```
!pip3 install pmdarima

     Requirement already satisfied: pmdarima in /usr/local/lib/python3.7/dist-packages (1
     Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages
     Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.7/dist-packages
     Requirement already satisfied: setuptools!=50.0.0,>=38.6.0 in /usr/local/lib/python3
     Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (fro
     Requirement already satisfied: scikit-learn>=0.22 in /usr/local/lib/python3.7/dist-pa
     Requirement already satisfied: pandas>=0.19 in /usr/local/lib/python3.7/dist-packages
     Requirement already satisfied: statsmodels!=0.12.0,>=0.11 in /usr/local/lib/python3.7
     Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-package
     Requirement already satisfied: Cython<0.29.18,>=0.29 in /usr/local/lib/python3.7/dist
     Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-packages
     Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dis
     Requirement already satisfied: patsy>=0.5 in /usr/local/lib/python3.7/dist-packages (
     Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (fr
```

```
# Import package
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import warnings
from statsmodels.tsa.api import SimpleExpSmoothing
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
from datetime import datetime
from statsmodels.tsa.arima_model import ARIMA
from statsmodels.graphics.tsaplots import plot_acf,plot_pacf
```

```
warnings.simplefilter('ignore')
```

```
data = pd.read_csv('Dataset4_yahoo304.96.8.14.csv',names = ['yahoo304_96_8_14'])
```

Applying KPSS and ADF test

1. ADF test

```
#define function for ADF test
from statsmodels.tsa.stattools import adfuller

def adf_test(atr):
    #Perform Dickey-Fuller test:
    timeseries = data[atr].dropna()
    print ('Results of Dickey-Fuller Test for ',atr,'\n')
    dftest = adfuller(timeseries, autolag='AIC')
    dfoutput = pd.Series(dftest[0:4], index=['Test Statistic','p-value','#Lags Used','Numb
    for key,value in dftest[4].items():
       dfoutput['Critical Value (%s)'%key] = value
```

```
        dfoutput['Critical Value (%s)'%key] = value
    print(dfoutput)

#apply adf test on the series
adf_test('yahoo304_96_8_14')
```

```
     Results of Dickey-Fuller Test for  yahoo304_96_8_14

     Test Statistic                   -3.286733
     p-value                           0.015482
     #Lags Used                       30.000000
     Number of Observations Used    4582.000000
     Critical Value (1%)              -3.431778
     Critical Value (5%)              -2.862171
     Critical Value (10%)             -2.567106
     dtype: float64
```

2. KPSS test

```
#define function for kpss test
from statsmodels.tsa.stattools import kpss
#define KPSS
def kpss_test(atr):
    timeseries = data[atr].dropna()
    print ('Results of KPSS Test for ',atr)
    kpsstest = kpss(timeseries, regression='c')
    kpss_output = pd.Series(kpsstest[0:3], index=['Test Statistic','p-value','Lags Used'])
    for key,value in kpsstest[3].items():
        kpss_output['Critical Value (%s)'%key] = value
    print (kpss_output)
kpss_test('yahoo304_96_8_14')
```

```
     Results of KPSS Test for  yahoo304_96_8_14
     Test Statistic            3.701679
     p-value                   0.010000
     Lags Used                32.000000
     Critical Value (10%)      0.347000
     Critical Value (5%)       0.463000
     Critical Value (2.5%)     0.574000
     Critical Value (1%)       0.739000
     dtype: float64
```

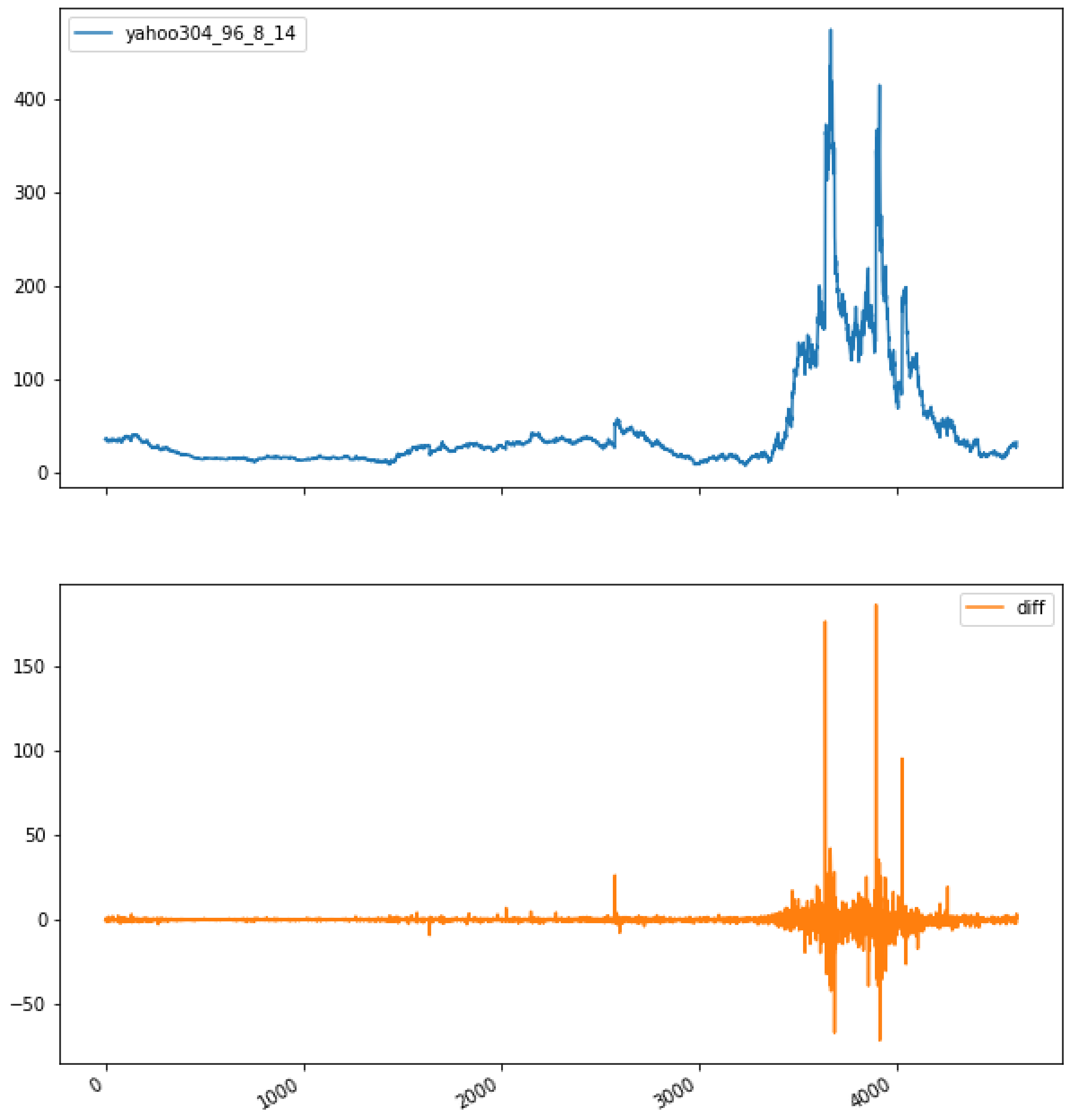
For ADF test, we can see that the p-value is below 0.05. Thus, from ADF test, we can say that the dataset is stationary.

