DATA ANALYTICS ASSIGNMENT

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SECTION ‘C’

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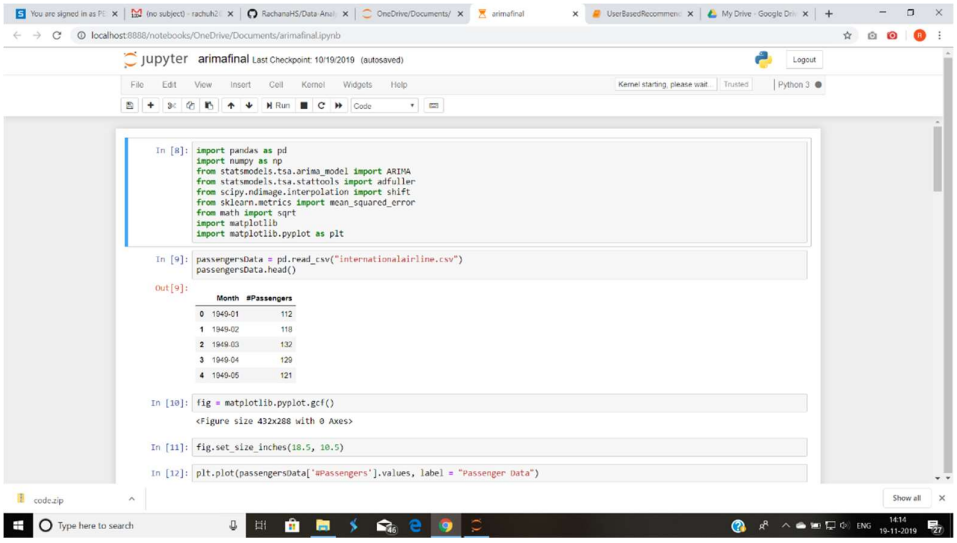
SECTION ‘E’

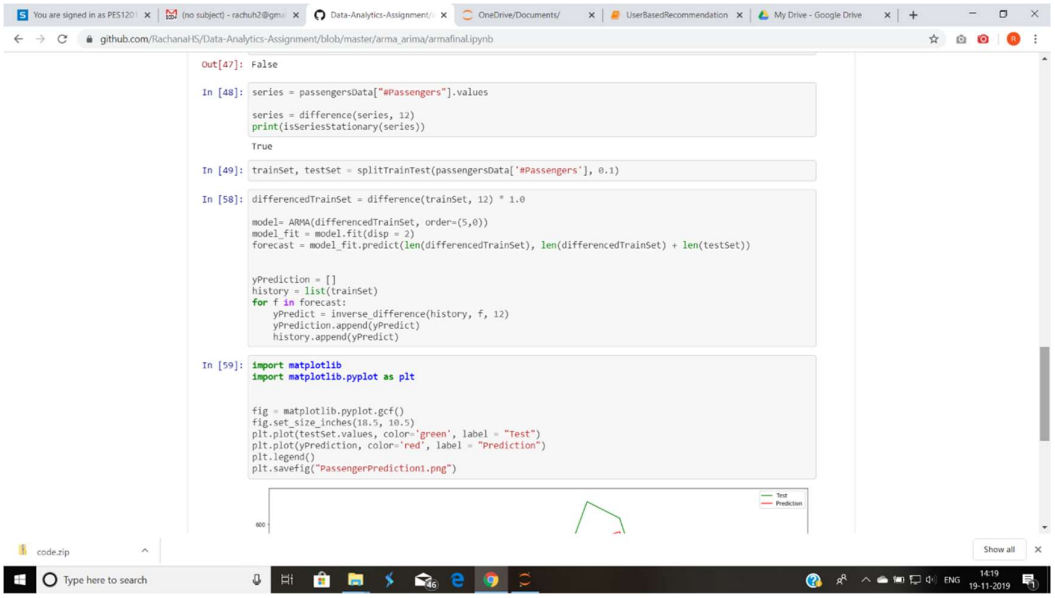
PROBLEM STATEMENT:

