Challenge-2

March 24, 2018

```
In [141]: import pandas as pd
          import numpy as np
          from matplotlib import pyplot as plt
          from sklearn.preprocessing import normalize
          from pandas.tools.plotting import autocorrelation_plot
          from sklearn.model_selection import train_test_split
          from keras.models import Sequential
          from keras.layers import LSTM,Dense
          %matplotlib inline
```

```
In [3]: data=pd.read_csv("File-2.csv")
        data.head(12)
```

```
Out[3]:         Month   1992   1993   1994   1995   1996   1997   1998   1999   2000  \
        0     January   8414   7939   8847   8584   7371   7415   8404   7377   8980
        1    February   9767   9283   8614   8719   8921   8881   9704   7361  11120
        2       March  13805  12934  12169  17108  12462  11768  13326  11511  12918
        3       April  12987  13432  14481  14771  11772  11469  11136  12852  13286
        4         May  32190  28900  30002  31103  29342  24840  24642  28128  28798
        5        June  46383  43848  52654  45349  42663  41663  55157  46405  56459
        6        July  57570  54320  60910  52238  49202  57045  55844  54063  62448
        7      August  52261  49702  47948  41221  47947  47552  47127  45320  49569
        8   September  30125  32182  30847  27665  25626  29737  30434  31033  30584
        9     October  17522  17691  15916  18433  14684  15763  15558  18382  18436
        10   November  12651  11833  12785  10875  10979  10776  10571  14499  14724
        11   December   7285   8146   8307   7228   6808   7815   7380   9147  11649

             ...   2008   2009   2010   2011   2012   2013   2014   2015  2016  2017
        0    ...  12378  10930  12064  13609  13822  14435  15292  16312   NaN   NaN
        1    ...  14087  12184  11990  14386  13669  14024  17430  16139   NaN   NaN
        2    ...  17213  15920  16243  19980  20686  20637  21284  24687   NaN   NaN
        3    ...  21058  19076  18196  23672  21505  25723  23174  31056   NaN   NaN
        4    ...  32541  33115  34192  43832  42213  48097  47387  54275   NaN   NaN
        5    ...  41465  44528  44922  57579  61807  61712  64508  80087   NaN   NaN
        6    ...  54774  56094  63800  61226  66723  65568  70482  84381   NaN   NaN
        7    ...  46913  49274  62313  51320  58573  73357  63325  82593   NaN   NaN
        8    ...  34062  37426  36428  38122  39311  41881  43456  53472   NaN   NaN
```

```
9   ...   23399  23464  30162  27210  26704  25587  30639  30361   NaN   NaN
10  ...   20691  17849  20102  20289  20918  21752  22661  25436   NaN   NaN
11  ...   13114  26015  16374  15533  16665  16986  22941  23417   NaN   NaN

[12 rows x 27 columns]
```