For KPSS test, Test Statistic is more than Critical Value, thus we reject the null hypothesis. Thus, from KPSS test, we can say that the dataset is non-stationary.

Since, both tests conclude that the series is stationary, therefore, the dataset is concluded as Difference-Stationary.

Making dataset stationary with differencing

```
# Differencing
data['diff'] = data['yahoo304_96_8_14'].diff(periods=1)

data.plot(subplots=True, figsize=(10,12))
plt.show()
```



Applying Exponential Smoothening

```
#List of least mse and mae
mseses=[]
msedes=[]
msetes=[]
maeses=[]
```

```
maeses=[]
maedes=[]
maetes=[]
```

Single Exponential Smoothing

```
#Defining Single Exponential Smoothing function ses
def ses(arr,alpha):
    arr1 = [arr[0]]
    for i in range(1, len(arr)):
        arr1.append(alpha * arr[i-1] + (1 - alpha) * arr1[i-1])
    return arr1


#Defining Mean of Squared Error Function mse
def mse(arr1,arr2):
  arr3=[0]
  for i, j in zip(arr1, arr2):
    arr3.append(i-j)
  Sum=0
  for i in arr3:
    sqr=i**2
    Sum+=sqr
  mse=Sum/(len(arr2)-1)
  return mse


#Function to make list of demand with interval 'n'
def dem_n(arr,n):
  arr1=[arr[0]]
  for i in range(1,len(arr)):
    if i%n==0:
      arr1.append(arr[i])
  return arr1


#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)

     Mean of Square Errors for alpha = 0.2 is:  96.05545489077616
     Mean of Square Errors for alpha = 0.5 is:  47.45126817506155
     Mean of Square Errors for alpha = 0.8 is:  36.266977799467504


#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8 is: ",mae3)

     Mean Absolute Errors for alpha = 0.2 is:  2.977391560154959
     Mean Absolute Errors for alpha = 0.5 is:  1.9522762583275515
     Mean Absolute Errors for alpha = 0.8 is:  1.6859884166178474


#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
```

```
     alpha:  0.8
```

Double Exponential Smoothing

```
#Defining Double Exponential Smoothing function des
def des(arr,alpha,beta):
  a=[arr[0]]
  l=len(arr)
  b=[(arr[l-1]-arr[0])/(l-1)]
  arr1 = [arr[0]]
  arr1.append(a[0]+b[0])
  for i in range(1,len(arr)-1):
      a.append(alpha * arr[i] + (1 - alpha) * (a[i-1]+b[i-1]))
      b.append(beta * (a[i]-a[i-1]) + (1 - beta) * (b[i-1]))
      arr1.append(a[i]+b[i])
  return arr1


#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

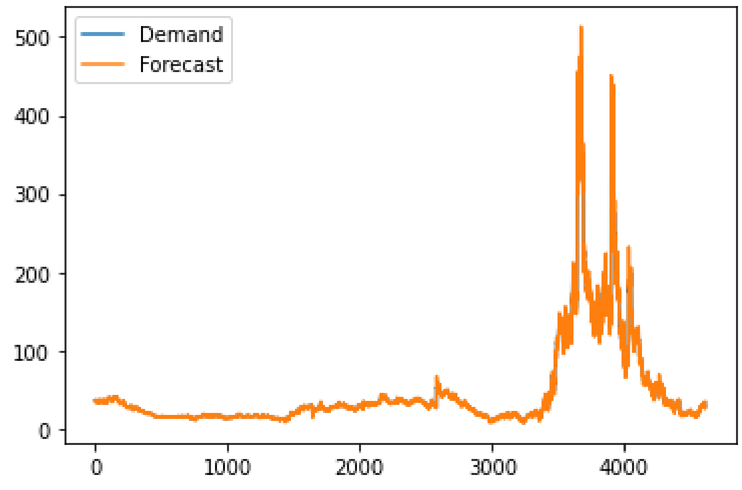
```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  98.61340054241282
     Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  53.99123148363984
     Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  50.11839964406356
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3 is:  2.964884523576852
     Mean Absolute Errors for alpha = 0.5,beta= 0.6 is:  2.152219376160902
     Mean Absolute Errors for alpha = 0.8,beta= 0.9 is:  2.0473756875762197
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
```

```
     alpha:  0.8
     beta:  0.9
```

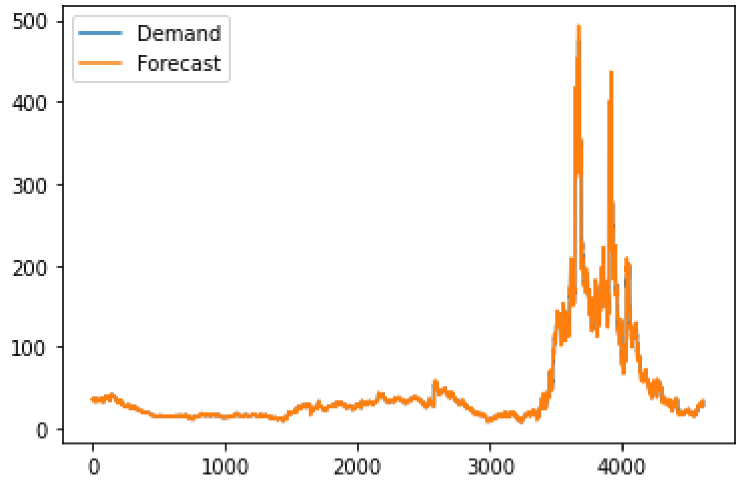


Triple Exponential Smoothing

```
#Defining initial trend
def initial_trend(arr, slen):
    Sum = 0
    for i in range(slen):
        Sum += float(arr[i+slen] - arr[i]) / slen
    return Sum / slen
```

```
#Defining initial seasonal
def initial_seasonal(arr, slen):
    arr1 = {}
    s_avg = []
    m = int(len(arr)/slen)
    for j in range(m):
        s_avg.append(sum(arr[slen*j:slen*j+slen])/float(slen))
    for i in range(slen):
        Sum = 0
        for j in range(m):
            Sum += arr[slen*j+i]-s_avg[j]
        arr1[i] = Sum/m
    return arr1


#Defining Triple Exponential Smoothing function tes with interval 'n'
def tes(arr, slen, alpha, beta, gamma, n):
    arr1 = []
    seasonals = initial_seasonal(arr, slen)
    for i in range(len(arr)+n):
        if i == 0:
            smooth = arr[0]
            trend = initial_trend(arr, slen)
            arr1.append(arr[0])
            continue
        if i >= len(arr):
            m = i - len(arr) + 1
            arr1.append((smooth + m*trend) + seasonals[i%slen])
        else:
            val = arr[i]
            lsmooth, smooth = smooth, alpha*(val-seasonals[i%slen]) + (1-alpha)*(smooth+tr
            trend = beta * (smooth-lsmooth) + (1-beta)*trend
            seasonals[i%slen] = gamma*(val-smooth) + (1-gamma)*seasonals[i%slen]
            arr1.append(smooth+trend+seasonals[i%slen])
    return arr1


