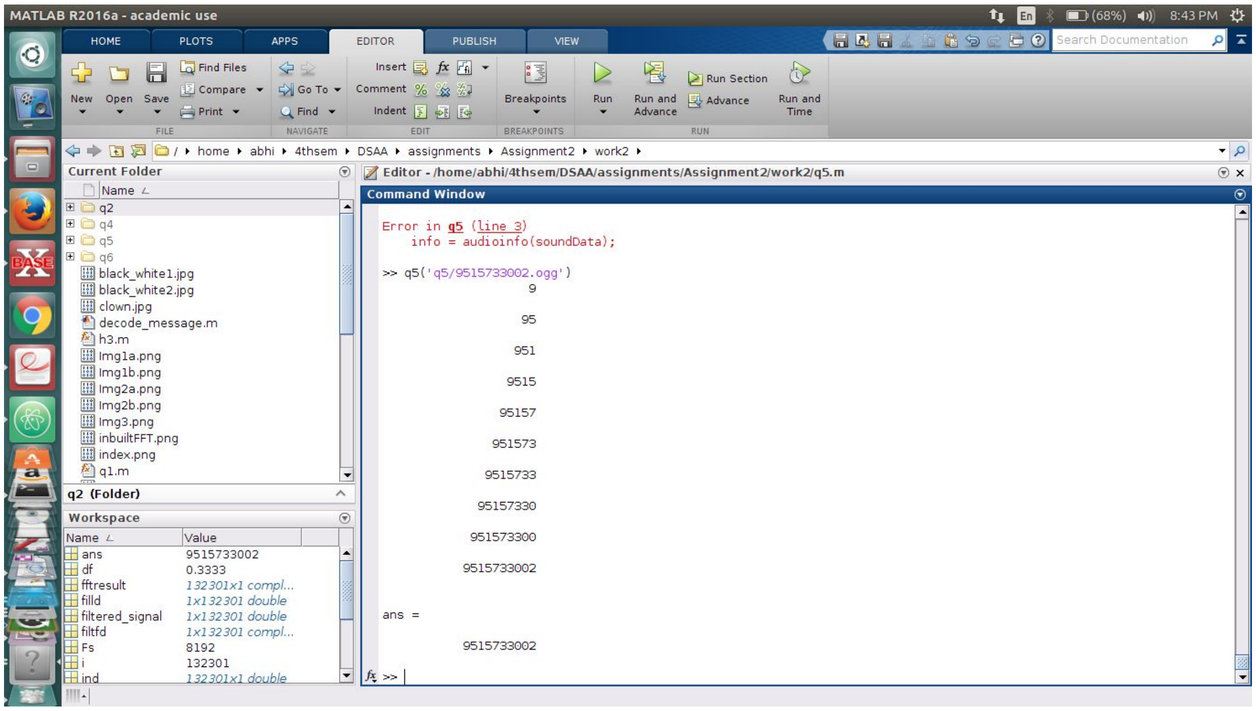


```
Fs          8192
i           132301
ind         132301x1 double
```

```
Warning: Integer ope
> In q4 (line 29)
>>
```

5. Finding the number dialled:

I compare the frequencies dialled with the frequencies of the individual digits and then take a dot product to check which is the most matching over each range.



MATLAB R2016a - academic use

Editor - /home/abhi/4thsem/DSAA/assignments/Assignment2/work2/q5.m

Command Window

```
Error in q5 (line 3)
    info = audioinfo(soundData);

>> q5('q5/9515733002.ogg')
          9

         95

        951

       9515

      95157

     951573

    9515733

   95157330

  951573300

 9515733002


ans =

 9515733002

>> 
```

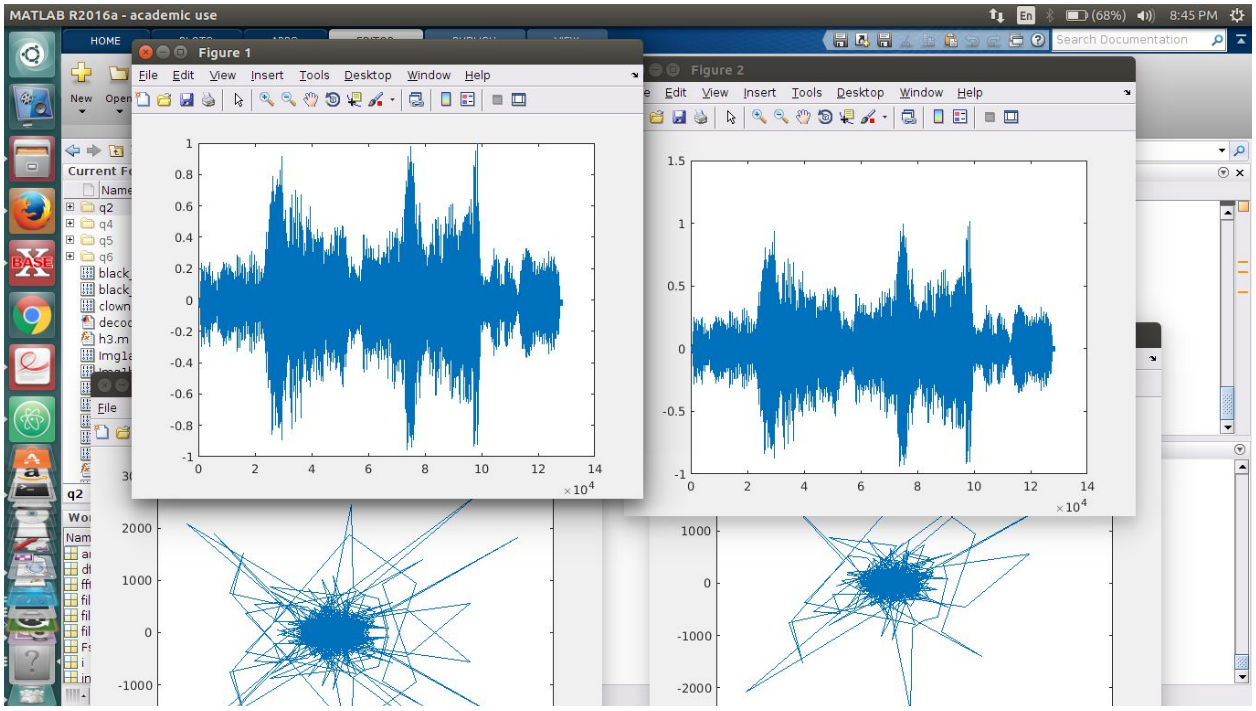
Current Folder

```
q2
q4
q5
q6
black_white1.jpg
black_white2.jpg
clown.jpg
decode_message.m
h3.m
Img1a.png
Img1b.png
Img2a.png
Img2b.png
Img3.png
inbuiltFFT.png
index.png
q1.m
```

Workspace

Name	Value
ans	9515733002
df	0.3333
fftresult	132301x1 compl...
filld	1x132301 double
filtered_signal	1x132301 double
filtfd	1x132301 compl...
Fs	8192
i	132301
ind	132301x1 double

6. Decoding the encrypted sound signal:



MATLAB R2016a - academic use
Figure 1
Figure 2
File Edit View Insert Tools Desktop Window Help
×10^4