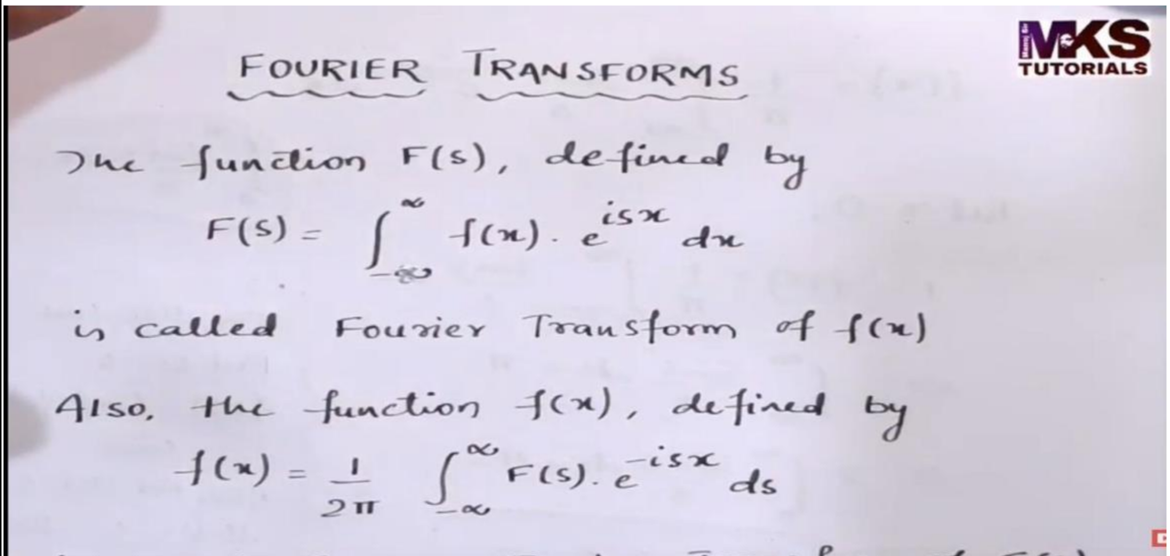
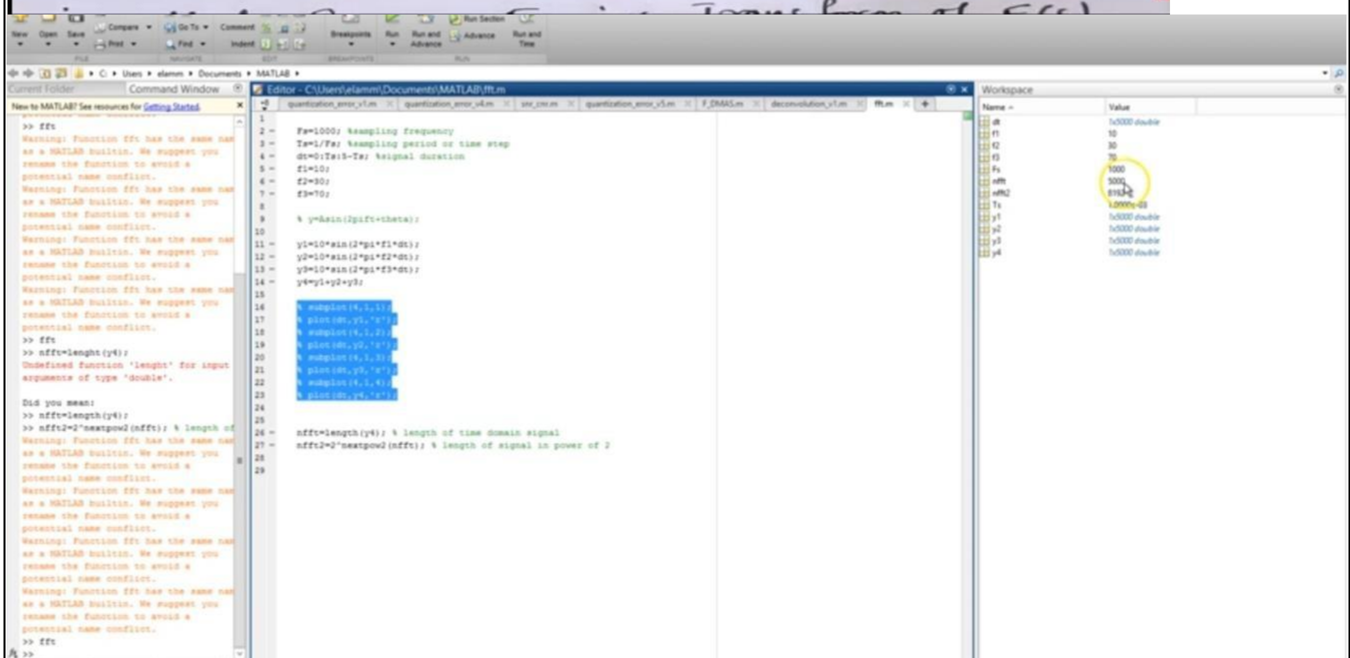