#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here
```

```
forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)

     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  11.639338570577138
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  6.348675651210603
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  19.48517402679209


#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)

     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  1.032820786741875
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  0.7323065580072101
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  1.239266078672252


#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
 print("gamma: ",gamma3)
 df3.plot(style=['-','-'])

     alpha:  0.5
     beta:  0.6
     gamma:  0.7
```



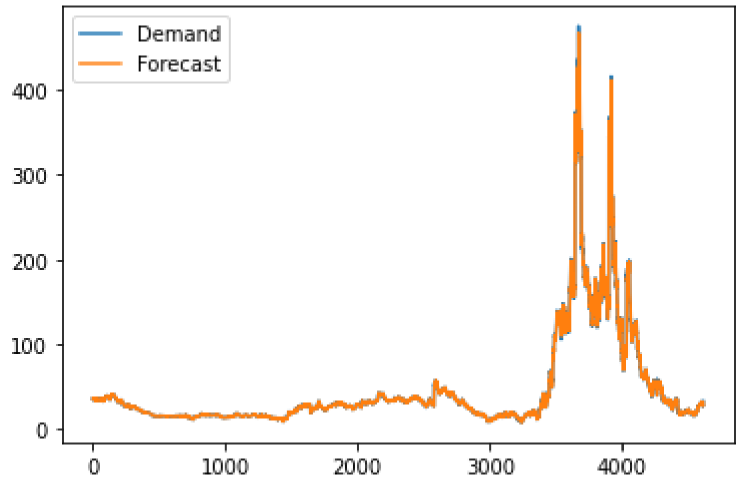
For 1 Unit

Single Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)

    Mean of Square Errors for alpha = 0.2 is:  96.05545489077616
    Mean of Square Errors for alpha = 0.5 is:  47.45126817506155
    Mean of Square Errors for alpha = 0.8 is:  36.266977799467504
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
     alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

Double Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)
```

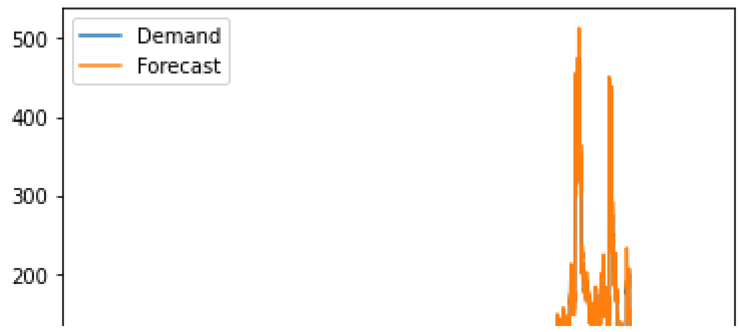
```
#Forecasting
alpha1=0.2
```

```
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  98.61340054241282
     Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  53.99123148363984
     Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  50.11839964406356
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
alpha:  0.8
beta:  0.9
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maedes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maedes.append(mae2)
else:
  maedes.append(mae3)
```

Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,1)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  11.639338570577138
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  6.348675651210603
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  19.48517402679209
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  1.032820786741875
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  0.7323065580072101
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  1.239266078672252
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
alpha:  0.5
beta:  0.6
gamma:  0.7
```

500
400
300
Demand
Forecast

```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

For 2 Unit

Single Exponential Smoothing

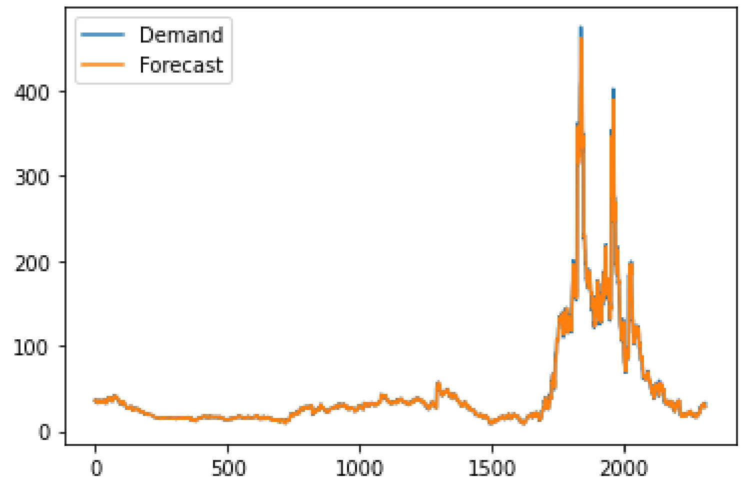
```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,2)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)
```

```
Mean of Square Errors for alpha = 0.2 is:  180.76450708751057
Mean of Square Errors for alpha = 0.5 is:  90.24920445458754
Mean of Square Errors for alpha = 0.8 is:  70.74433216569851
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}
```

```
df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
     alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

Double Exponential Smoothing

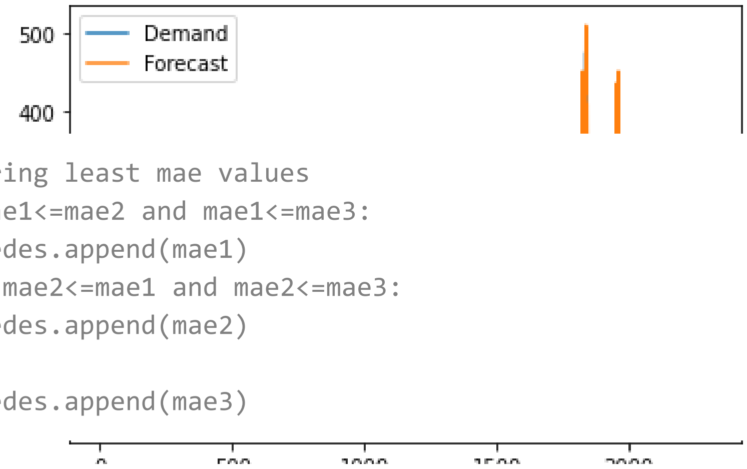
```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,2)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
```

```
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  189.56455362093845
     Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  105.91052413310219
     Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  100.69577635286231
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
    alpha:  0.8
    beta:  0.9
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maedes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maedes.append(mae2)
else:
  maedes.append(mae3)
```

Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,2)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

```
    Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  22.053348792543282
    Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  11.733396511437721
    Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  37.76557145513107
```

```
#Calculating Mean Absolute Errors
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  1.4890138335978669
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  1.0783372848909816
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  1.7916636448595848
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
    alpha:  0.5
    beta:  0.6
    gamma:  0.7
```