APPLYING ARMA AND ARIMA ON A DATASET

SCREENSHOTS

ARMA





Out[47]: False

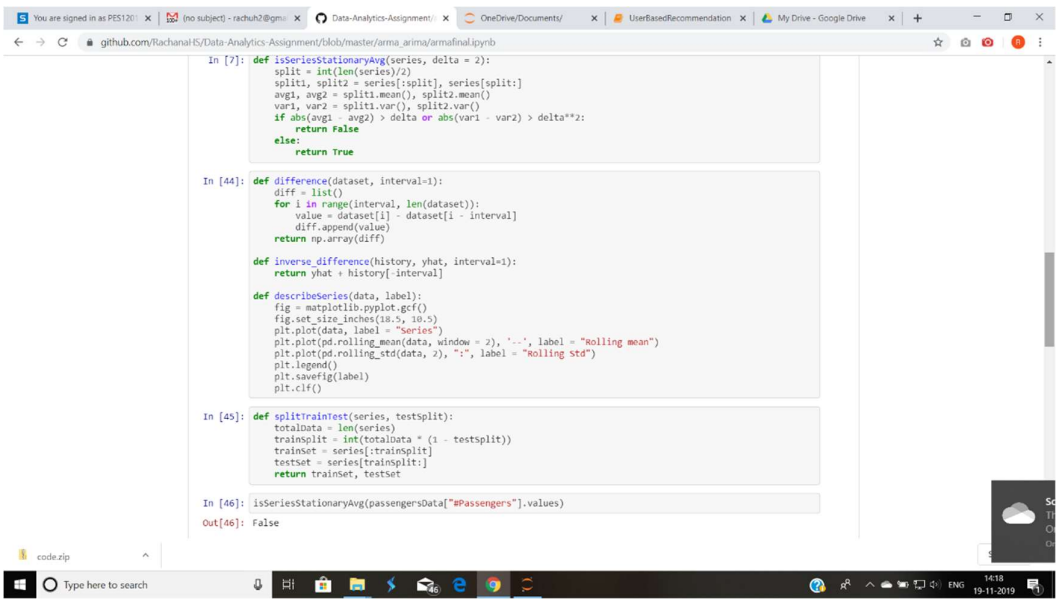
In [48]:
```
series = passengersData["#Passengers"].values

series = difference(series, 12)
print(isSeriesStationary(series))
```

True

In [49]:
```
trainSet, testSet = splitTrainTest(passengersData['#Passengers'], 0.1)
```

In [58]:
```
differencedTrainSet = difference(trainSet, 12) * 1.0

model= ARMA(differencedTrainSet, order=(5,0))
model_fit = model.fit(disp = 2)
forecast = model_fit.predict(len(differencedTrainSet), len(differencedTrainSet) + len(testSet))


yPrediction = []
history = list(trainSet)
for f in forecast:
    yPredict = inverse_difference(history, f, 12)
    yPrediction.append(yPredict)
    history.append(yPredict)
```

In [59]:
```
import matplotlib
import matplotlib.pyplot as plt


fig = matplotlib.pyplot.gcf()
fig.set_size_inches(18.5, 10.5)
plt.plot(testSet.values, color='green', label = "Test")
plt.plot(yPrediction, color='red', label = "Prediction")
plt.legend()
plt.savefig("PassengerPrediction1.png")
```

