In [0]:

```
ls
```

```
apple_data.csv  drive/  sample_data/
```

In [0]:

```
#Moving Average
```

In [0]:

```
# importing libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# reading the data
df = pd.read_csv('apple_data.csv')

# looking at the first five rows of the data
print(df.head())
print('\n Shape of the data:')
print(df.shape)

# setting the index as date
df['date'] = pd.to_datetime(df.date,format='%d-%m-%Y')
df.index = df['date']

#creating dataframe with date and the target variable
data = df.sort_index(ascending=True, axis=0)
new_data = pd.DataFrame(index=range(0,len(df)),columns=['date', 'close'])

for i in range(0,len(data)):
     new_data['date'][i] = data['date'][i]
     new_data['close'][i] = data['close'][i]

# NOTE: While splitting the data into train and validation set, we cannot use random splitting since that will destroy the time component. So here we have set the last year’s data into validation and the 4 years’ data before that into train set.

# splitting into train and validation
train = new_data[:987]
valid = new_data[987:]

# shapes of training set
print('\n Shape of training set:')
print(train.shape)

# shapes of validation set
print('\n Shape of validation set:')
print(valid.shape)

# In the next step, we will create predictions for the validation set and check the RMSE using the actual values.
# making predictions
preds = []
for i in range(0,valid.shape[0]):
    a = train['close'][len(train)-248+i:].sum() + sum(preds)
    b = a/248
    preds.append(b)

# checking the results (RMSE value)
rms=np.sqrt(np.mean(np.power((np.array(valid['close'])-preds),2)))
print('\n RMSE value on validation set:')
print(rms)
```

```
         date symbol        open  ...  close - open     eps ratio      pe ratio
0  06-04-2015   AAPL  124.470001  ...      2.879997  7.740000e-08  1.646740e+09
1  16-11-2015   AAPL  111.379997  ...      2.800003  7.350000e-08  1.554752e+09
2  09-12-2014   AAPL  110.190002  ...      3.930001  6.530000e-08  1.751087e+09
3  04-12-2015   AAPL  115.290001  ...      3.739998  6.470000e-08  1.842222e+09
4  10-08-2015   AAPL  116.529999  ...      3.190002  5.810000e-08  2.066971e+09

[5 rows x 10 columns]

 Shape of the data:
(1508, 10)

 Shape of training set:
(987, 2)

 Shape of validation set:
(521, 2)

 RMSE value on validation set:
34.69765254799593
```

In [0]:

```
#plot
valid['Predictions'] = 0
valid['Predictions'] = preds
plt.plot(train['close'])
plt.plot(valid[['close', 'Predictions']])
```

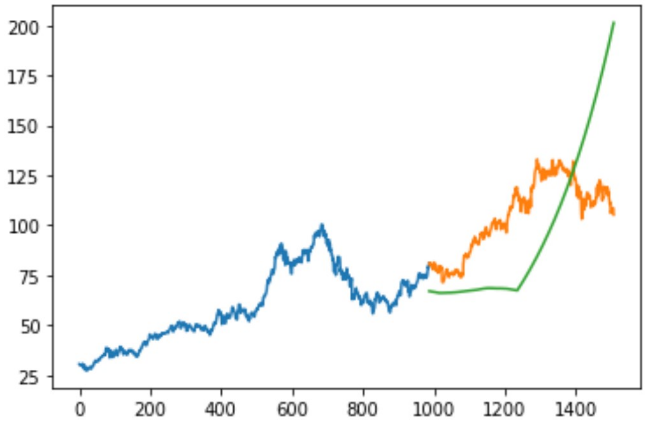
```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:2: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
```

Out[0]:

```
[<matplotlib.lines.Line2D at 0x7f48873ec4e0>,
 <matplotlib.lines.Line2D at 0x7f48873ec5f8>]
```



In [0]:
```
#plot
valid['Predictions'] = 0
valid['Predictions'] = preds

valid.index = new_data[987:].index
train.index = new_data[:987].index

plt.plot(train['close'])
plt.plot(valid[['close', 'Predictions']])
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

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A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
```
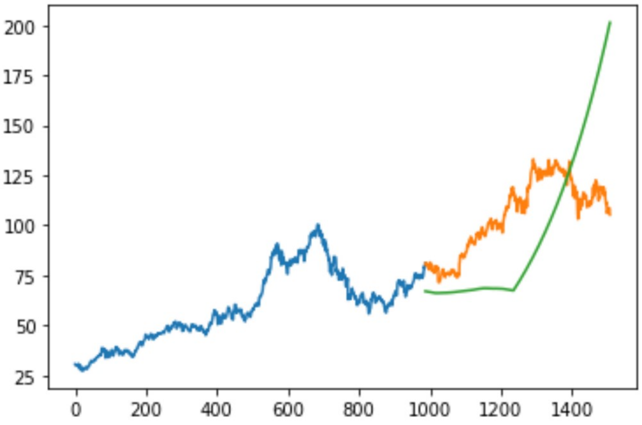