In [4]:
```
data=data.drop(['Month'],axis=1)
```

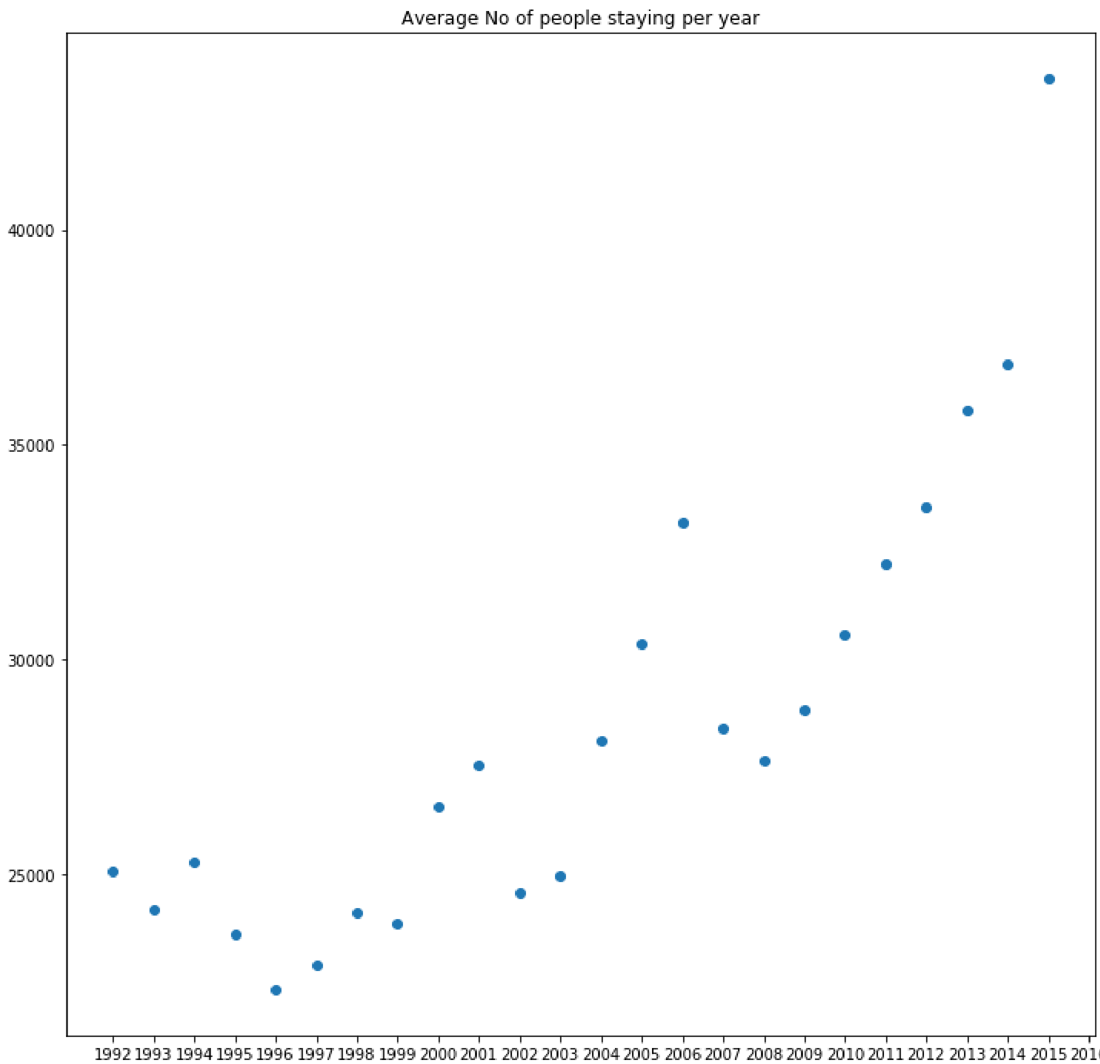
In [5]:
```
data.describe()
```

Out[5]:
```
              1992          1993          1994          1995          1996  \
count     12.00000     12.000000     12.000000     12.000000     12.000000
mean   25080.00000  24184.166667  25290.000000  23607.833333  22314.750000
std    18186.16863  17088.698817  18959.685915  15667.452667  16215.749029
min     7285.00000   7939.000000   8307.000000   7228.000000   6808.000000
25%    11930.00000  11195.500000  11338.500000  10336.000000  10464.500000
50%    15663.50000  15561.500000  15198.500000  17770.500000  13573.000000
75%    35738.25000  35098.500000  35122.250000  33632.500000  32672.250000
max    57570.00000  54320.000000  60910.000000  52238.000000  49202.000000

               1997          1998          1999          2000          2001  \
count     12.000000     12.000000     12.000000     12.000000     12.000000
mean   22893.666667  24106.916667  23839.833333  26580.916667  27545.750000
std    17300.951436  18625.949320  16793.889678  19237.015051  21559.770433
min     7415.000000   7380.000000   7361.000000   8980.000000   8179.000000
25%    10302.250000  10354.250000  10920.000000  12600.750000  11172.750000
50%    13765.500000  14442.000000  16440.500000  16580.000000  16001.000000
75%    32718.500000  34607.250000  34604.750000  35330.250000  38385.000000
max    57045.000000  55844.000000  54063.000000  62448.000000  64896.000000

       ...          2008          2009          2010          2011  \
count  ...     12.000000     12.000000     12.000000     12.000000
mean   ...  27641.250000  28822.916667  30565.500000  32229.833333
std    ...  14174.342506  15125.446196  18396.157709  17456.750493
min    ...  12378.000000  10930.000000  11990.000000  13609.000000
25%    ...  16431.500000  17366.750000  16341.250000  18868.250000
50%    ...  22228.500000  24739.500000  25132.000000  25441.000000
75%    ...  35912.750000  39201.500000  38551.500000  45704.000000
max    ...  54774.000000  56094.000000  63800.000000  61226.000000

               2012          2013          2014          2015  2016  2017
count     12.000000     12.000000     12.000000     12.000000   0.0   0.0
mean   33549.666667  35813.250000  36881.583333  43518.000000   NaN   NaN
std    19586.275869  21477.312868  20127.410679  26375.827391   NaN   NaN
min    13669.000000  14024.000000  15292.000000  16139.000000   NaN   NaN
25%    19680.750000  19724.250000  22316.750000  24369.500000   NaN   NaN
50%    24104.500000  25655.000000  26906.500000  30708.500000   NaN   NaN
75%    46303.000000  51500.750000  51371.500000  60728.000000   NaN   NaN
```

```
max     66723.000000  73357.000000  70482.000000  84381.000000   NaN   NaN

[8 rows x 26 columns]
```

