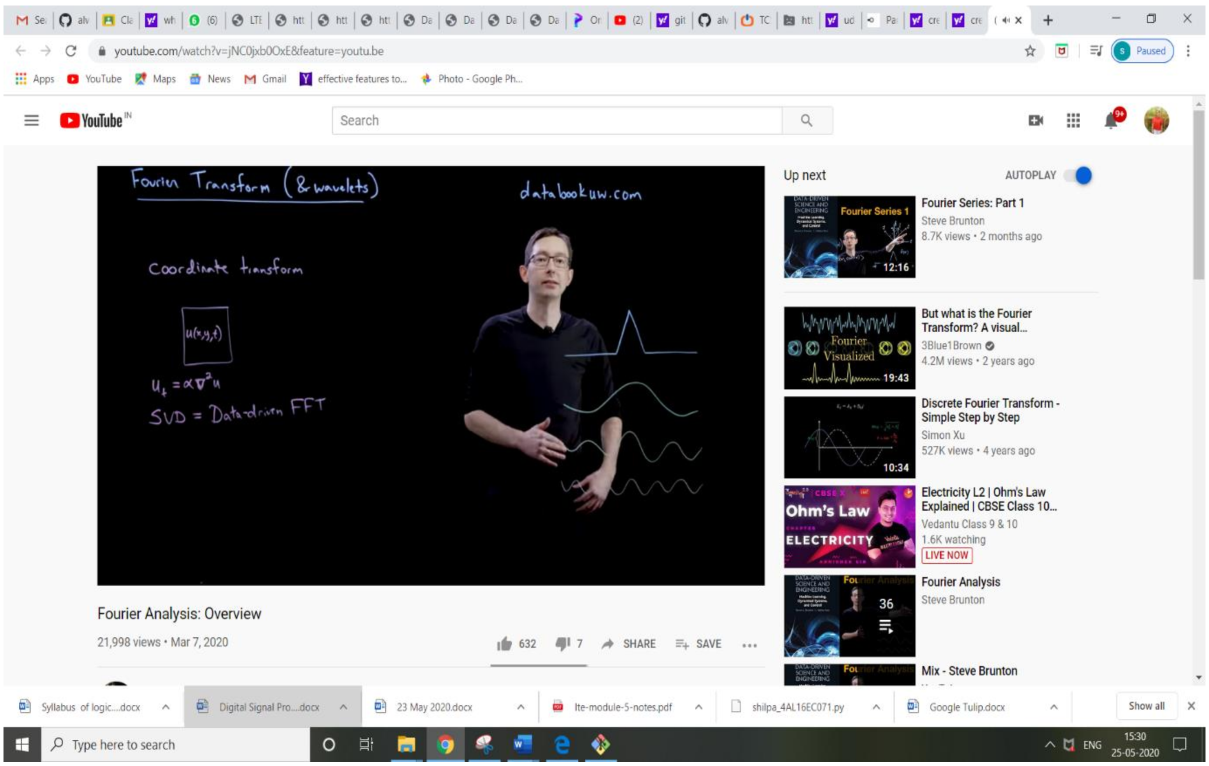
DAILY ASSESSMENT FORMAT

Date:	25/05/2020	Name:	Shilpa N
Course:	DSP	USN:	4AL16EC071
Topic:	DAY 1	Semester & Section:	8 “B”
Github Repository:	Shilpan-test		

FORENOON SESSION DETAILS
Image of session 

Report – Report can be typed or hand written for up to two pages.

Fourier transform and wavelets

FT is a coordinate transformation used in the representation of data in images. Spoke about history of FT. we can take arbitrary function and we can approximate this by some sines of increasingly frequency. Discussed about Laplacian operator, Hilbert spaces. Fast forward two hundred years, and the fast Fourier transform has become the cornerstone of computational mathematics, enabling realtime image and audio compression, global communication networks, modern devices and hardware, numerical physics and engineering at scale, and advanced data analysis. Simply put, the fast Fourier transform has had a more significant and profound role in shaping the modern world than any other algorithm to date.