```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

For 4 Unit

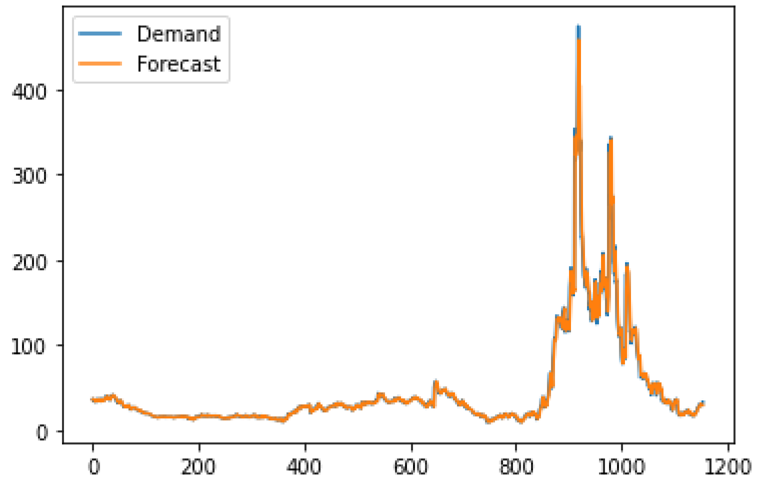
Single Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,4)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)
```

```
    Mean of Square Errors for alpha = 0.2 is:  324.88713214124726
    Mean of Square Errors for alpha = 0.5 is:  167.06281335851196
    Mean of Square Errors for alpha = 0.8 is:  135.12511739078056
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

Double Exponential Smoothing

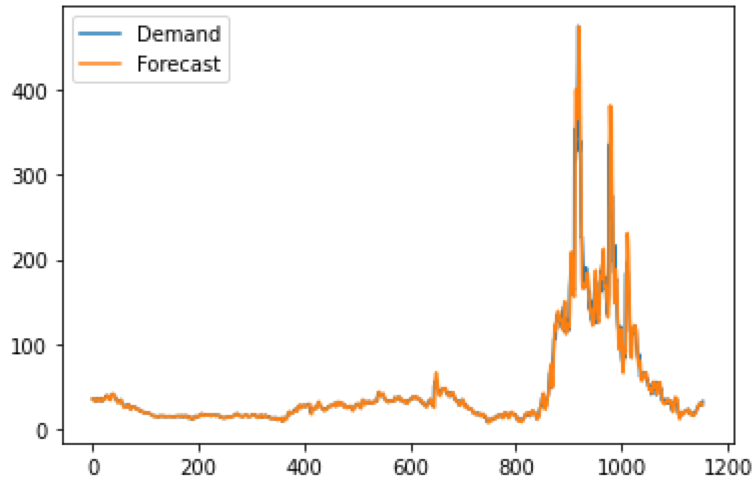
```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,4)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)
```

```
#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  389.5482290439572
     Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  179.78037941617038
     Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  200.49519102127783
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
     alpha:  0.5
     beta:  0.6
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maedes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maedes.append(mae2)
else:
  maedes.append(mae3)
```

Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,4)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

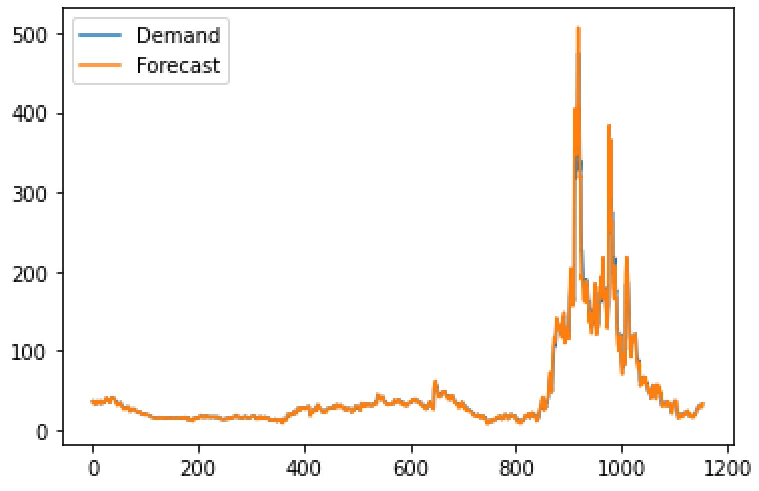
```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  40.92701807206647
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  21.350809413671804
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  70.76855113847974
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  2.1853413729779603
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  1.5846934379909212
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  2.5783465554224296
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
     alpha:  0.5
     beta:  0.6
     gamma:  0.7
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

For 8 Unit

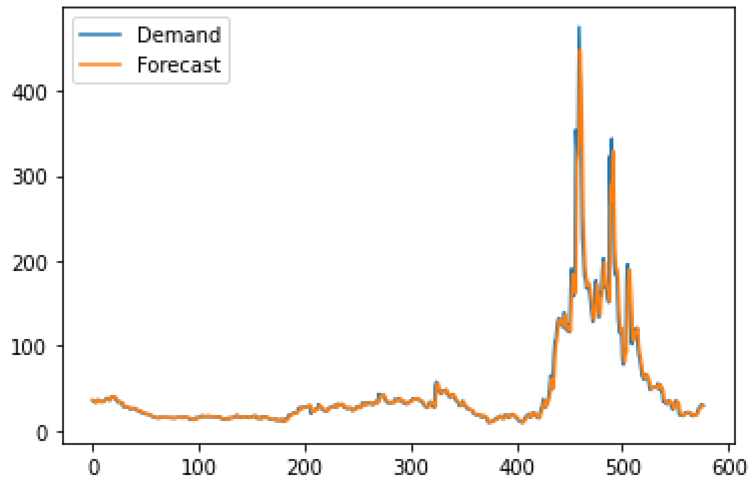
Single Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,8)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2 is:  595.4377000575759
     Mean of Square Errors for alpha = 0.5 is:  354.46155227597797
     Mean of Square Errors for alpha = 0.8 is:  284.3567740733148
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
     alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

Double Exponential Smoothing

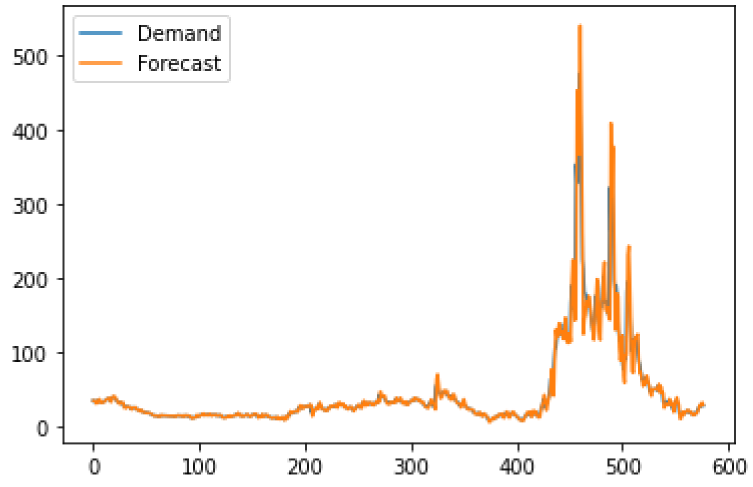
```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,8)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)
```

```
print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  861.5601415083182
     Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  443.02309370147407
     Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  401.47865143128286
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
     alpha:  0.8
     beta:  0.9
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maedes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maedes.append(mae2)
```