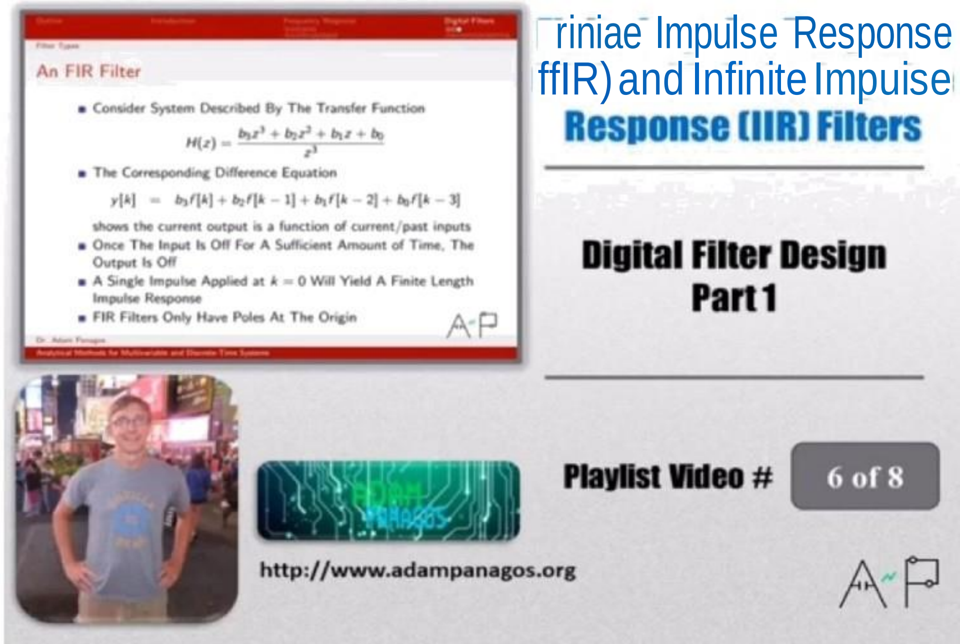
DAILY ASSESSMENT FORMAT