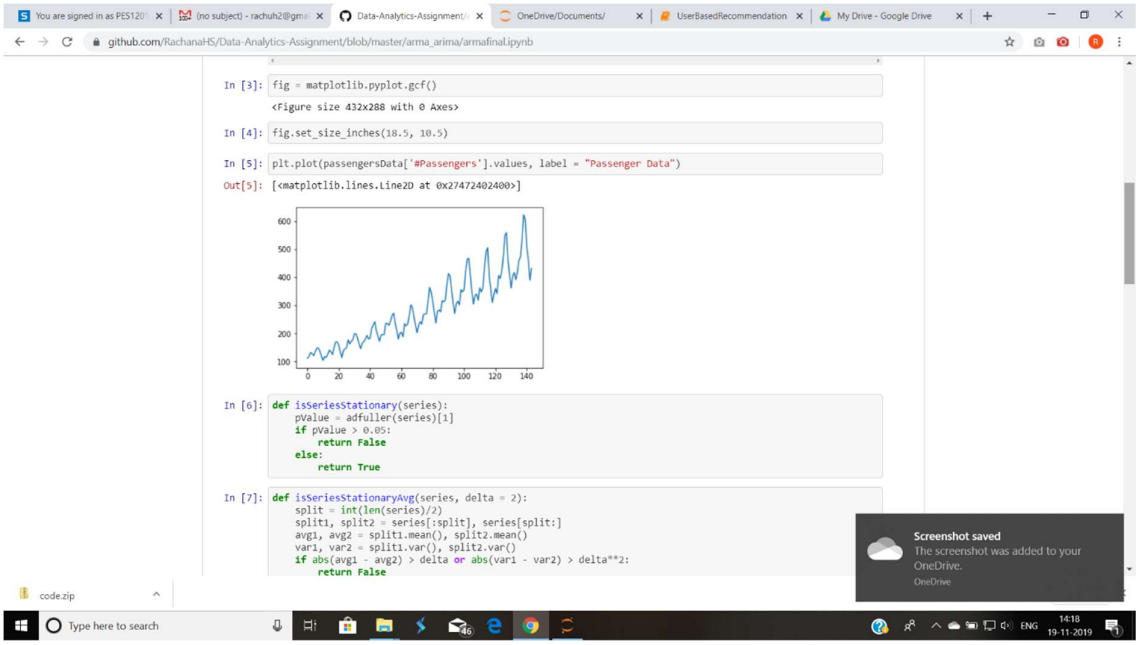
In [7]:
```
def isSeriesStationaryAvg(series, delta = 2):
    split = int(len(series)/2)
    split1, split2 = series[:split], series[split:]
    avg1, avg2 = split1.mean(), split2.mean()
    var1, var2 = split1.var(), split2.var()
    if abs(avg1 - avg2) > delta or abs(var1 - var2) > delta**2:
        return False
    else:
        return True
```

In [44]:
```
def difference(dataset, interval=1):
    diff = list()
    for i in range(interval, len(dataset)):
        value = dataset[i] - dataset[i - interval]
        diff.append(value)
    return np.array(diff)

def inverse_difference(history, yhat, interval=1):
    return yhat + history[-interval]

def describeSeries(data, label):
    fig = matplotlib.pyplot.gcf()
    fig.set_size_inches(18.5, 10.5)
    plt.plot(data, label = "Series")
    plt.plot(pd.rolling_mean(data, window = 2), '--', label = "Rolling mean")
    plt.plot(pd.rolling_std(data, 2), ":", label = "Rolling Std")
    plt.legend()
    plt.savefig(label)
    plt.clf()
```

In [45]:
```
def splitTrainTest(series, testSplit):
    totalData = len(series)
    trainSplit = int(totalData * (1 - testSplit))
    trainSet = series[:trainSplit]
    testSet = series[trainSplit:]
    return trainSet, testSet
```

