In [1]:
```
ls
```

```
ebay_data.csv  sample_data/
```

In [0]:
```
#Moving Average
```

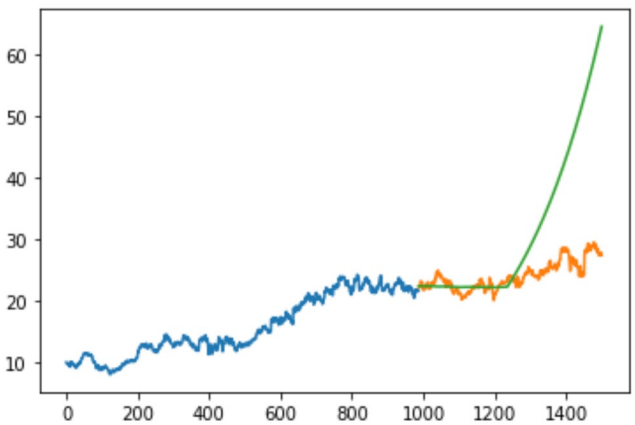
In [2]:
```
# importing libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# reading the data
df = pd.read_csv('ebay_data.csv')

# 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 rando
m splitting since that will destroy the time component. So here we have set the las
t 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  ...     pe ratio  pe_ratio  eps_ratio
0  24-11-2015   EBAY  28.420000  ...  390881193.1  3.908812       7.47
1  02-11-2015   EBAY  27.730000  ...  418758789.6  4.187588       6.81
2  04-12-2015   EBAY  28.719999  ...  472307315.4  4.723073       6.26
3  16-09-2015   EBAY  26.000000  ...  471042195.9  4.710422       5.68
4  12-10-2015   EBAY  24.040001  ...  467890714.7  4.678907       5.26

[5 rows x 12 columns]

 Shape of the data:
(1500, 12)

 Shape of training set:
(987, 2)

 Shape of validation set:
(513, 2)

 RMSE value on validation set:
12.719048838818077
```

In [3]:
```
#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
```

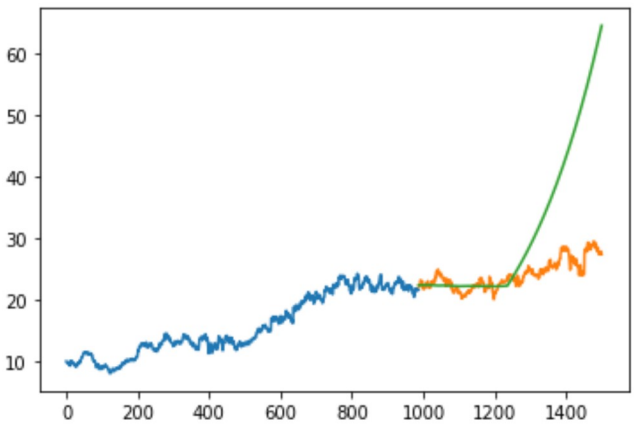
Out[3]:
```
[<matplotlib.lines.Line2D at 0x7fba2c5d6978>,
 <matplotlib.lines.Line2D at 0x7fba2c5d6a90>]
```



In [4]:
```
#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
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[4]:
```
[<matplotlib.lines.Line2D at 0x7fba2c0b8278>,
 <matplotlib.lines.Line2D at 0x7fba2c0b8390>]
```



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 [6]:
```
#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
```

```
/usr/local/lib/python3.6/dist-packages/sklearn/utils/deprecation.py:144: FutureW
arning: The sklearn.ensemble.forest module is  deprecated in version 0.22 and wi
ll be removed in version 0.24. The corresponding classes / functions should inst
ead be imported from sklearn.ensemble. Anything that cannot be imported from skl
earn.ensemble is now part of the private API.
  warnings.warn(message, FutureWarning)
```

In [7]:
```
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 [8]:
```
#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[8]:
```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

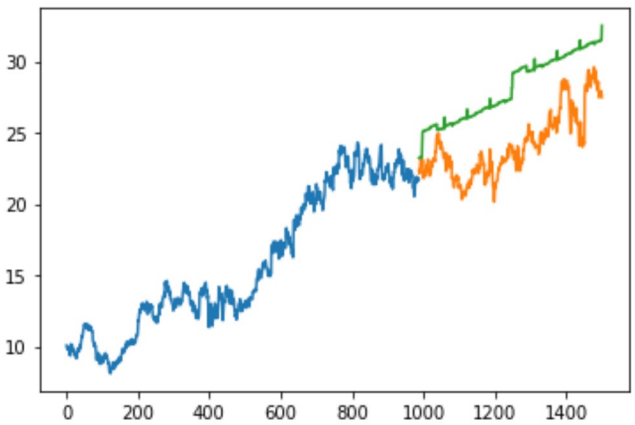
In [9]:
```
#make predictions and find the rmse
preds = model.predict(x_valid)
rms=np.sqrt(np.mean(np.power((np.array(y_valid)-np.array(preds)),2)))
rms
```