Date:	**May 27 2020**	**Name:**	**Apeksha S Shetty**
Course:	**Digital signal processing**	**USN:**	**4AL16EC006**
Topic:	**Fourier transform**	**Semester & Section:**	**8TH SEM A**
Github Repository:	**Apeksha-97**		

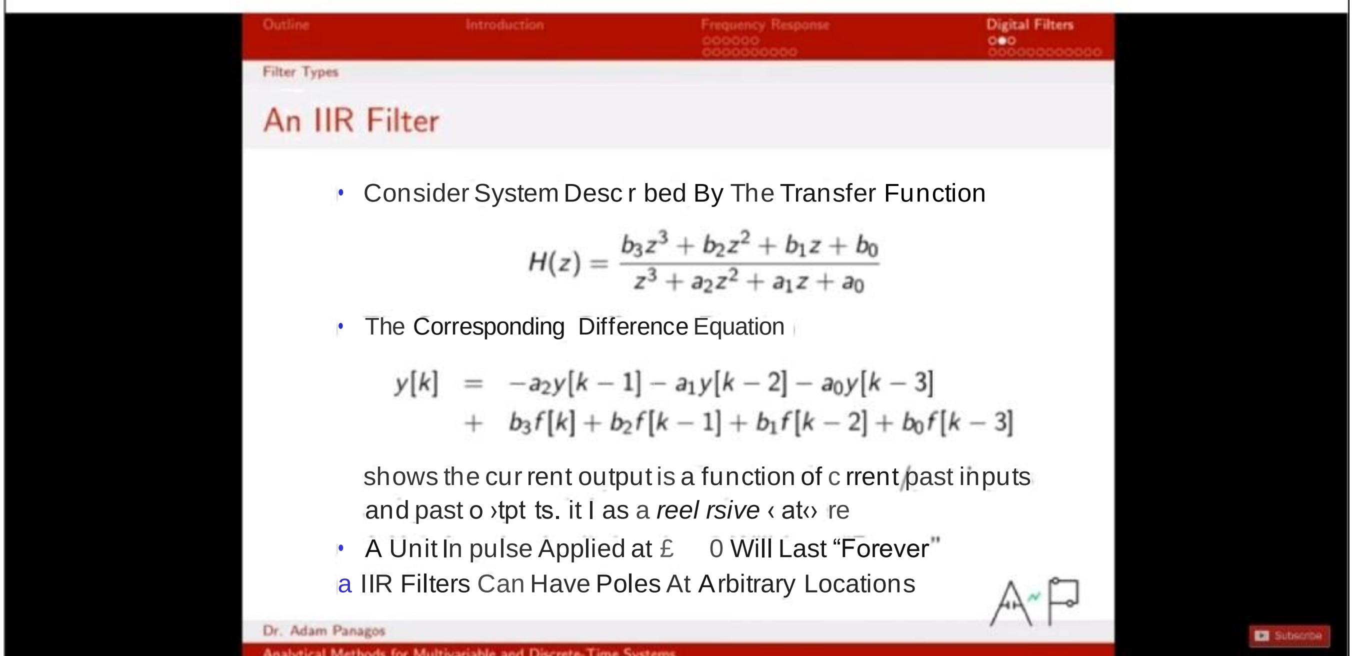
FORENOON SESSION DETAILS
Image of session



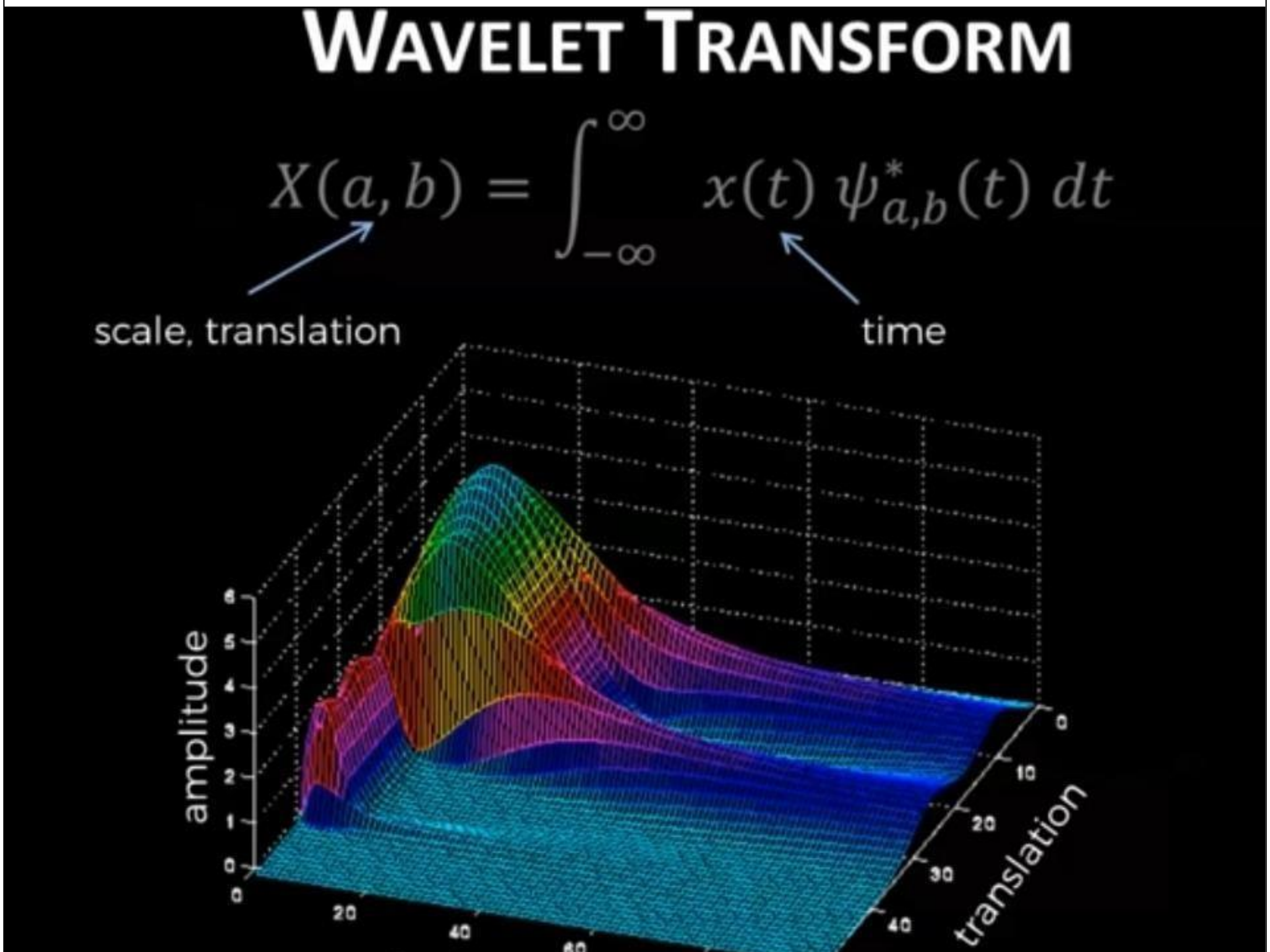




An FIR Filter
Consider System Described By The Transfer Function
$H(z) = \frac{b_3z^3 + b_2z^2 + b_1z + b_0}{z^3}$
The Corresponding Difference Equation
$y[k] = b_3f[k] + b_2f[k-1] + b_1f[k-2] + b_0f[k-3]$
shows the current output is a function of current/past inputs
Once The Input Is Off For A Sufficient Amount of Time, The Output Is Off
A Single Impulse Applied at $k = 0$ Will Yield A Finite Length Impulse Response
FIR Filters Only Have Poles At The Origin
riniae Impulse Response ffIR) and Infinite Impuise
Response (IIR) Filters
Digital Filter Design
Part 1
Playlist Video #
6 of 8
http://www.adampanagos.org



Outline
Introduction
Frequency Response
Digital Filters
Filter Types
An IIR Filter
Consider System Desc r bed By The Transfer Function
$$H(z) = \frac{b_3z^3 + b_2z^2 + b_1z + b_0}{z^3 + a_2z^2 + a_1z + a_0}$$
The Corresponding Difference Equation
$$\begin{aligned} y[k] &= -a_2y[k-1] - a_1y[k-2] - a_0y[k-3] \\ &+ b_3f[k] + b_2f[k-1] + b_1f[k-2] + b_0f[k-3] \end{aligned}$$
shows the cur rent output is a function of c rrent/past inputs and past o ›tpt ts. it I as a *reel rsive* ‹ at‹› re
A Unit In pulse Applied at £ 0 Will Last “Forever”
IIR Filters Can Have Poles At Arbitrary Locations
Dr. Adam Panagos
Analytical Methods for Multivariable and Discrete-Time Systems
Subscribe


WAVELET TRANSFORM
$X(a,b) = \int_{-\infty}^{\infty} x(t)\, \psi^{*}_{a,b}(t)\, dt$
scale, translation
time
amplitude
translation
0
1
2
3
4
5
6
10
20
30
40
60

Reports can be typed or handwritten of upto two pages

Day 8

Day - 8 Digital Signal processing

Fourier transforms

The function $F(s)$, defined by

$$F(s) = \int_{-\infty}^{\infty} f(x) \cdot e^{isx} \cdot dx$$ is called Fourier transform of $f(x)$

Also, the function $f(x)$, defined by

$$f(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(s) \cdot e^{-isx} \cdot ds.$$

is called $\underbrace{\text{Inverse fourier transform of } F(s)}_{\text{Inversion Formula}}$

(1). Find the fourier transform of

$$f(x) = \begin{cases} 1 & , |x| < 1 \\ 0 & , |x| > 1 \end{cases}$$ hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$.