In [46]:
```
isSeriesStationaryAvg(passengersData["#Passengers"].values)
```

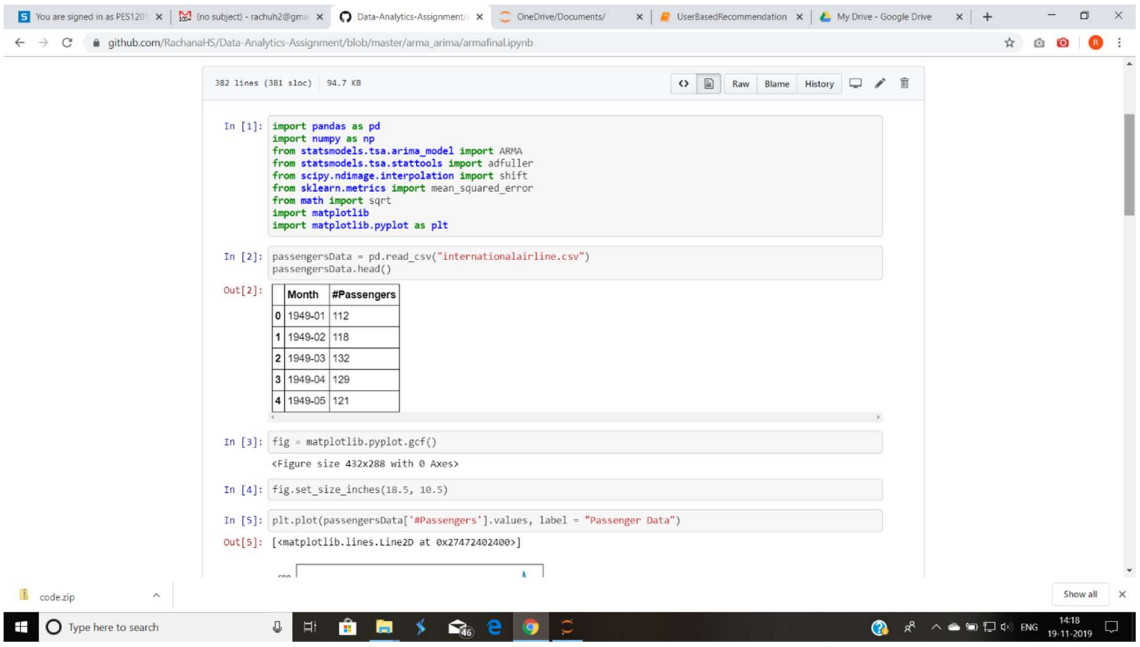
Out[46]: False



```
In [3]: fig = matplotlib.pyplot.gcf()
        <Figure size 432x288 with 0 Axes>

In [4]: fig.set_size_inches(18.5, 10.5)

In [5]: plt.plot(passengersData['#Passengers'].values, label = "Passenger Data")
Out[5]: [<matplotlib.lines.Line2D at 0x27472402400>]
```



```
In [6]: def isSeriesStationary(series):
            pValue = adfuller(series)[1]
            if pValue > 0.05:
                return False
            else:
                return True

In [7]: def isSeriesStationaryAvg(series, delta = 2):
            split = int(len(series)/2)
            split1, split2 = series[:split], series[split:]
            avg1, avg2 = split1.mean(), split2.mean()
            var1, var2 = split1.var(), split2.var()
            if abs(avg1 - avg2) > delta or abs(var1 - var2) > delta**2:
                return False
```