Out[0]:
```
[<matplotlib.lines.Line2D at 0x7f4886f31a90>,
 <matplotlib.lines.Line2D at 0x7f4886f4e7f0>]
```



In [0]:
```
#linear regression
```

In [0]:
```
#setting index as date values
df['date'] = pd.to_datetime(df.date,format='%d-%m-%Y')
df.index = df['date']

#sorting
data = df.sort_index(ascending=True, axis=0)

#creating a separate dataset
new_data = pd.DataFrame(index=range(0,len(df)),columns=['date', 'close'])

for i in range(0,len(data)):
    new_data['date'][i] = data['date'][i]
    new_data['close'][i] = data['close'][i]
```

In [0]:

```
#create features
from fastai.structured import  add_datepart
add_datepart(new_data, 'date')
new_data.drop('Elapsed', axis=1, inplace=True)  #elapsed will be the time stamp
```

In [0]:

```
new_data['mon_fri'] = 0
for i in range(0,len(new_data)):
    if (new_data['Dayofweek'][i] == 0 or new_data['Dayofweek'][i] == 4):
        new_data['mon_fri'][i] = 1
    else:
        new_data['mon_fri'][i] = 0
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:4: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:6: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
```

In [0]:

```
#split into train and validation
train = new_data[:987]
valid = new_data[987:]

x_train = train.drop('close', axis=1)
y_train = train['close']
x_valid = valid.drop('close', axis=1)
y_valid = valid['close']

#implement linear regression
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train,y_train)
```

Out[0]:

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

In [0]:

```
#make predictions and find the rmse
preds = model.predict(x_valid)
rms=np.sqrt(np.mean(np.power((np.array(y_valid)-np.array(preds)),2)))
rms
```

Out[0]:

```
18.78211155292696
```

In [0]:

```
#plot
valid['Predictions'] = 0
valid['Predictions'] = preds

valid.index = new_data[987:].index
train.index = new_data[:987].index

plt.plot(train['close'])
plt.plot(valid[['close', 'Predictions']])
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
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/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:2: SettingWithCopyW
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See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
```
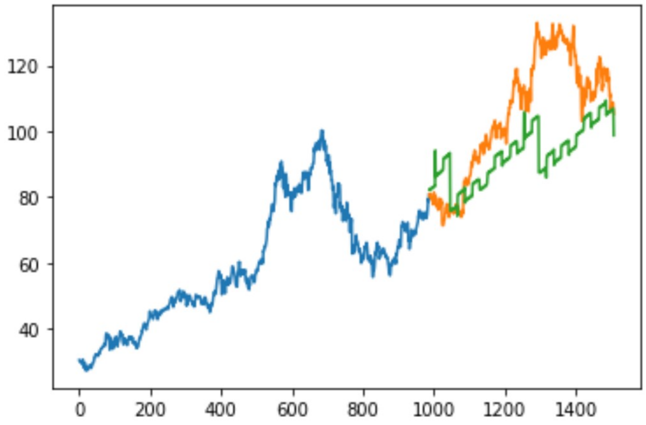

Out[0]:

```
[<matplotlib.lines.Line2D at 0x7f4886ed6048>,
 <matplotlib.lines.Line2D at 0x7f4886ed6fd0>]
```



In [0]:

```
#knearest neighbors
```

In [0]:

```
#importing libraries
from sklearn import neighbors
from sklearn.model_selection import GridSearchCV
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler(feature_range=(0, 1))
```

In [0]:

```
#scaling data
x_train_scaled = scaler.fit_transform(x_train)
x_train = pd.DataFrame(x_train_scaled)
x_valid_scaled = scaler.fit_transform(x_valid)
x_valid = pd.DataFrame(x_valid_scaled)

#using gridsearch to find the best parameter
params = {'n_neighbors':[2,3,4,5,6,7,8,9]}
knn = neighbors.KNeighborsRegressor()
model = GridSearchCV(knn, params, cv=5)

#fit the model and make predictions
model.fit(x_train,y_train)
preds = model.predict(x_valid)
```

In [0]:

```
#rmse
rms=np.sqrt(np.mean(np.power((np.array(y_valid)-np.array(preds)),2)))
rms
```

Out[0]:

```
43.93560649035426
```

In [0]:

```
#plot
valid['Predictions'] = 0
valid['Predictions'] = preds
plt.plot(valid[['close', 'Predictions']])
plt.plot(train['close'])
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: SettingWithCopyW
arning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
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See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stab
le/user_guide/indexing.html#returning-a-view-versus-a-copy
```
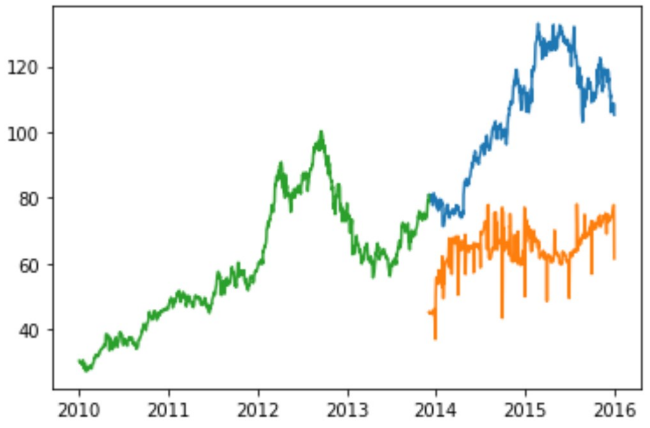

Out[0]:

```
[<matplotlib.lines.Line2D at 0x7f4879f4ba58>]
```



In [0]:

```
#Auto ARIMA
```

In [0]:

```
#auto arima
from pyramid.arima import auto_arima

data = df.sort_index(ascending=True, axis=0)

train = data[:987]
valid = data[987:]

training = train['close']
validation = valid['close']

model = auto_arima(training, start_p=1, start_q=1,max_p=3, max_q=3, m=12,start_P=0,
seasonal=True,d=1, D=1, trace=True,error_action='ignore',suppress_warnings=True)
model.fit(training)

forecast = model.predict(n_periods=521)
forecast = pd.DataFrame(forecast,index = valid.index,columns=['Prediction'])
```

```
Fit ARIMA: order=(1, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=3031.690, BIC=3056.
097, Fit time=16.058 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 0, 12); AIC=3651.944, BIC=3661.
707, Fit time=0.087 seconds
Fit ARIMA: order=(1, 1, 0) seasonal_order=(1, 1, 0, 12); AIC=3358.055, BIC=3377.
580, Fit time=1.771 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=3029.835, BIC=3049.
361, Fit time=13.845 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(1, 1, 1, 12); AIC=3031.835, BIC=3056.
242, Fit time=13.027 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 0, 12); AIC=3653.883, BIC=3668.
527, Fit time=0.524 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 2, 12); AIC=3031.836, BIC=3056.
243, Fit time=28.128 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(1, 1, 2, 12); AIC=3027.948, BIC=3057.
236, Fit time=22.227 seconds
Fit ARIMA: order=(1, 1, 1) seasonal_order=(1, 1, 2, 12); AIC=3029.851, BIC=3064.
021, Fit time=34.769 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(1, 1, 2, 12); AIC=3026.460, BIC=3050.
867, Fit time=16.797 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 2, 12); AIC=3030.372, BIC=3049.
898, Fit time=24.523 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(2, 1, 2, 12); AIC=3027.241, BIC=3056.
529, Fit time=19.684 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(1, 1, 1, 12); AIC=3030.373, BIC=3049.
898, Fit time=7.378 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 1, 12); AIC=3028.390, BIC=3043.
034, Fit time=4.489 seconds
Fit ARIMA: order=(1, 1, 0) seasonal_order=(1, 1, 2, 12); AIC=3027.970, BIC=3057.
258, Fit time=21.957 seconds
Total fit time: 225.273 seconds
```

In [0]:

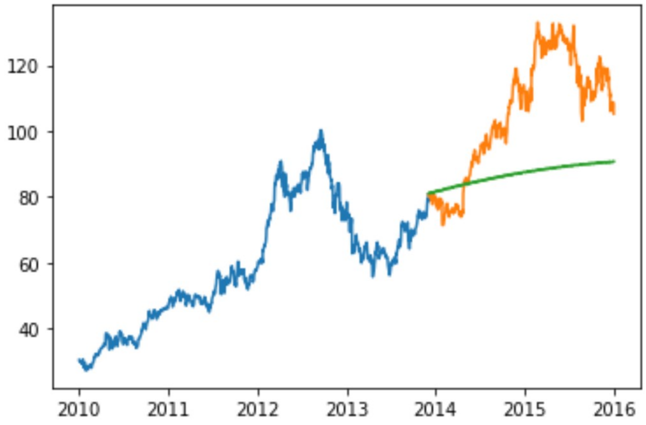
```
rms=np.sqrt(np.mean(np.power((np.array(valid['close'])-np.array(forecast['Predictio
n'])),2)))
rms
```

Out[0]:

```
24.05347913916104
```

```
In [0]: #plot
        plt.plot(train['close'])
        plt.plot(valid['close'])
        plt.plot(forecast['Prediction'])
```

```
Out[0]: [<matplotlib.lines.Line2D at 0x7f4879cfdef0>]
```



```
In [0]:
```