(2) Find the Fourier transform of

$$f(x) = \begin{cases} 1 - x^2 & , |x| \leq 1 \\ 0 & , |x| > 1 \end{cases}$$

FFT → Four Fourier transform

DFT $X_p = \sum_{n=0}^{N-1} x_n \cdot W_N^{np}$ $\quad 0 \leq p \leq N-1$

$$W_N \triangleq e^{-j\frac{2\pi}{N}}$$

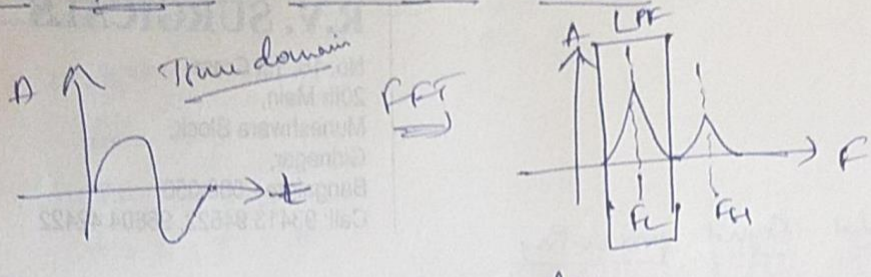
$$X_0 = x_0 e^{-j2\pi(0)(0)/4} + x_1 e^{-j2\pi(1)(0)/4} + x_2 e^{-j2\pi(2)(0)/4} + x_3 e^{-j2\pi(3)(0)/4}$$

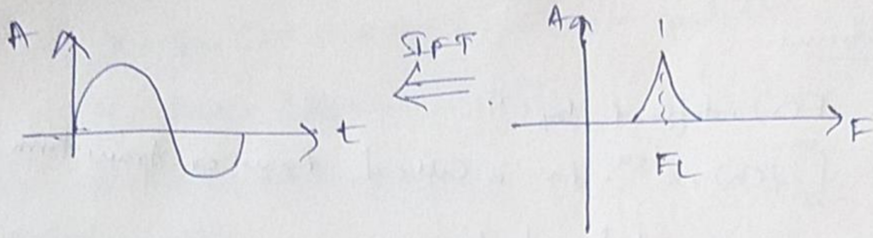
$$X_0 = x_0 + x_1 + x_2 + x_3.$$

$$X_1 = x_0 + x_1 e^{-j2\pi/4} - x_2 + x_3 e^{-j2\pi 3/4}$$

$$X_1 = x_0 + x_1 e^{-j2\pi/4} - x_2 \cancel{4} + x_3.$$

Fast fourier transform Matlab






```
fa = 1000; # Sampling Frequency
Ta = 1/fa; # sampling period or time step.
dt = 0:Ta:2-Ta; # Signal duration.

f1 = 10;
f2 = 30;
f3 = 70;

# y = A sin(2 pi f t + θ);

y1 = 10 * sin(2*pi*f1*dt);
y2 = 10 * sin(2*pi*f2*dt);
y3 = 10 * sin(2*pi*f3*dt);
                              y4 = y1 + y2 + y3;
subplot(3,1,1);
plot(dt, y1, red);
subplot(3,1,2)
plot(dt, y2, red);

subplot(3,1,3)
plot(dt, y3, red);

subplot(4,1,4)
plot(dt, y4, red);
```

```
nfft = length(y4);
      # length of time domain
        Signal

nfft2 = 2 ^ nextpow2(nfft);
      # length of signal in power of
```

Study And Analysis FIR and IIR using FDA tool in matlab.

: filter Design

fs = 500

T = 1/fs;

t = 0 : T : 1-T;

x = sin(2*pi*10*t) + 0.2*randn(size(t));

Y = filter(Num, 1, x);

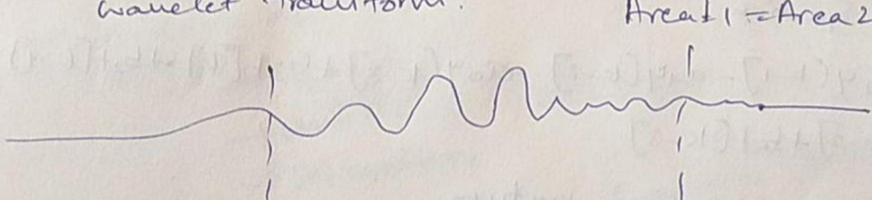
plot(t, x, t, y);

d = LPF

Introduction to WT (wavelets).