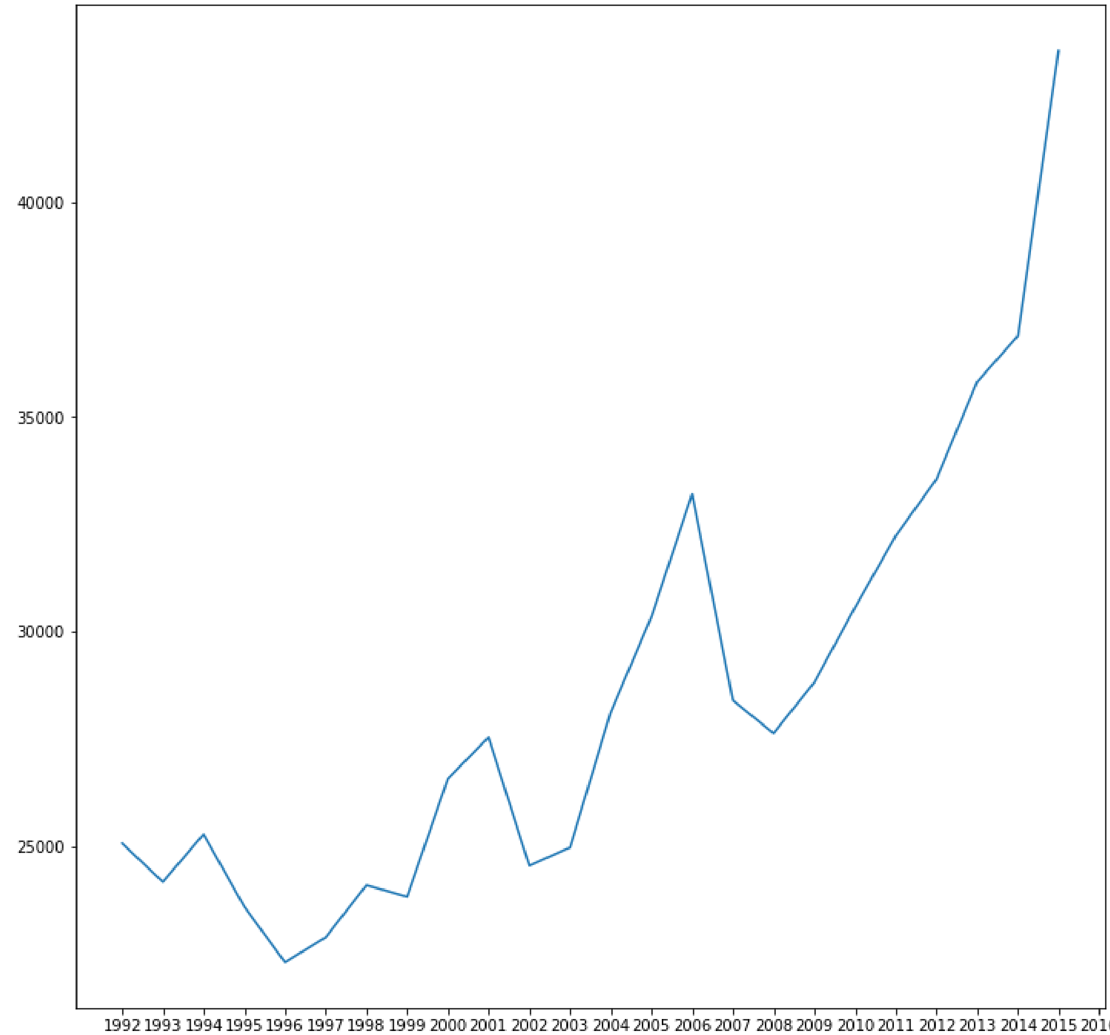
```
In [120]: plt.figure(figsize=(12,12))
          no=range(len(data.mean()))
          plt.scatter(list(data.columns.values),data.mean())
          plt.title("Average No of people staying per year")
```

```
Out[120]: Text(0.5,1,'Average No of people staying per year')
```



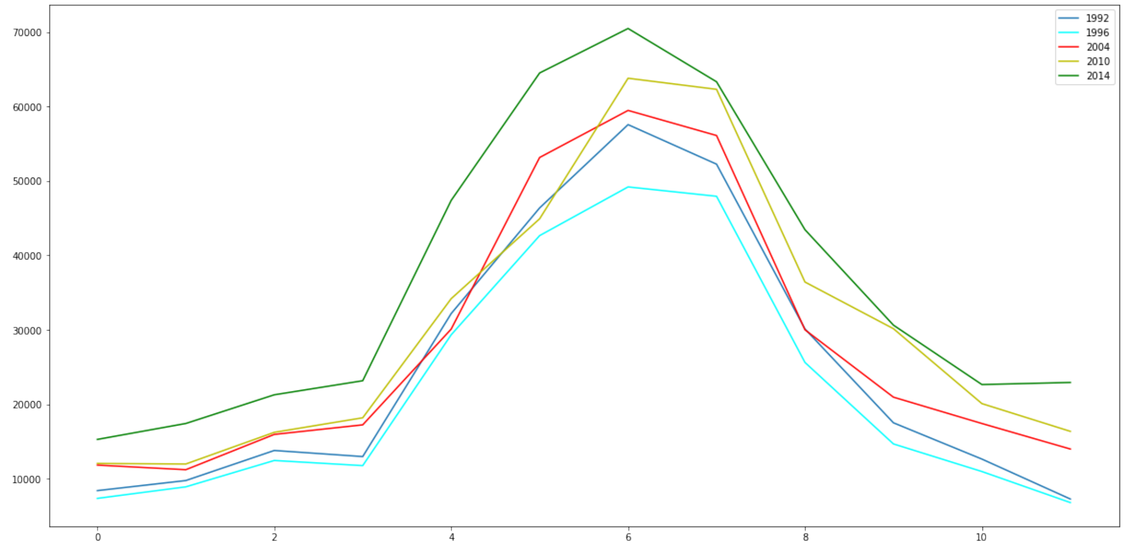

```
In [8]: plt.figure(figsize=(12,12))
        plt.plot(data.mean())
        plt.title("Average no of people visiting")
```

Out[8]: [<matplotlib.lines.Line2D at 0x1220c1c50>]




```
In [9]: plt.figure(figsize=(20,10))
        plt.plot(data['1992'])
        plt.plot(data['1996'],color='cyan')
        plt.plot(data['2004'],color='r')
        plt.plot(data['2010'],color='y')
        plt.plot(data['2014'],color='g')
        plt.legend()
```