FFT is used to compute Fourier series on a computer. Modern digital commutation is depending on FFT. Fourier series convert ant component in time to frequency. Thy have discussed it using noise signal. Discussed about basics of DFT. How to expand summation and how to deal with complex coefficients was discussed. How to deal with complex number and how to plot it on a plane was briefed. Solved some examples.

Fourier series- A Fourier series is an expansion of a periodic function $f(x)$ in terms of an infinite sum of sines and cosines. Fourier series make use of the orthogonality relationships of the sine and cosine functions. The computation and study of Fourier series is known as harmonic analysis and is extremely useful as a way to break up an *arbitrary* periodic function into a set of simple terms that can be plugged in, solved individually, and then recombined to obtain the solution to the original problem or an approximation to it to whatever accuracy is desired or practical. How to solve Fourier series was discussed with problem. How to solve complex valued function.

Inner products of functions and vectors

In this section, we will make use of inner products and norms of functions. In particular, we will use the common Hermitian inner product for functions f(x) and g(x) defined for x on a domain x ∈ [a, b]:

$<f(x),g(x)> = \int_a^b f(x)^{-} g(x)dx$ --------------→ (2.1)

where ‾ g denotes the complex conjugate. The inner product of functions may seem strange or unmotivated at first, but this definition becomes clear when we consider the inner product of vectors of data. If we discretize the functions f(x) and g(x) into vectors of data, as in we would like the vector inner product to converge to the function inner product as the sampling resolution is increased. The inner product of the data vectors $f = [f_1\ f_2 \cdots f_n]^T$ and $g =[g_1\ g_2 \cdots g_n]^T$ is
defined by:

$<f,g> = g*f = \sum^n_{k=1} f_k g_k = \sum^n_{k=1} f(xk)\ g(xk)$.-------------------→ (2.2)

The magnitude of this inner product will grow as more data points are added; i.e., as n increases. Thus, we may normalize by Δx = (b−a)/(n−1):

$b-a\ /n-1\ <f,g> = \sum^n_{k=1} f(xk)^{-}\ g(xk)\Delta x$, ---------------------→(2.3)

whichistheRiemannapproximationtothecontinuousfunctioninnerproduct. It is now clear that as we take the limit of n → ∞ (i.e., infinite data resolution, with Δx → 0), the vector inner product converges to the inner product of functions in (2.1).

This inner product also induces a norm on functions, given by

$\|f\|_2 = (<f,f>)^{1/2} = \sqrt{< f, f >} = (\int_a^b f(x)^- f(x)dx)^{1/2}$.-------------------→ (2.4)

The set of all functions with bounded norm define the set of square integrable functions, denoted by L2([a,b]); this is also known as the set of Lebesgue integrable functions. The interval [a,b] may also be chosen to be infinite (e.g., (−∞,∞)), semi-infinite (e.g., [a,∞)), or periodic (e.g., [−π,π)). A fun example of a function in L2([1,∞)) is f(x) = 1/x. The square of f has finite integral from 1 to ∞, although the integral of the function itself diverges. The shape obtained by rotating this function about the x-axis is known as Gabriel's horn, as the volume is finite (related to the integral of f2), while the surface area is infinite (related to the integral of f). As in finite-dimensional vector spaces, the inner product may be used to project a function into an new coordinate system defined by a basis of orthogonal functions. A Fourier series representation of a function f is precisely a projection of this function onto the orthogonal set of sine and cosine functions with integer period on the domain [a,b]. This is the subject of the following sections.

Fourier series

$f(x) = a_0/2 + \sum^{\infty}_{k=1}(a_k \cos(kx) + b_k \sin(kx))$

Thus, the functions ψk = eikx for k ∈ Z (i.e., for integer k) provide a basis for periodic, complex-valued functions on an interval [0,2π). It is simple to see that these functions are orthogonal:

$$\langle \psi_j, \psi_k \rangle = \int_{-\pi}^{\pi} e^{ijx} e^{-ikx} dx = \int_{-\pi}^{\pi} e^{i(j-k)x} dx = \left[\frac{e^{i(j-k)x}}{i(j-k)} \right]_{-\pi}^{\pi} = \begin{cases} 0 & \textbf{if } j \neq k \\ 2\pi & \textbf{if } j = k. \end{cases}$$

$$\begin{aligned} \vec{f} &= \langle \vec{f}, \vec{x} \rangle \frac{\vec{x}}{\|\vec{x}\|^2} + \langle \vec{f}, \vec{y} \rangle \frac{\vec{y}}{\|\vec{y}\|^2} \\ &= \langle \vec{f}, \vec{u} \rangle \frac{\vec{u}}{\|\vec{u}\|^2} + \langle \vec{f}, \vec{v} \rangle \frac{\vec{v}}{\|\vec{v}\|^2}. \end{aligned}$$

- Fourier series approximation to a hat function.

% Define domain

dx = 0.001; L = pi;

```
x = (-1+dx:dx:1)*L;
n = length(x); nquart = floor(n/4);
% Define hat function
f = 0*x; f(nquart:2*nquart) = 4*(1:nquart+1)/n;
f(2*nquart+1:3*nquart) = 1-4*(0:nquart-1)/n;
plot(x,f,'-k','LineWidth',1.5), hold on
% Compute Fourier series
CC = jet(20);
A0 = sum(f.*ones(size(x)))*dx;
fFS = A0/2;
for k=1:20
A(k) = sum(f.*cos(pi*k*x/L))*dx; % Inner product
B(k) = sum(f.*sin(pi*k*x/L))*dx;
fFS = fFS + A(k)*cos(k*pi*x/L) + B(k)*sin(k*pi*x/L);
plot(x,fFS,'-','Color',CC(k,:),'LineWidth',1.2)
end
```

- The truncated Fourier series is plagued by ringing oscillations, known as Gibbs phenomena, around the sharp corners of the step function. This example highlights the challenge of applying the Fourier series to discontinuous functions:

```
dx = 0.01; L = 10;
x = 0:dx:L;
n = length(x); nquart = floor(n/4);
f = zeros(size(x)); f(nquart:3*nquart) = 1;
A0 = sum(f.*ones(size(x)))*dx*2/L;
fFS = A0/2;
for k=1:100
Ak = sum(f.*cos(2*pi*k*x/L))*dx*2/L;
Bk = sum(f.*sin(2*pi*k*x/L))*dx*2/L;
fFS = fFS + Ak*cos(2*k*pi*x/L) + Bk*sin(2*k*pi*x/L);
end
plot(x,f,'k','LineWidth',2), hold on
plot(x,fFS,'r-','LineWidth',1.2)
```

Date:	25/05/2020	Name:	Shilpa N
Course:	PYTHON	USN:	4AL16EC071
Topic:	DAY 7	Semester & Section:	8 “B”

AFTERNOON SESSION DETAILS

If you are working in a big IT company then you may notice that their couple of websites are blocked especially social networking sites like facebook, youtube, Instagram etc.

Instead of using third-party applications to blocks certain website, we can develop our own custom application which will block websites of our choice and developing a website blocker in python is not so difficult too. That’s what we going to do- develop a python script which will block the website we want.

Prerequisite:

- Python 3.x installed
- Basic knowledge of Python

What we are going to do:

We are going to develop python application which will block a certain website (whatever website you want- facebook, youtube etc.) during certain hours of the day(9:00 to 18:00 hours), consider office hours of the day, we want to blocks all social networking sites. We are going to use the python built-in libraries, so no need to install any third party packages.