→ Fourier transform ⇒ $X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi Ft} \cdot dt$

wavelet transform.



$x(a,b) = \int_{-\infty}^{\infty} x(t) \psi^{*}_{a,b}(t) \cdot dt$

→ translation and Scale.

→ → high-frequency Scale

→ low-frequency Scale

→ Resolution.

→ correlation.

$x(a,b) = \int_{-\infty}^{\infty} x(t) \psi^{*}_{a,b}(t) \, dt$

→ Vanishing moments.

$m_k = \int_{-\infty}^{\infty} f(x) x^k \cdot dx$

→ higher No. of Vanishing moments = more Complex wavelet

... representation of Complex Signal

FIR AND IIR filters

By the transfer function

$$H(z) = \frac{b_3 z^3 + b_2 z^2 + b_1 z + b_0}{z^3}$$

Digital filter classified as Recursive or Non-recursive

Also called IIR & FIR

IIR

$$H(z) = \frac{b_3 z^3 + b_2 z^2 + b_1 z + b_0}{z^3 + a_2 z^2 + a_1 z + a_0}.$$

Difference Equation

$$y(k) = -a_2 y(k-1] - a_1 y[k-2] - a_0 y[k-3] + b_3 f[k] + b_2 f[k-1] + b_1 f[k-2] + b_0 f[k-3]$$

→ It has a recursive nature.

→ A unit impulse applied at $k=0$ will last "forever".

→ IIR filters can have poles at arbitrary locations.

FIR filter

$$H(z) = \frac{b_3 z^3 + b_2 z^2 + b_1 z + b_0}{z^3}.$$

$$y(k] = b_3 f[k] + b_2 f[k-1] + b_1 f[k-2] + b_0 f[k-3]$$

→ Once the input is off for a sufficient amount of time, the o/p is OFF.

→ Single impulse applied at $k=0$ will yield a finite length impulse response.

→ FIR filters only have poles at the origin.

... vanishing moments = longer support.

→ Regularity

→ Selectivity in Frequency

Heisenberg uncertainity.

more selective wavelet = less compact support.

CWT & DWT :-

→ 20-2000 Hz is the range of hearing

Fourier Series.

$$f(t) = \frac{1}{2}a_0 + \sum_{k=1}^{\infty} (a_k \cos 2\pi k t + b_k \sin 2\pi k t)$$

Fourier transform.

$$X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi F t} \, dt$$

Discrete Fourier transform.

Continuous $X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi F t} dt$

~~discrete~~

Continuous wavelet transform $\phi(t)$

$f(t) * \phi[2^k t]$

↳ study of f^n at various resolution.

$$CWT(\tau, S) = \int \langle f(t), \psi\left(\frac{t-\tau}{S}\right) \rangle$$

$$STFT(\quad \langle f(t), g(t-u) e^{j\xi t} \rangle$$

$$\langle (f, g) \rangle = \int f \cdot g^* W$$

IMPLEMENTATION OF SIGNAL FILTERING SIGNAL USING WT IN MATLAB

```
Clear all
[K,FS]audioread("man_voice.wav");
K=k*0.5/RMS(k);
K=awgn(k,2,'measured');
B=wthresh(c,s,0.25);
Y=waverec(b,l,'db');
Y=y*0.5/RMS(y);
Sound(y,FS);
```

SHORT TIME FOURIER TRANSFORM AND THE SPECTOGRAM

-analysis of time varying special characteristics
Speech
Music
Seismology

-increases : bandwidth decreases and impulses response duration increases

WELCH'S METHOD AND WINDOWING

- Power spectrum estimation
- Pwelch(MATLAB) calculates spectral density =multiply by fs/2 to get spectrum
- Example power spectrum estimates in db
  Hammming window
  No overlap(R=L)
  Effect of averaging on variance

ECG SIGNAL ANALYSIS USING MATLAB

- Electrical activity of heart

```
Sig=load('ecg txt');
Plot(Sig)
Xlabel('samples');
Ylabel('electrical activity');
Title ('ecg signal sampled at 100hz ');
Hold on
Plot(sign,'r0');
Edit
```