```
else:
  maedes.append(mae3)
```

Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,8)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

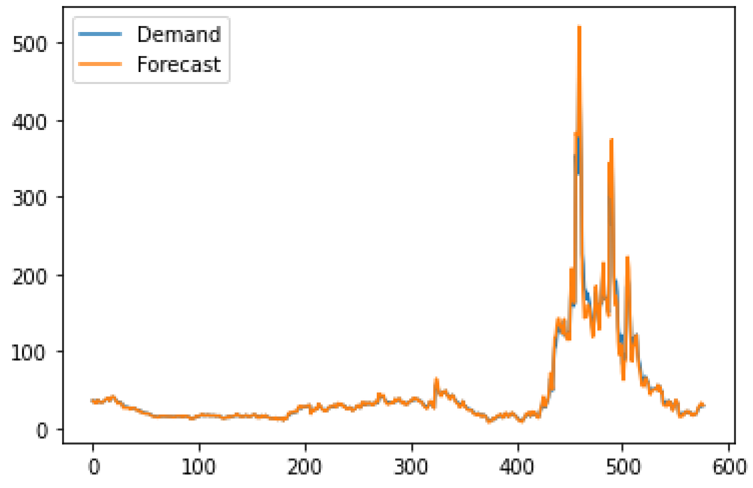
```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  86.62536866355454
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  43.77633888809179
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  150.47577578775852
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  3.1931530914015007
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  2.444632845486679
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  3.8543419881386067
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
alpha:  0.5
beta:  0.6
gamma:  0.7
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

For 12 Unit

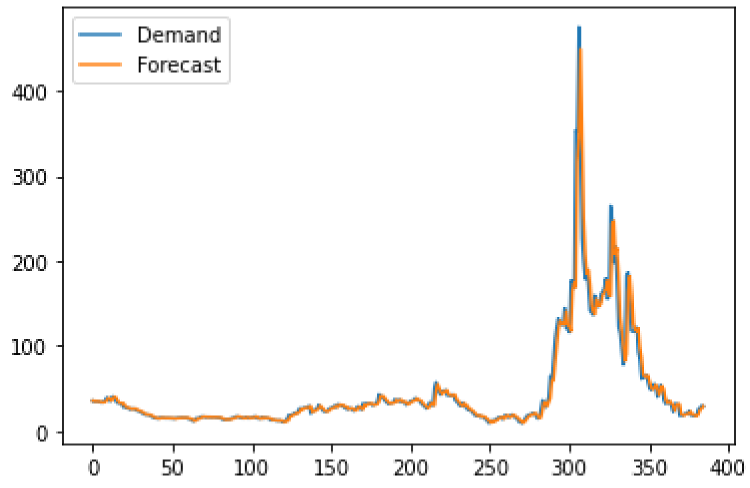
Single Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,12)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2 is:  695.2913065175823
     Mean of Square Errors for alpha = 0.5 is:  434.09441905658844
     Mean of Square Errors for alpha = 0.8 is:  347.86041803251385
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

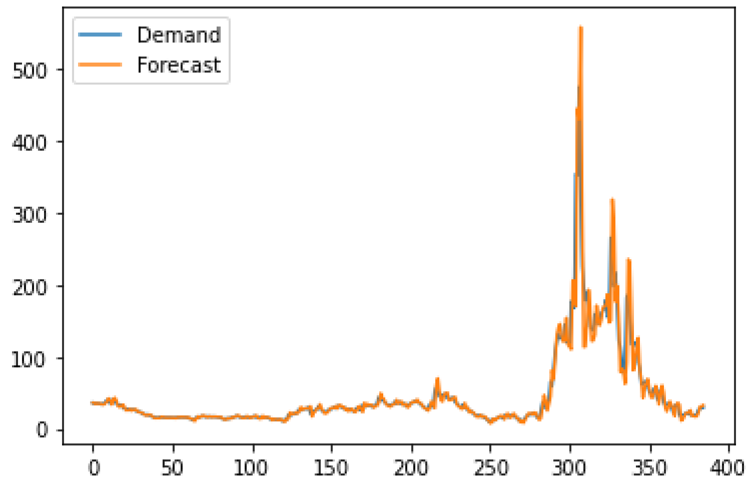
Double Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,12)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  917.0415874290327
Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  576.8322453010067
Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  490.8480707638323
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
alpha:  0.8
beta:  0.9
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maedes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maedes.append(mae2)
else:
  maedes.append(mae3)
```

Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,12)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  105.68945928872901
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  52.452436971990124
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  185.33925379432878
```

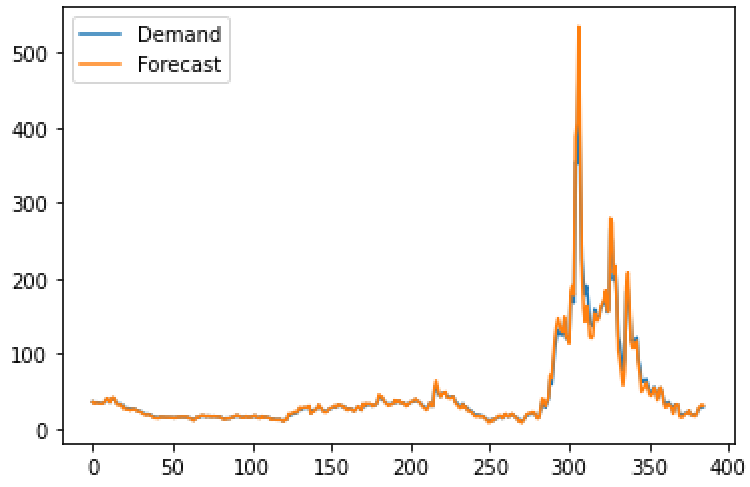
```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  3.718815282718495
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  2.7884595336623166
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  4.5485157158957294
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}
```

```
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
     alpha:  0.5
     beta:  0.6
     gamma:  0.7
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

For 24 Interval

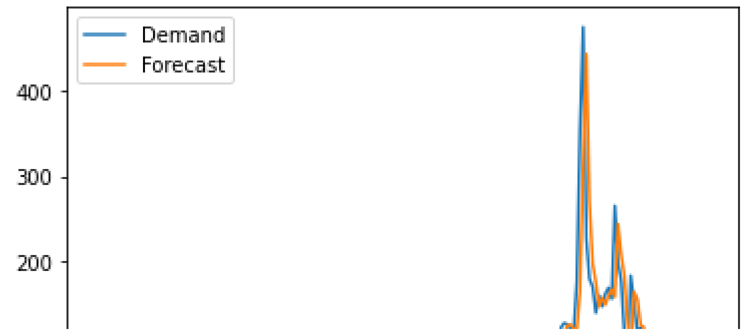
Single Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,24)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

forecast1=ses(demand,alpha1)
forecast2=ses(demand,alpha2)
forecast3=ses(demand,alpha3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8 is: ",mse3)
```

```
     Mean of Square Errors for alpha = 0.2 is:  1307.5088358730952
     Mean of Square Errors for alpha = 0.5 is:  945.8271328960523
     Mean of Square Errors for alpha = 0.8 is:  849.7836364017458
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  df1.plot(style=['-','-'])
  mseses.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  df2.plot(style=['-','-'])
  mseses.append(mse2)
else:
  print('alpha: ',alpha3)
  df3.plot(style=['-','-'])
  mseses.append(mse3)
```

```
alpha:  0.8
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maeses.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maeses.append(mae2)
else:
  maeses.append(mae3)
```