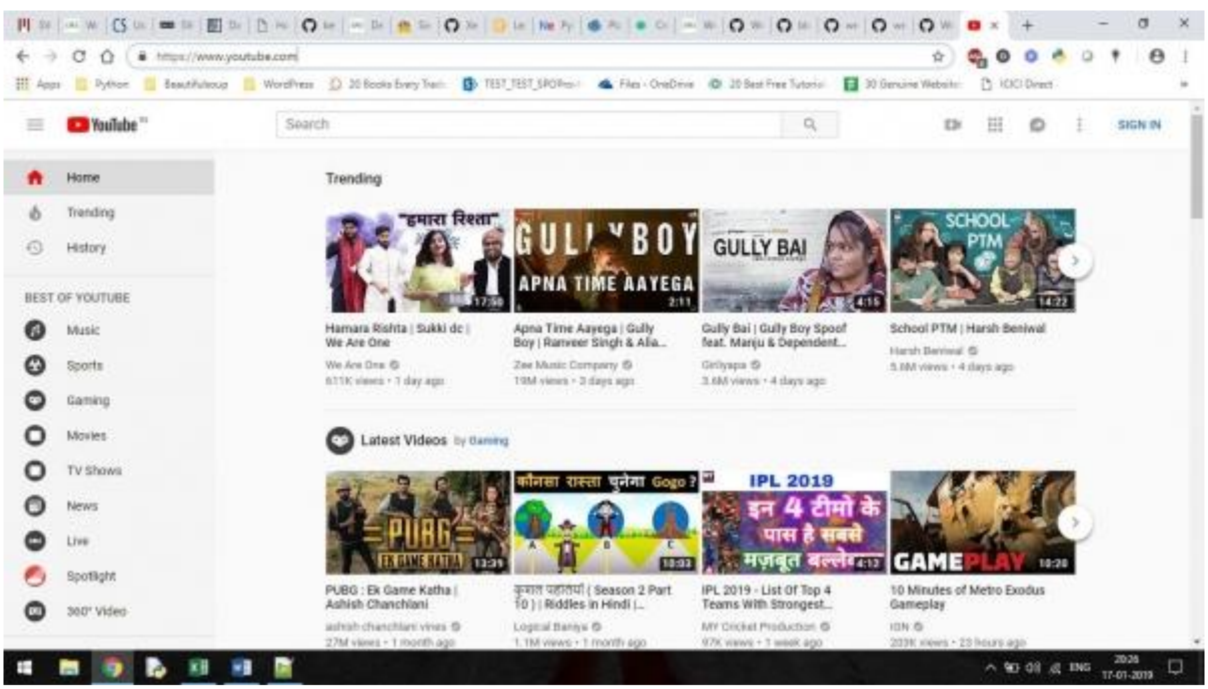
How do we do it?

Every operating system has a hosts file. Location of the host file may be different for the different operating system. This host file is map hostname to IP address of the machine. In this host file, we going to list websites which we want to block.

Our host file will look something like,

```
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97     rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host

# localhost name resolution is handled within DNS itself.
#   127.0.0.1       localhost
#   ::1             localhost
```

As I have not mentioned, any website name in my host file. If I try to open “youtube.com”, I can do it without any problem. Below is the screenshot (just to make sure after running my scripts, this website shouldn’t open if I want to block it.)