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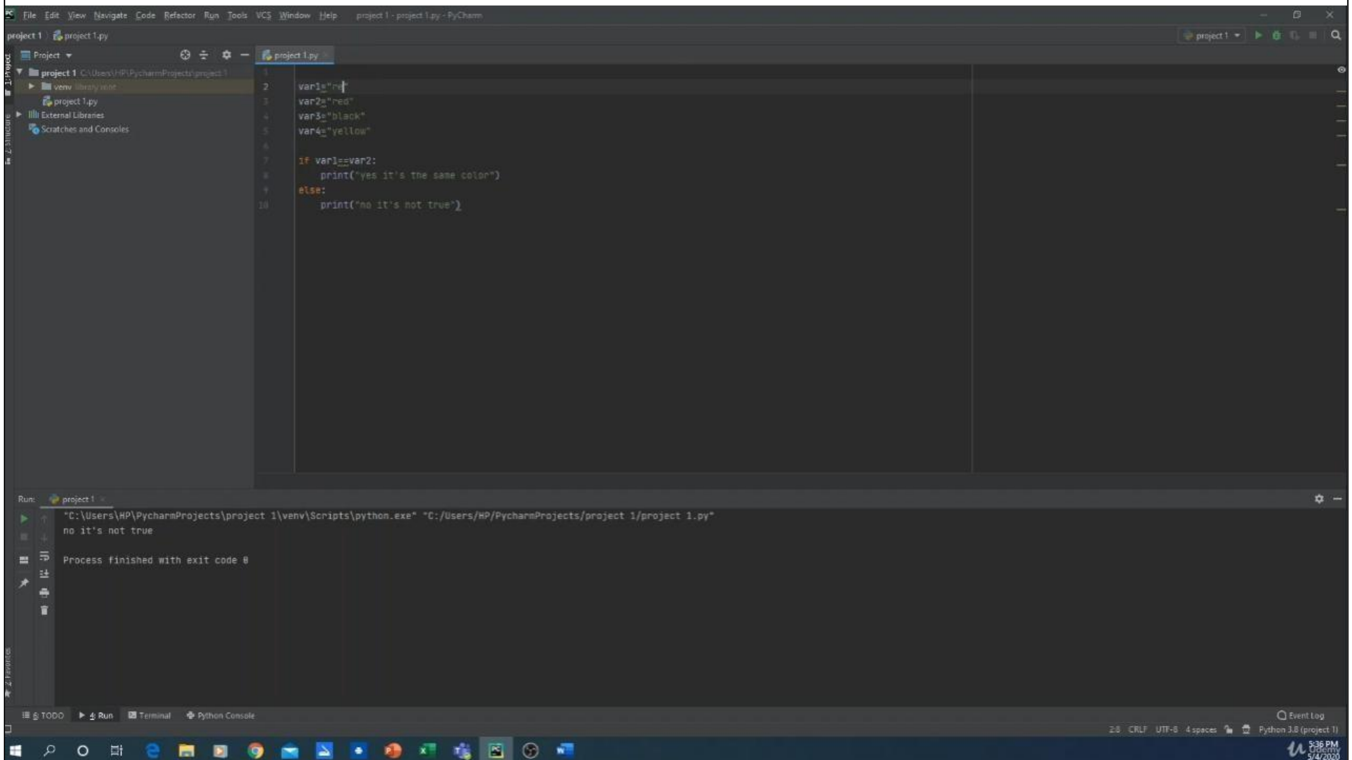
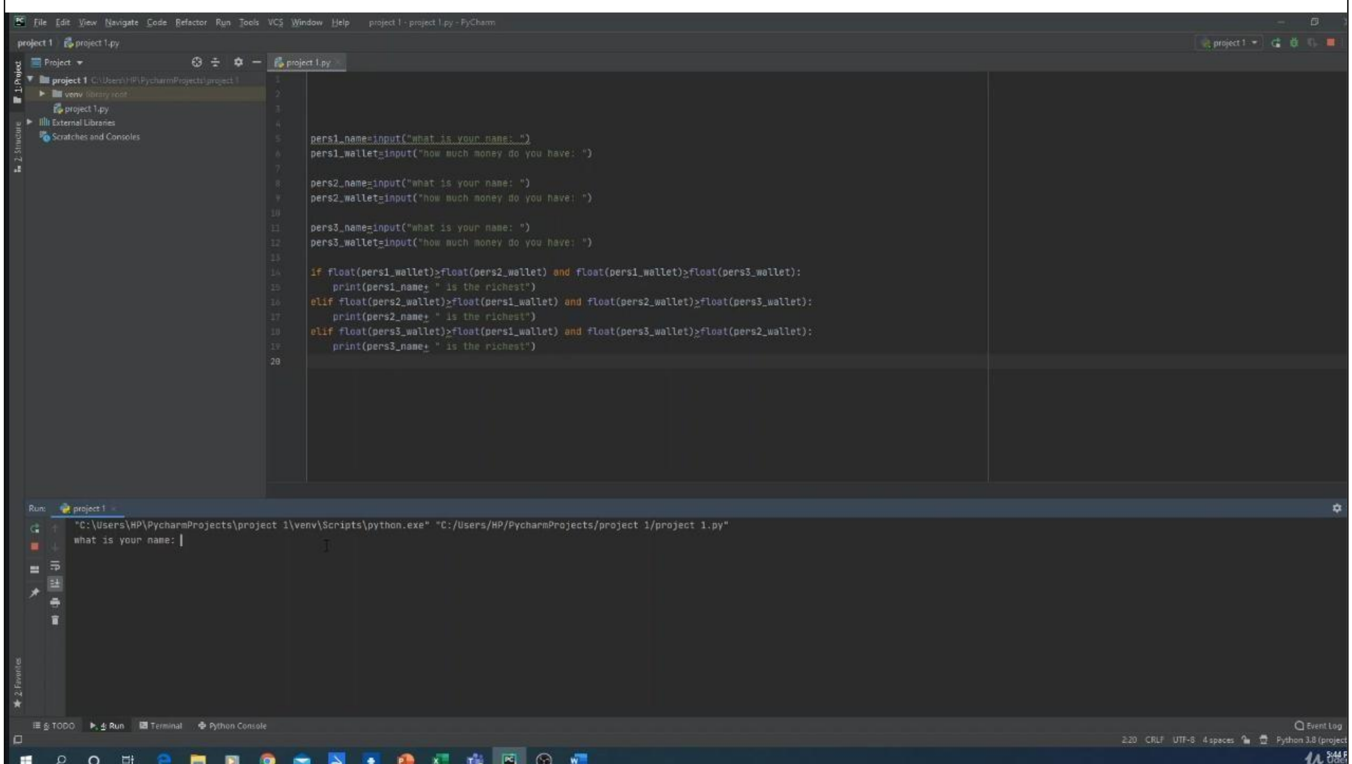
Image