Double Exponential Smoothing

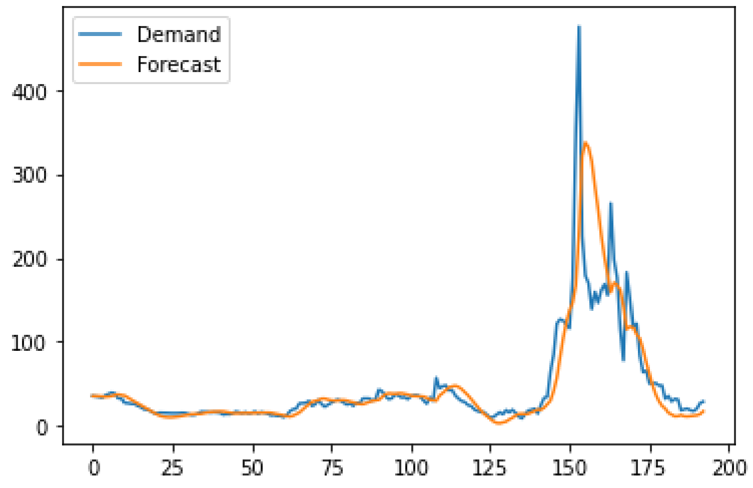
```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,24)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9

forecast1=des(demand,alpha1,beta1)
forecast2=des(demand,alpha2,beta2)
forecast3=des(demand,alpha3,beta3)


#Calculating Mean of Square Errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 is: ",mse3)
```

```
Mean of Square Errors for alpha = 0.2,beta= 0.3 is:  1371.9935841256988
Mean of Square Errors for alpha = 0.5,beta= 0.6 is:  1424.4136667011549
Mean of Square Errors for alpha = 0.8,beta= 0.9 is:  1425.973409598658
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
```

```
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  df1.plot(style=['-','-'])
  msedes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  df2.plot(style=['-','-'])
  msedes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  df3.plot(style=['-','-'])
  msedes.append(mse3)
```

```
     alpha:  0.2
     beta:  0.3
```



Triple Exponential Smoothing

```
#Creating demand list in 'n' intervals
demand=dem_n(data.yahoo304_96_8_14,24)


#Forecasting
alpha1=0.2
alpha2=0.5
alpha3=0.8

beta1=0.3
beta2=0.6
beta3=0.9
```

```
gamma1=0.4
gamma2=0.7
gamma3=0.95

#Considering season of 1 hours here

forecast1=tes(demand,1,alpha1,beta1,gamma1,0)
forecast2=tes(demand,1,alpha2,beta2,gamma2,0)
forecast3=tes(demand,1,alpha3,beta3,gamma3,0)


#Calculating mean of sqaured errors
mse1=mean_squared_error(demand,forecast1)
mse2=mean_squared_error(demand,forecast2)
mse3=mean_squared_error(demand,forecast3)

print("Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is: ",mse1)
print("Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is: ",mse2)
print("Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is: ",mse3)
```

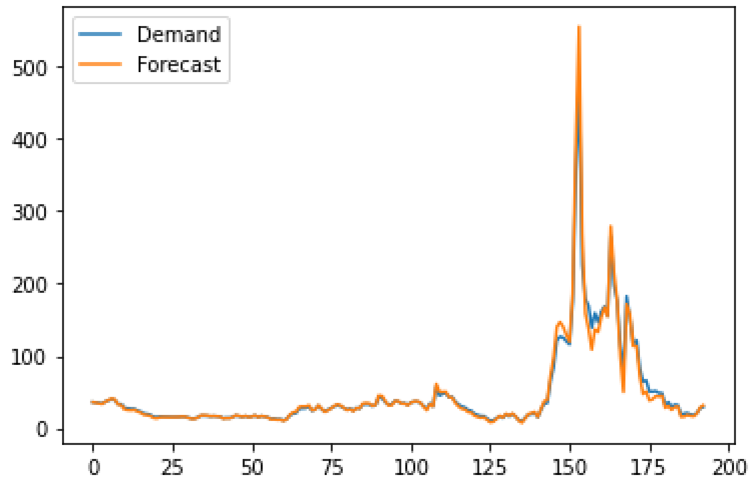
```
     Mean of Square Errors for alpha = 0.2,beta= 0.3 gamma=0.4 is:  223.8033725086531
     Mean of Square Errors for alpha = 0.5,beta= 0.6 gamma=0.7 is:  92.95581609431166
     Mean of Square Errors for alpha = 0.8,beta= 0.9 gamma=0.95 is:  444.40722954115944
```

```
#Calculating Mean Absolute Errors
mae1=mean_absolute_error(demand,forecast1)
mae2=mean_absolute_error(demand,forecast2)
mae3=mean_absolute_error(demand,forecast3)

print("Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is: ",mae1)
print("Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is: ",mae2)
print("Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is: ",mae3)
```

```
     Mean Absolute Errors for alpha = 0.2,beta= 0.3, gamma=0.4 is:  5.802045015904002
     Mean Absolute Errors for alpha = 0.5,beta= 0.6, gamma=0.7 is:  3.957796285812707
     Mean Absolute Errors for alpha = 0.8,beta= 0.9, gamma=0.95 is:  7.297799596309526
```

```
#Comparing mse and plotting for least mse
d1={'Demand':demand,'Forecast':forecast1}
d2={'Demand':demand,'Forecast':forecast2}
d3={'Demand':demand,'Forecast':forecast3}

df1=pd.DataFrame(d1)
df2=pd.DataFrame(d2)
df3=pd.DataFrame(d3)

if mse1<=mse2 and mse1<=mse3:
  print('alpha: ',alpha1)
  print('beta: ',beta1)
  print('gamma: ',gamma1)
  df1.plot(style=['-','-'])
  msetes.append(mse1)
elif mse2<=mse1 and mse2<=mse3:
  print('alpha: ',alpha2)
  print('beta: ',beta2)
  print('gamma: ',gamma2)
  df2.plot(style=['-','-'])
  msetes.append(mse2)
else:
  print('alpha: ',alpha3)
  print('beta: ',beta3)
  print('gamma: ',gamma3)
  df3.plot(style=['-','-'])
  msetes.append(mse3)
```

```
alpha:  0.5
beta:  0.6
gamma:  0.7
```



```
#Storing least mae values
if mae1<=mae2 and mae1<=mae3:
  maetes.append(mae1)
elif mae2<=mae1 and mae2<=mae3:
  maetes.append(mae2)
else:
  maetes.append(mae3)
```