Out[9]: <matplotlib.legend.Legend at 0x107e05828>

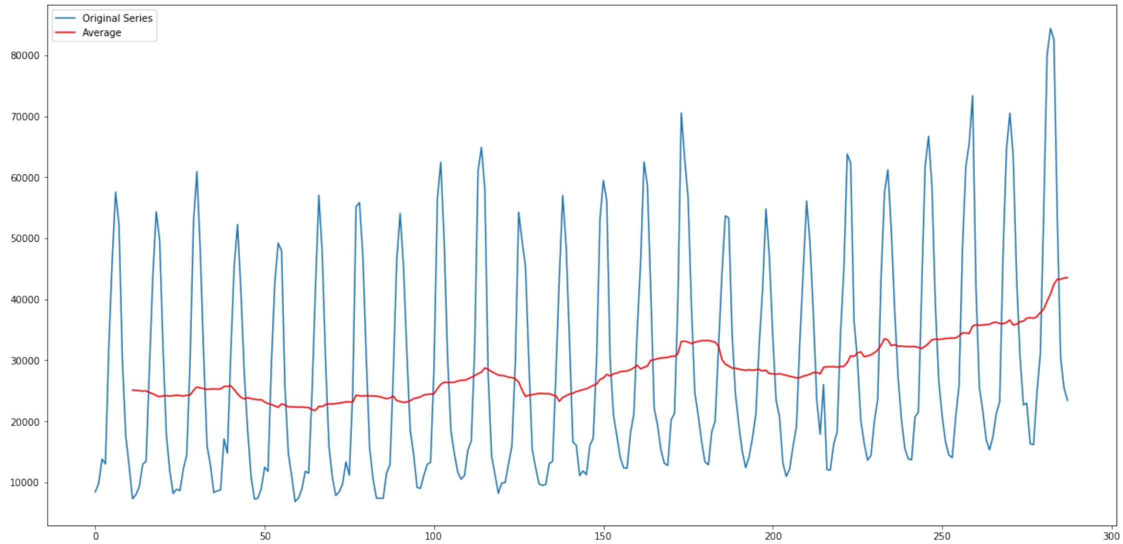



```
In [9]: dummy=[]
        for i in list(data.columns.values)[:-2]:
            dummy.append(list(data[i]))
        Series=[j for i in dummy for j in i]
```

```
In [160]: series=pd.Series(Series)
          moving_avg = pd.rolling_mean(series,12)
          plt.figure(figsize=(20,10))
          plt.plot(Series,label='Original Series')
          plt.plot(moving_avg,color='r',label='Average')
          plt.legend()
```

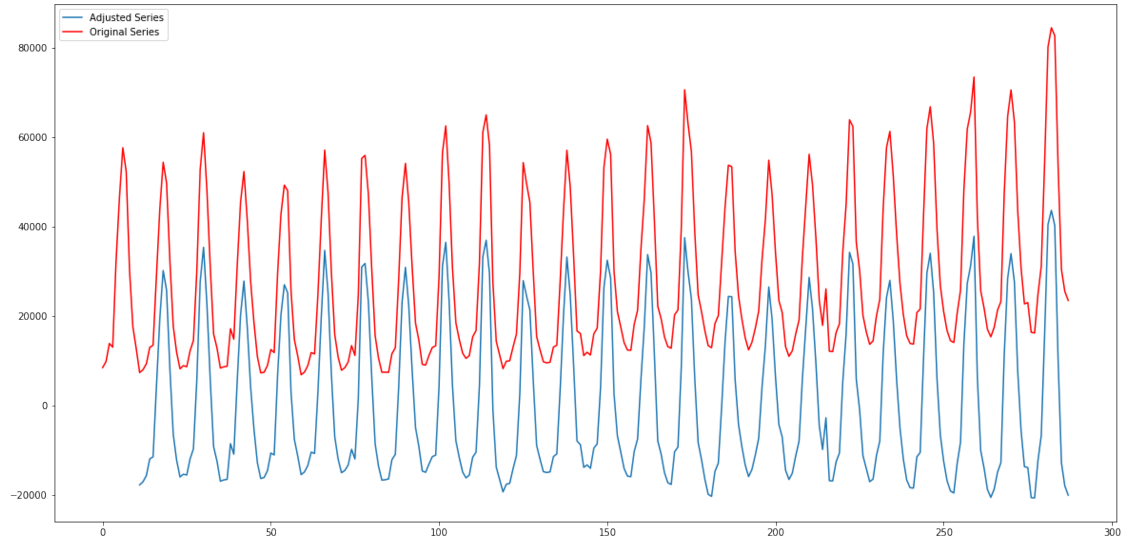
```
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:2: FutureWarning: pd.rolling_mean
        Series.rolling(window=12,center=False).mean()
```

```
Out[160]: <matplotlib.legend.Legend at 0x139421588>
```




```
In [161]: adjusted=series-moving_avg
          plt.figure(figsize=(20,10))
          plt.plot(adjusted,label='Adjusted Series')
          plt.plot(series,color='r',label='Original Series')
          plt.legend()
```