project 1 - project 1.py - PyCharm
project 1.py
var1="re"
var2="red"
var3="black"
var4="yellow"
if var1==var2:
print("yes it's the same color")
else:
print("no it's not true")
Run: project 1
"C:\Users\HP\PycharmProjects\project 1\venv\Scripts\python.exe" "C:/Users/HP/PycharmProjects/project 1/project 1.py"
no it's not true
Process finished with exit code 0


project 1 - project 1.py - PyCharm
project 1.py
pers1_name=input("what is your name: ")
pers1_wallet=input("how much money do you have: ")
pers2_name=input("what is your name: ")
pers2_wallet=input("how much money do you have: ")
pers3_name=input("what is your name: ")
pers3_wallet=input("how much money do you have: ")
if float(pers1_wallet)>float(pers2_wallet) and float(pers1_wallet)>float(pers3_wallet):
print(pers1_name+ " is the richest")
elif float(pers2_wallet)>float(pers1_wallet) and float(pers2_wallet)>float(pers3_wallet):
print(pers2_name+ " is the richest")
elif float(pers3_wallet)>float(pers1_wallet) and float(pers3_wallet)>float(pers2_wallet):
print(pers3_name+ " is the richest")
Run: project 1
"C:\Users\HP\PycharmProjects\project 1\venv\Scripts\python.exe" "C:/Users/HP/PycharmProjects/project 1/project 1.py"
what is your name:

Day8

Report can be typed or handwritten of upto two pages

Use of if statement with numericals

```
Var1="red";
Var2="orange";
Var3="black";
Var4="yellow";

If var1== var2:
    Print("yes it's the same colour ")
Else:
    Print("no it's not true")
```

- **If statement for the decision making**
- **Without the use of the boolean functions**
- **With string to string**

Data manipulation
In variables and in strings

```
Variable_1="apple"
List_1=["apple","banana","ananas","melon"]
List_1[3]="ananas"
List_1[2]="tomato"
Print(list_1)
```