Least MSE and MAE values are

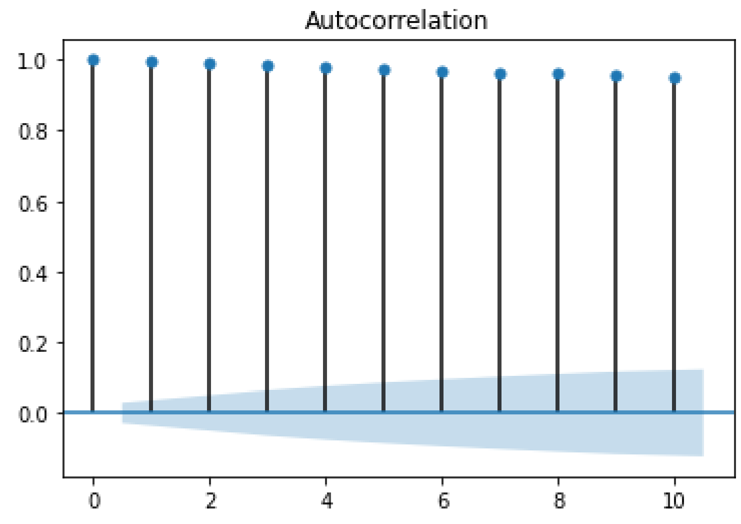
```
print("Least MSE ses")
print(mseses)
print("Least MSE des")
print(msedes)
print("Least MSE tes")
print(msetes)


print("Least MAE ses")
print(maeses)
print("Least MAE des")
print(maedes)
print("Least MAE tes")
print(maetes)
```

```
    Least MSE ses
    [36.266977799467504, 70.74433216569851, 135.12511739078056, 284.3567740733148, 347.86
    Least MSE des
    [50.11839964406356, 100.69577635286231, 179.78037941617038, 401.47865143128286, 490.8
    Least MSE tes
    [6.348675651210603, 11.733396511437721, 21.350809413671804, 43.77633888809179, 52.452
    Least MAE ses
    [0.7323065580072101, 0.7323065580072101, 1.0783372848909816, 1.5846934379909212, 2.44
    Least MAE des
    [0.7323065580072101, 0.7323065580072101, 1.0783372848909816, 1.5846934379909212, 2.44
    Least MAE tes
    [0.7323065580072101, 1.0783372848909816, 1.5846934379909212, 2.444632845486679, 2.788
```

Applying ACF and PACF

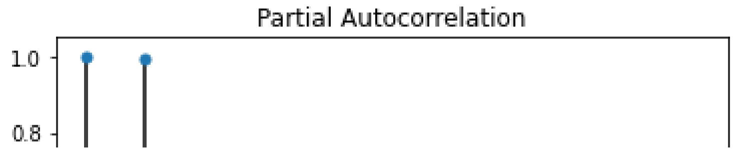
```
#Plotting ACF
plot_acf(data.yahoo304_96_8_14,lags=10)
plt.show
```

```
    <function matplotlib.pyplot.show>
```

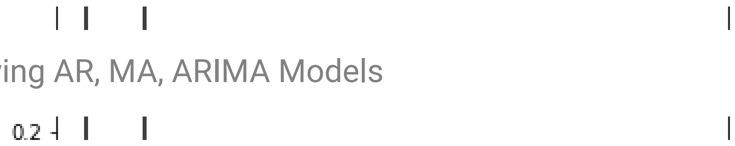


```
#plotting PACF
plot_pacf(data.yahoo304_96_8_14,lags=10)
plt.show
```

```
<function matplotlib.pyplot.show>
```



Applying AR, MA, ARIMA Models



```
#AR

#fit model
model=ARIMA(data['yahoo304_96_8_14'], order=(3,0,0))
model_fit=model.fit()

#model summary
print(model_fit.summary())

#make prediction
data['forecastAR'] = model_fit.predict()
data[['yahoo304_96_8_14','forecastAR']].plot()
```

```
                              ARMA Model Results
==============================================================================
Dep. Variable:       yahoo304_96_8_14   No. Observations:                 4613
Model:                     ARMA(3, 0)   Log Likelihood              -14672.712
Method:                       css-mle   S.D. of innovations              5.820
Date:                Mon, 01 Mar 2021   AIC                          29355.423
Time:                        05:24:04   BIC                          29387.607
```

```
mse=mean_squared_error(data.yahoo304_96_8_14,data.forecastAR.dropna())
print("MSE for AR is:",mse)
```

```
MSE for AR is: 33.89131601513936
const                     45.3611     14.804      3.064      0.002      16.346
```

```
mae=mean_absolute_error(data.yahoo304_96_8_14,data.forecastAR.dropna())
print("MAE for AR is:",mae)
```

```
MAE for AR is: 1.631457515002413
                    Real          Imaginary           Modulus         Frequency
```

```
#MA

#fit model
model=ARIMA(data['diff'].dropna(), order=(0,0,2))
model_fit=model.fit()

#model summary
print(model_fit.summary())

#make prediction
data['forecastMA'] = model_fit.predict()
data[['diff','forecastMA']].plot()
```

```
                              ARMA Model Results
==============================================================================
Dep. Variable:                   diff   No. Observations:                 4612
Model:                     ARMA(0, 2)   Log Likelihood              -14673.764
Method:                       css-mle   S.D. of innovations              5.828
Date:                Mon, 01 Mar 2021   AIC                          29355.529
Time:                        05:24:05   BIC                          29381.275
Sample:                             0   HQIC                         29364.589

==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
```

```
mse=mean_squared_error(data.yahoo304_96_8_14[0:-1],data.forecastMA.dropna())
print("MSE for MA is:",mse)
```

```
    MSE for MA is: 5509.995684894809
```

```
mae=mean_absolute_error(data.yahoo304_96_8_14[0:-1],data.forecastMA.dropna())
print("MAE for MA is:",mae)
```

```
    MAE for MA is: 46.141560834983046
```

```
#ARIMA

#fit model
model=ARIMA(data['diff'].dropna(), order=(3,0,2))
model_fit=model.fit()

#model summary
print(model_fit.summary())

#make prediction
data['forecastARIMA'] = model_fit.predict()
data[['diff','forecastARIMA']].plot()
```

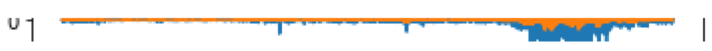
```
                              ARMA Model Results
==============================================================================
Dep. Variable:                   diff   No. Observations:                 4612
Model:                     ARMA(3, 2)   Log Likelihood              -14636.373
Method:                       css-mle   S.D. of innovations              5.781
Date:                Mon, 01 Mar 2021   AIC                          29286.746
Time:                        05:24:08   BIC                          29331.801
Sample:                             0   HQIC                         29302.602

==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
const         -0.0007      0.091     -0.007      0.994      -0.178       0.177
ar.L1.diff    -0.3720      0.017    -21.541      0.000      -0.406      -0.338
ar.L2.diff    -0.8936      0.018    -48.907      0.000      -0.929      -0.858
ar.L3.diff     0.0250      0.015      1.633      0.103      -0.005       0.055
ma.L1.diff     0.4286      0.009     47.771      0.000       0.411       0.446
ma.L2.diff     0.9581      0.012     76.842      0.000       0.934       0.983
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1           -0.2209           -1.0279j            1.0514           -0.2837
```

```
mse=mean_squared_error(data.yahoo304_96_8_14[0:-1],data.forecastARIMA.dropna())
print("MSE for MA is:",mse)
```

```
MSE for MA is: 5511.605519032832
```

```
mae=mean_absolute_error(data.yahoo304_96_8_14[0:-1],data.forecastARIMA.dropna())
print("MAE for MA is:",mae)
```

```
MAE for MA is: 46.14158164074054
```