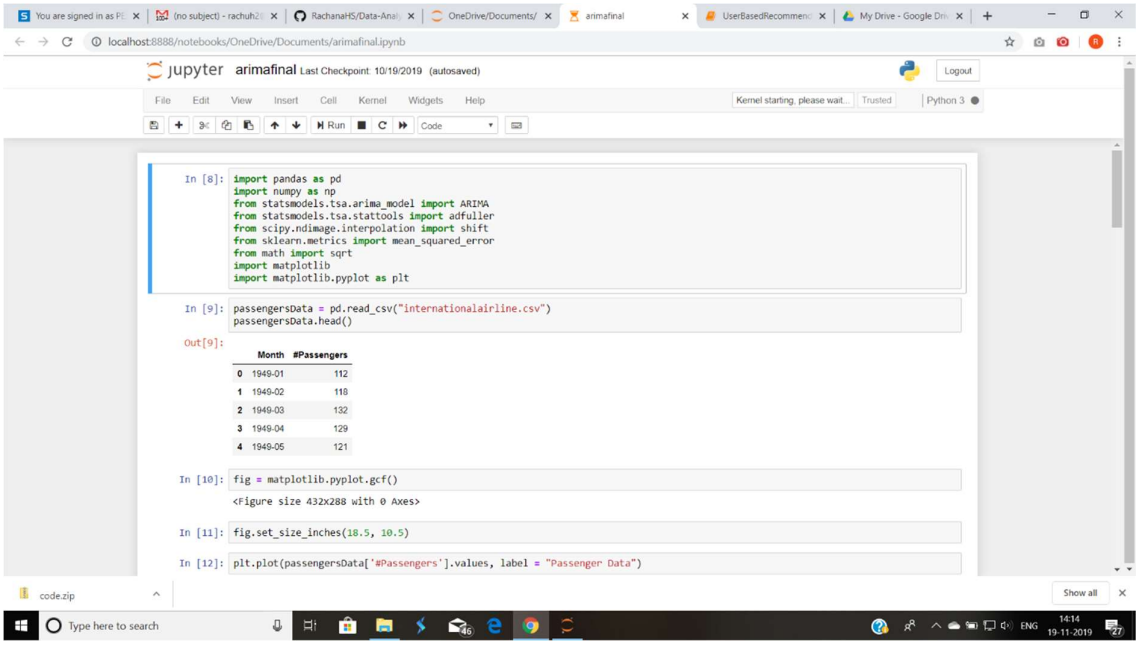
```
382 lines (381 sloc)  94.7 KB

In [1]: import pandas as pd
        import numpy as np
        from statsmodels.tsa.arima_model import ARMA
        from statsmodels.tsa.stattools import adfuller
        from scipy.ndimage.interpolation import shift
        from sklearn.metrics import mean_squared_error
        from math import sqrt
        import matplotlib
        import matplotlib.pyplot as plt

In [2]: passengersData = pd.read_csv("internationalairline.csv")
        passengersData.head()
```

Out[2]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121

```
In [3]: fig = matplotlib.pyplot.gcf()
        <Figure size 432x288 with 0 Axes>

In [4]: fig.set_size_inches(18.5, 10.5)

In [5]: plt.plot(passengersData['#Passengers'].values, label = "Passenger Data")
Out[5]: [<matplotlib.lines.Line2D at 0x27472402400>]
```


ARIMA



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Run Code

In [8]:
```
import pandas as pd
import numpy as np
from statsmodels.tsa.arima_model import ARIMA
from statsmodels.tsa.stattools import adfuller
from scipy.ndimage.interpolation import shift
from sklearn.metrics import mean_squared_error
from math import sqrt
import matplotlib
import matplotlib.pyplot as plt
```

In [9]:
```
passengersData = pd.read_csv("internationalairline.csv")
passengersData.head()
```

Out[9]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121

In [10]:
```
fig = matplotlib.pyplot.gcf()
```
```
<Figure size 432x288 with 0 Axes>
```

In [11]:
```
fig.set_size_inches(18.5, 10.5)
```

In [12]:
```
plt.plot(passengersData['#Passengers'].values, label = "Passenger Data")
```