Out[9]:
```
4.244193425780009
```

In [10]:
```
#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
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[10]:
```
[<matplotlib.lines.Line2D at 0x7fba1b16a2e8>,
 <matplotlib.lines.Line2D at 0x7fba1b16a400>]
```



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)
```

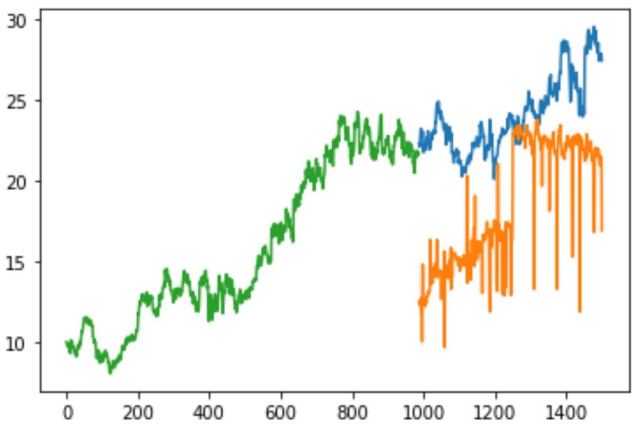
In [13]:
```
#rmse
rms=np.sqrt(np.mean(np.power((np.array(y_valid)-np.array(preds)),2)))
rms
```

Out[13]:
```
6.3016049595531545
```

In [14]:
```
#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.
/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[14]:
```
[<matplotlib.lines.Line2D at 0x7fba1d1bc908>]
```



In [0]:
```
#Auto ARIMA
```

In [16]:
```
#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=513)
forecast = pd.DataFrame(forecast,index = valid.index,columns=['Prediction'])
```

```
Fit ARIMA: order=(1, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=542.801, BIC=567.20
8, Fit time=14.346 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 0, 12); AIC=1202.944, BIC=1212.
707, Fit time=0.529 seconds
Fit ARIMA: order=(1, 1, 0) seasonal_order=(1, 1, 0, 12); AIC=889.182, BIC=908.70
8, Fit time=4.041 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=548.010, BIC=567.53
6, Fit time=9.919 seconds
Fit ARIMA: order=(1, 1, 1) seasonal_order=(1, 1, 1, 12); AIC=545.357, BIC=574.64
6, Fit time=17.370 seconds
Fit ARIMA: order=(1, 1, 1) seasonal_order=(0, 1, 0, 12); AIC=1155.119, BIC=1174.
645, Fit time=5.818 seconds
Fit ARIMA: order=(1, 1, 1) seasonal_order=(0, 1, 2, 12); AIC=547.049, BIC=576.33
8, Fit time=37.379 seconds
Fit ARIMA: order=(1, 1, 1) seasonal_order=(1, 1, 2, 12); AIC=546.763, BIC=580.93
3, Fit time=52.194 seconds
Fit ARIMA: order=(2, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=545.063, BIC=574.35
1, Fit time=18.171 seconds
Fit ARIMA: order=(1, 1, 0) seasonal_order=(0, 1, 1, 12); AIC=548.089, BIC=567.61
5, Fit time=11.915 seconds
Fit ARIMA: order=(1, 1, 2) seasonal_order=(0, 1, 1, 12); AIC=545.239, BIC=574.52
7, Fit time=17.806 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 1, 12); AIC=547.729, BIC=562.37
3, Fit time=6.774 seconds
Fit ARIMA: order=(2, 1, 2) seasonal_order=(0, 1, 1, 12); AIC=545.924, BIC=580.09
4, Fit time=20.695 seconds
Total fit time: 216.966 seconds
```

In [18]:
```
rms=np.sqrt(np.mean(np.power((np.array(valid['close'])-np.array(forecast['Predictio
n'])),2)))
rms
```

Out[18]:
```
1.476733921953927
```

In [19]:
```
#plot
plt.plot(train['close'])
plt.plot(valid['close'])
plt.plot(forecast['Prediction'])
```

Out[19]:
```
[<matplotlib.lines.Line2D at 0x7fba1adfb5c0>]
```

In [0]: