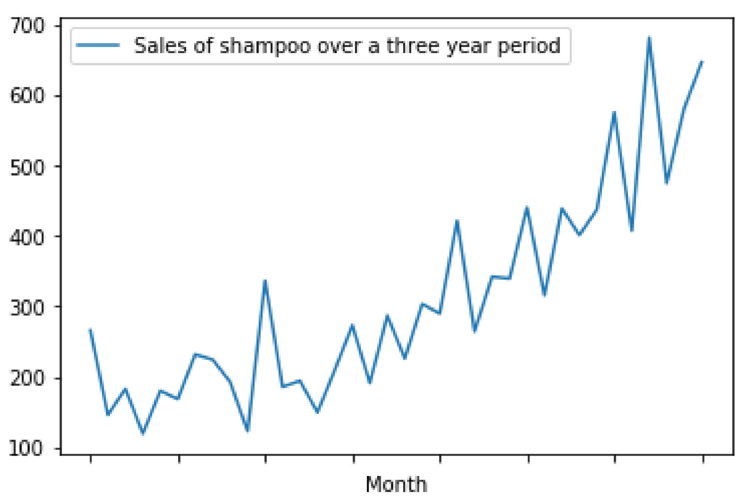
In this assignment students have to make ARIMA model over shampoo sales data and check the MSE between predicted and actual value. Student can download data in .csv format from the following link: https://datamarket.com/data/set/22r0/sales-of-shampoo-over-a-three-yearperiod#!ds=22r0&display=line (https://datamarket.com/data/set/22r0/sales-of-shampoo-over-a-three-yearperiod#!ds=22r0&display=line) Hint: Following is the command import packages and data from pandas import read_csv from pandas import datetime from matplotlib import pyplot from statsmodels.tsa.arima_model import ARIMA from sklearn.metrics import mean_squared_error def parser(x): return datetime.strptime('190'+x, '%Y-%m') series = read_csv('shampoo-sales.csv', header=0, parse_dates=[0], index_col=0, squeeze=True, date_parser=parser)

In [13]:
```
import pandas as pd
from pandas import datetime
from matplotlib import pyplot
from statsmodels.tsa.arima_model import ARIMA
from sklearn.metrics import mean_squared_error
def parser(x):
    return datetime.strptime('190'+x, '%Y-%m')
series = pd.read_csv(r'C:\Users\Annonymous-1\Desktop\sales-of-shampoo-over-a-three-ye.csv', header=0, parse_dates=True, index_col='Month')
series.head()
import warnings
warnings.filterwarnings('ignore')
```

In [14]:
```
series.dropna(axis=0, inplace=True)
```

In [15]:
```
series.plot()
pyplot.show()
```



In [16]:
```
# From here we can see that Shampoo sales data has a clear trend, that means t
ime series is not stationary and will require
# differencing to make it stationary.
X = series.values
X
```

Out[16]:
```
array([[266. ],
       [145.9],
       [183.1],
       [119.3],
       [180.3],
       [168.5],
       [231.8],
       [224.5],
       [192.8],
       [122.9],
       [336.5],
       [185.9],
       [194.3],
       [149.5],
       [210.1],
       [273.3],
       [191.4],
       [287. ],
       [226. ],
       [303.6],
       [289.9],
       [421.6],
       [264.5],
       [342.3],
       [339.7],
       [440.4],
       [315.9],
       [439.3],
       [401.3],
       [437.4],
       [575.5],
       [407.6],
       [682. ],
       [475.3],
       [581.3],
       [646.9]])
```

In [17]:
```
size = int(len(X) * 0.60)
print(len(X))
print(size)
```

```
36
21
```

In [18]:
```
train, test = X[0:size], X[size:len(X)]
```

In [19]:
```python
history = [x for x in train]
predictions = list()
for t in range(len(test)):
    model = ARIMA(history, order=(5,1,0))
    model_fit = model.fit(disp=0)
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
error = mean_squared_error(test, predictions)
print('Test MSE: %.3f' % error)
```

```
predicted=272.964466, expected=421.600000
predicted=290.313820, expected=264.500000
predicted=349.117712, expected=342.300000
predicted=306.512952, expected=339.700000
predicted=387.376449, expected=440.400000
predicted=348.154255, expected=315.900000
predicted=386.308818, expected=439.300000
predicted=356.082087, expected=401.300000
predicted=446.379462, expected=437.400000
predicted=394.737224, expected=575.500000
predicted=434.915402, expected=407.600000
predicted=507.923547, expected=682.000000
predicted=435.482779, expected=475.300000
predicted=652.743826, expected=581.300000
predicted=546.343519, expected=646.900000
Test MSE: 7547.806
```

In [20]:
```python
pyplot.plot(test)
pyplot.plot(predictions, color='red')
pyplot.show()
```