Below is our website blocker program −

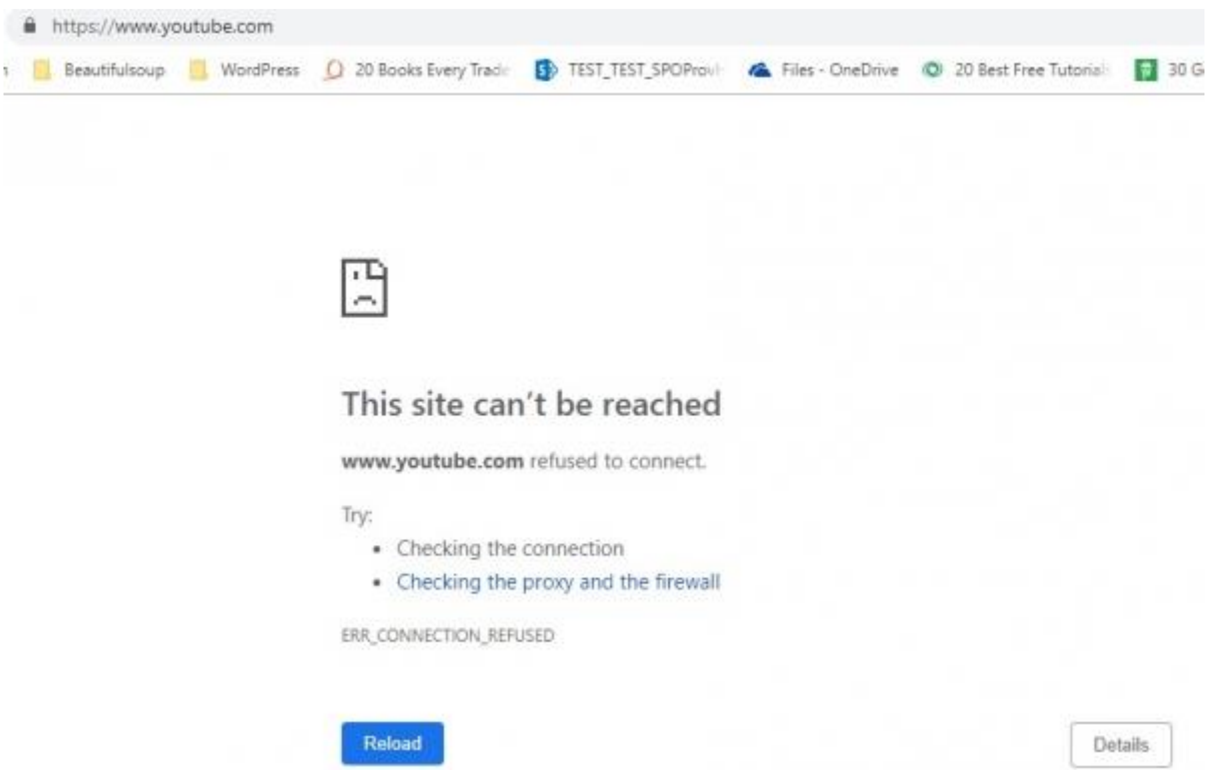
```
#Import libraries

import time

from datetime import datetime as dt

#Windows host file path

hostsPath=r"C:\Windows\System32\drivers\etc\hosts"

redirect="127.0.0.1"

#Add the website you want to block, in this list

websites=["www.youtube.com","youtube.com", "www.facebook.com", "facebook.com"]

while True:

  #Duration during which, website blocker will work

  if dt(dt.now().year,dt.now().month,dt.now().day,9) < dt.now() <
dt(dt.now().year,dt.now().month,dt.now().day,18):

  print ("Sorry Not Allowed...")

  with open(hostsPath,'r+') as file:

    content = file.read()

    for site in websites:

      if site in content:

        pass

      else:

        file.write(redirect+" "+site+"\n")

  else:

    with open(hostsPath,'r+') as file:

    content = file.readlines()

    file.seek(0)

    for line in content:

      if not any(site in line for site in websites):
```

```
        file.write(line)

      file.truncate()

  print ("Allowed access!")

time.sleep(5)
```

Output

```
Sorry Not Allowed...
Sorry Not Allowed...
Sorry Not Allowed...
Sorry Not Allowed...
Sorry Not Allowed...
Sorry Not Allowed...
Sorry Not Allowed...
....
```

Now if I try to open – youtube.com or facebook.com, we'll get –



We can customize above code as per our requirement like duration, websites, custom messages etc.