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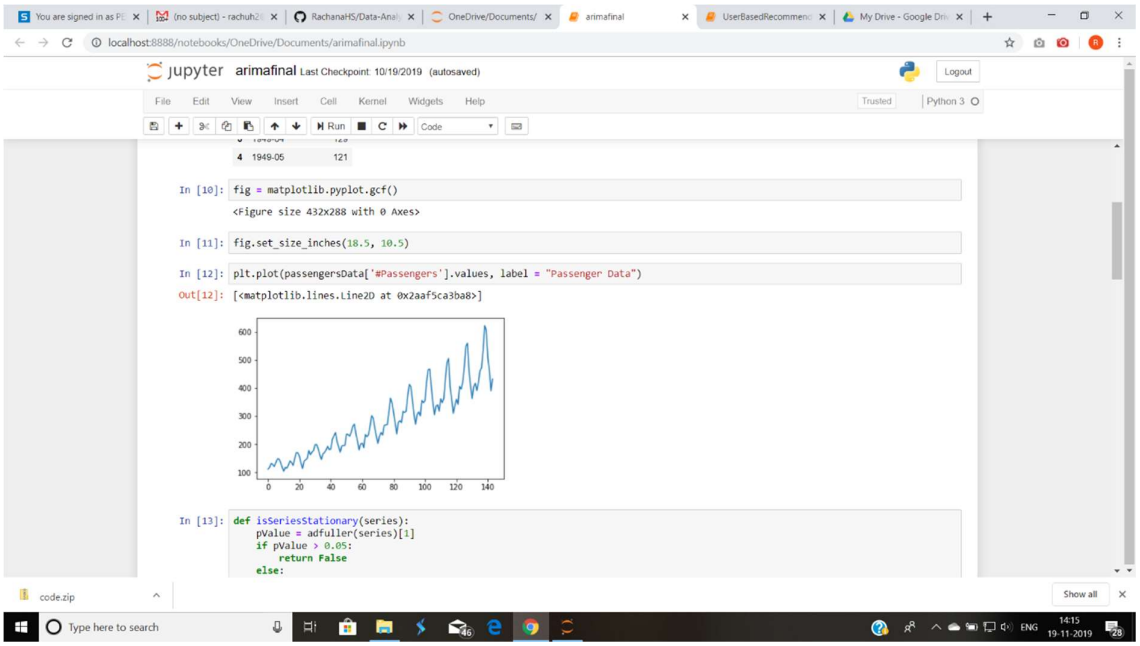

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Run Code

4	1949-05	121

In [10]:
```
fig = matplotlib.pyplot.gcf()
```
```
<Figure size 432x288 with 0 Axes>
```

In [11]:
```
fig.set_size_inches(18.5, 10.5)
```

In [12]:
```
plt.plot(passengersData['#Passengers'].values, label = "Passenger Data")
```

Out[12]:
```
[<matplotlib.lines.Line2D at 0x2aaf5ca3ba8>]
```


In [13]:
```
def isSeriesStationary(series):
    pValue = adfuller(series)[1]
    if pValue > 0.05:
        return False
    else:
```

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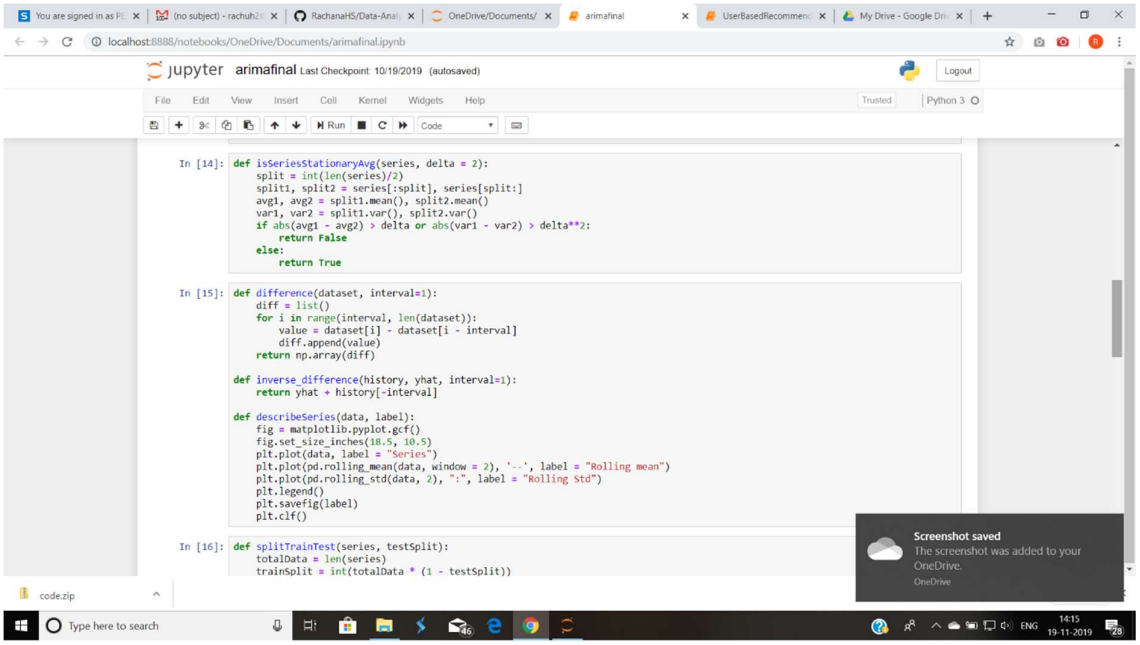