Out[161]: <matplotlib.legend.Legend at 0x139475da0>

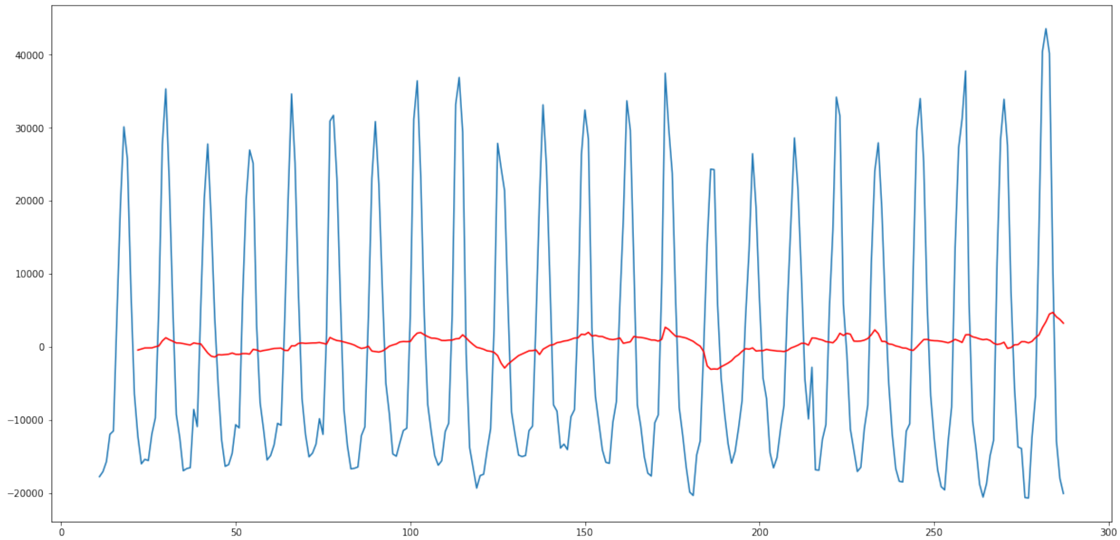



```
In [162]: moving_avg = pd.rolling_mean(adjusted,12)
          plt.figure(figsize=(20,10))
```

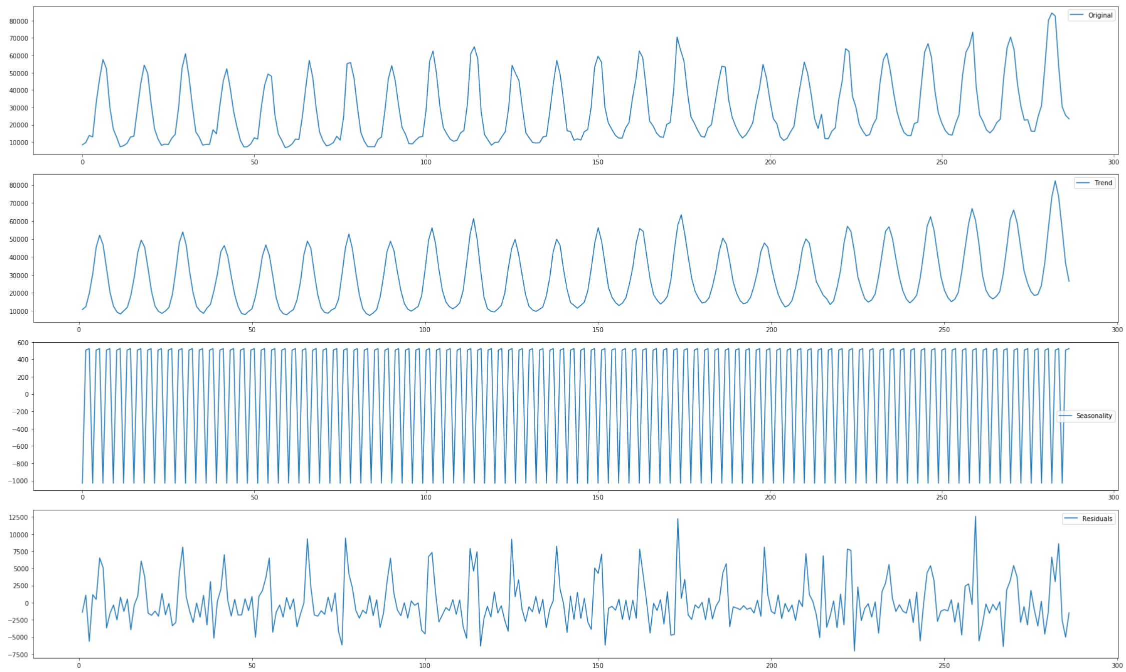
```
plt.plot(adjusted)
plt.plot(moving_avg,color='r')
```

```
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:1: FutureWarning: pd.rolling_mean
        Series.rolling(window=12,center=False).mean()
  """Entry point for launching an IPython kernel.
```

```
Out[162]: [<matplotlib.lines.Line2D at 0x13936f908>]
```