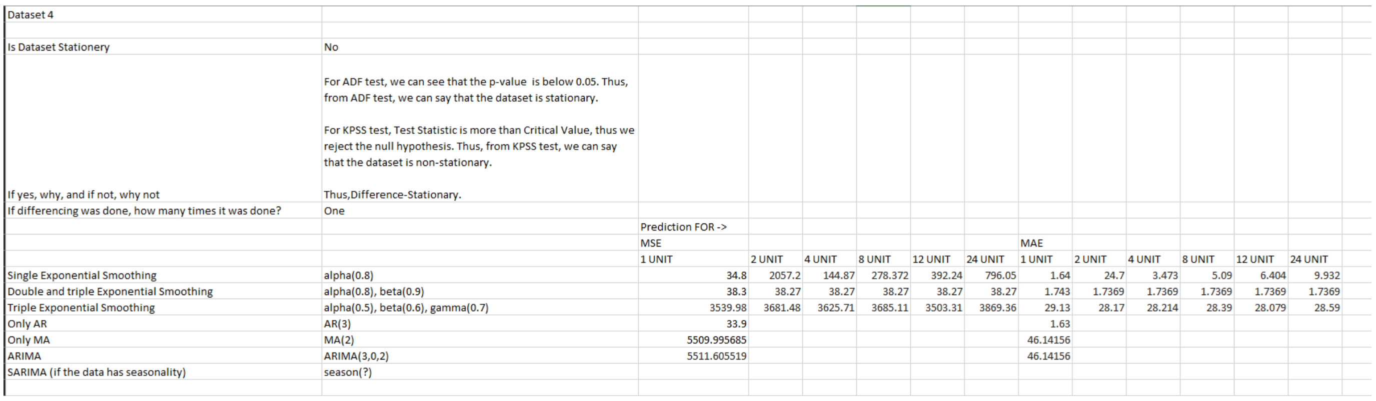
Applying Auto ARIMA

```
import pmdarima as pm
model = pm.auto_arima(data.iloc[:,0], start_p=1, start_q=1,test='adf',max_p=3, max_q=3,m=1
print(model.summary())
```

```
Performing stepwise search to minimize aic
 ARIMA(1,0,1)(0,0,0)[0]             : AIC=29358.877, Time=0.40 sec
 ARIMA(0,0,0)(0,0,0)[0]             : AIC=52832.194, Time=0.08 sec
 ARIMA(1,0,0)(0,0,0)[0]             : AIC=inf, Time=0.19 sec
 ARIMA(0,0,1)(0,0,0)[0]             : AIC=46916.004, Time=0.68 sec
 ARIMA(2,0,1)(0,0,0)[0]             : AIC=29360.811, Time=0.71 sec
 ARIMA(1,0,2)(0,0,0)[0]             : AIC=29357.882, Time=0.48 sec
 ARIMA(0,0,2)(0,0,0)[0]             : AIC=42222.823, Time=2.91 sec
 ARIMA(2,0,2)(0,0,0)[0]             : AIC=29345.809, Time=2.09 sec
 ARIMA(3,0,2)(0,0,0)[0]             : AIC=29290.882, Time=4.59 sec
 ARIMA(3,0,1)(0,0,0)[0]             : AIC=29348.048, Time=2.03 sec
 ARIMA(3,0,3)(0,0,0)[0]             : AIC=29296.227, Time=4.54 sec
 ARIMA(2,0,3)(0,0,0)[0]             : AIC=29340.140, Time=1.17 sec
 ARIMA(3,0,2)(0,0,0)[0] intercept   : AIC=29295.962, Time=9.00 sec

Best model:  ARIMA(3,0,2)(0,0,0)[0]
Total fit time: 28.895 seconds
                               SARIMAX Results
==============================================================================
Dep. Variable:                      y   No. Observations:                 4613
Model:               SARIMAX(3, 0, 2)   Log Likelihood              -14639.441
Date:                Mon, 01 Mar 2021   AIC                          29290.882
Time:                        05:25:11   BIC                          29329.502
Sample:                             0   HQIC                         29304.473
                               - 4613
Covariance Type:                  opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1          0.6191      0.008     77.475      0.000       0.603       0.635
ar.L2         -0.5112      0.010    -49.807      0.000      -0.531      -0.491
ar.L3          0.8846      0.008    105.040      0.000       0.868       0.901
ma.L1          0.4173      0.007     55.685      0.000       0.403       0.432
ma.L2          0.9431      0.008    123.834      0.000       0.928       0.958
sigma2        33.4673      0.092    363.507      0.000      33.287      33.648
===================================================================================
Ljung-Box (L1) (Q):                   1.46   Jarque-Bera (JB):          36931252.63
Prob(Q):                              0.23   Prob(JB):                         0.00
Heteroskedasticity (H):             442.37   Skew:                            13.32
Prob(H) (two-sided):                  0.00   Kurtosis:                       440.53
===================================================================================

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-step)
```

Best model: ARIMA(3,0,2)(0,0,0)[0]

Final Result



Dataset 4													
Is Dataset Stationery	No												
If yes, why, and if not, why not	For ADF test, we can see that the p-value is below 0.05. Thus, from ADF test, we can say that the dataset is stationary. For KPSS test, Test Statistic is more than Critical Value, thus we reject the null hypothesis. Thus, from KPSS test, we can say that the dataset is non-stationary. Thus,Difference-Stationary.												
If differencing was done, how many times it was done?	One												
		Prediction FOR ->											
		MSE						MAE					
		1 UNIT	2 UNIT	4 UNIT	8 UNIT	12 UNIT	24 UNIT	1 UNIT	2 UNIT	4 UNIT	8 UNIT	12 UNIT	24 UNIT
Single Exponential Smoothing	alpha(0.8)	34.8	2057.2	144.87	278.372	392.24	796.05	1.64	24.7	3.473	5.09	6.404	9.932
Double and triple Exponential Smoothing	alpha(0.8), beta(0.9)	38.3	38.27	38.27	38.27	38.27	38.27	1.743	1.7369	1.7369	1.7369	1.7369	1.7369
Triple Exponential Smoothing	alpha(0.5), beta(0.6), gamma(0.7)	3539.98	3681.48	3625.71	3685.11	3503.31	3869.36	29.13	28.17	28.214	28.39	28.079	28.59
Only AR	AR(3)	33.9						1.63					
Only MA	MA(2)	5509.995685						46.14156					
ARIMA	ARIMA(3,0,2)	5511.605519						46.14156					
SARIMA (if the data has seasonality)	season(?)												