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Trusted Python 3

Run Code

In [14]:
```
def isSeriesStationaryAvg(series, delta = 2):
    split = int(len(series)/2)
    split1, split2 = series[:split], series[split:]
    avg1, avg2 = split1.mean(), split2.mean()
    var1, var2 = split1.var(), split2.var()
    if abs(avg1 - avg2) > delta or abs(var1 - var2) > delta**2:
        return False
    else:
        return True
```

In [15]:
```
def difference(dataset, interval=1):
    diff = list()
    for i in range(interval, len(dataset)):
        value = dataset[i] - dataset[i - interval]
        diff.append(value)
    return np.array(diff)

def inverse_difference(history, yhat, interval=1):
    return yhat + history[-interval]

def describeSeries(data, label):
    fig = matplotlib.pyplot.gcf()
    fig.set_size_inches(18.5, 10.5)
    plt.plot(data, label = "Series")
    plt.plot(pd.rolling_mean(data, window = 2), '--', label = "Rolling mean")
    plt.plot(pd.rolling_std(data, 2), ":", label = "Rolling Std")
    plt.legend()
    plt.savefig(label)
    plt.clf()
```

In [16]:
```
def splitTrainTest(series, testSplit):
    totalData = len(series)
    trainSplit = int(totalData * (1 - testSplit))
```

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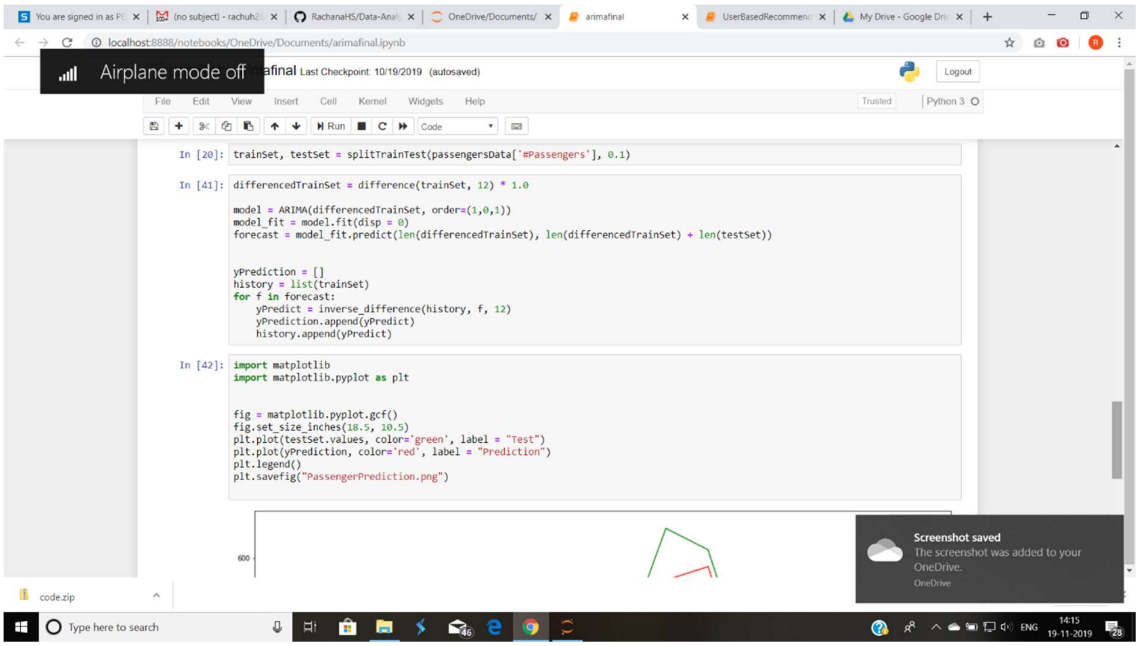