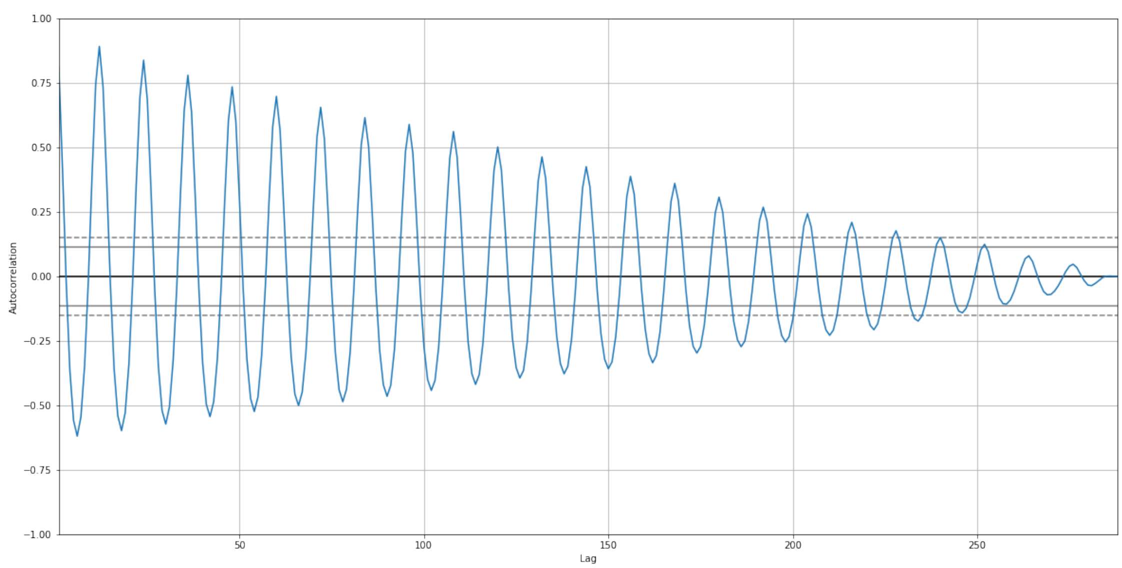

```
In [163]: from statsmodels.tsa.seasonal import seasonal_decompose
          decomposition = seasonal_decompose(np.asarray(series),freq=3)

          trend = decomposition.trend
          seasonal = decomposition.seasonal
          residual = decomposition.resid
          plt.figure(figsize=(25,15))
          plt.subplot(411)
          plt.plot(series, label='Original')
          plt.legend(loc='best')
          plt.subplot(412)
          plt.plot(trend, label='Trend')
          plt.legend(loc='best')
          plt.subplot(413)
          plt.plot(seasonal,label='Seasonality')
          plt.legend(loc='best')
          plt.subplot(414)
          plt.plot(residual, label='Residuals')
          plt.legend(loc='best')
          plt.tight_layout()
```




```
In [164]: plt.figure(figsize=(20,10))
          autocorrelation_plot(series)
```

```
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:2: FutureWarning: 'pandas.tools.pl
```

```
Out[164]: <matplotlib.axes._subplots.AxesSubplot at 0x13936ff28>
```



```
In [194]: inp=np.reshape(np.asarray(series[:-1]),(287,1))
          out=np.reshape(np.asarray(series[1:]),(287,1))
          mean=np.mean(inp)
```

```
In [195]: print(np.mean(inp))
          inp=inp/np.mean(inp)
          out=inp/np.mean(inp)
```

```
28521.728223
```

```
In [196]: X_train,X_test,Y_train,Y_test=train_test_split(inp,out,test_size=0.3)
```

```
In [197]: X_train = np.reshape(X_train, (X_train.shape[0], 1, 1))
          X_test = np.reshape(X_test, (X_test.shape[0], 1, 1))
```

```
In [198]: model = Sequential()
          model.add(LSTM(6, input_shape=(1, 1)))
          model.add(Dense(1))
          model.compile(loss='mean_squared_error', optimizer='adagrad')
          model.fit(X_train,Y_train, epochs=20, batch_size=1)
```

```
Epoch 1/20
200/200 [==============================] - 3s - loss: 0.4896
Epoch 2/20
200/200 [==============================] - 1s - loss: 0.2204
Epoch 3/20
200/200 [==============================] - 1s - loss: 0.1561
Epoch 4/20
200/200 [==============================] - 1s - loss: 0.1256
Epoch 5/20
200/200 [==============================] - 1s - loss: 0.1045
Epoch 6/20
200/200 [==============================] - 1s - loss: 0.0882
Epoch 7/20
200/200 [==============================] - 1s - loss: 0.0745
Epoch 8/20
200/200 [==============================] - 1s - loss: 0.0628
Epoch 9/20
200/200 [==============================] - 1s - loss: 0.0528
Epoch 10/20
200/200 [==============================] - 1s - loss: 0.0443
Epoch 11/20
200/200 [==============================] - 1s - loss: 0.0370
Epoch 12/20
200/200 [==============================] - 1s - loss: 0.0309
```