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Run Code

In [20]:
```
trainSet, testSet = splitTrainTest(passengersData['#Passengers'], 0.1)
```

In [41]:
```
differencedTrainSet = difference(trainSet, 12) * 1.0

model = ARIMA(differencedTrainSet, order=(1,0,1))
model_fit = model.fit(disp = 0)
forecast = model_fit.predict(len(differencedTrainSet), len(differencedTrainSet) + len(testSet))


yPrediction = []
history = list(trainSet)
for f in forecast:
    yPredict = inverse_difference(history, f, 12)
    yPrediction.append(yPredict)
    history.append(yPredict)
```

In [42]:
```
import matplotlib
import matplotlib.pyplot as plt


fig = matplotlib.pyplot.gcf()
fig.set_size_inches(18.5, 10.5)
plt.plot(testSet.values, color='green', label = "Test")
plt.plot(yPrediction, color='red', label = "Prediction")
plt.legend()
plt.savefig("PassengerPrediction.png")
```

600

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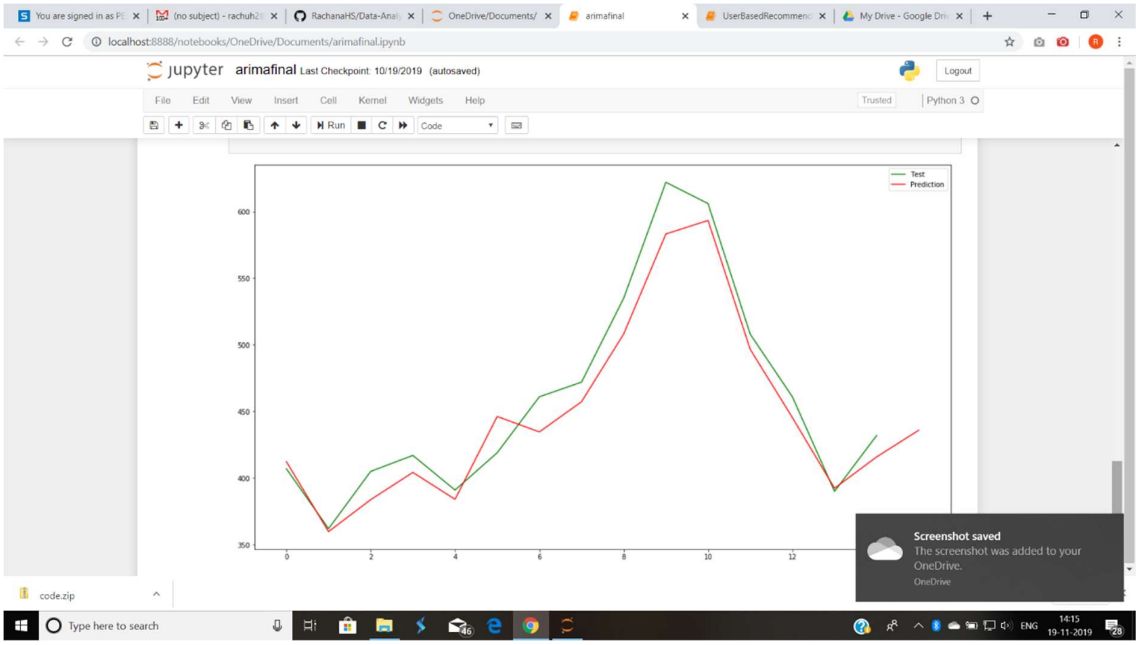
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Run
Code
Test
Prediction
600
550
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12
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