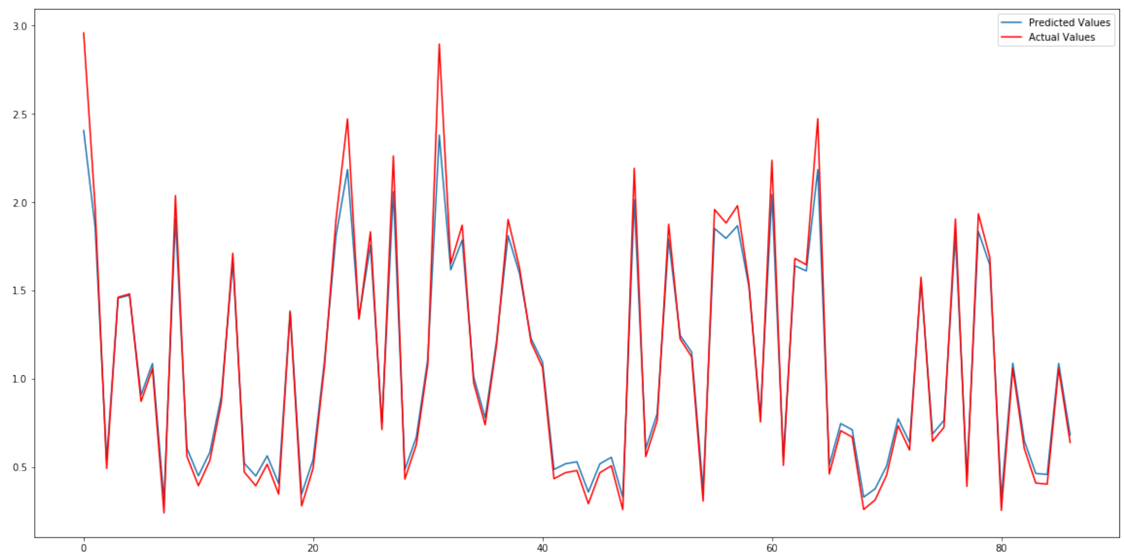
```
Epoch 13/20
200/200 [==============================] - 1s - loss: 0.0258
Epoch 14/20
200/200 [==============================] - 1s - loss: 0.0214
Epoch 15/20
200/200 [==============================] - 1s - loss: 0.0178
Epoch 16/20
200/200 [==============================] - 1s - loss: 0.0147
Epoch 17/20
200/200 [==============================] - 1s - loss: 0.0122
Epoch 18/20
200/200 [==============================] - 1s - loss: 0.0101
Epoch 19/20
200/200 [==============================] - 1s - loss: 0.0084
Epoch 20/20
200/200 [==============================] - 1s - loss: 0.0070
```

Out[198]: <keras.callbacks.History at 0x13dd8eb00>

In [199]:
```
preds=model.predict(X_test)
complete_pred=model.predict(X_train)
```

In [200]:
```
plt.figure(figsize=(20,10))
plt.plot(preds,label="Predicted Values")
plt.plot(Y_test,color='r',label="Actual Values")
plt.legend()
```

Out[200]: <matplotlib.legend.Legend at 0x13ffbc828>



In [ ]: