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LAB-8 Pandas Time Series Analysis

In [2]:
```
import pandas as pd
from dateutil.parser import parse
import matplotlib.pyplot as plt
```

In [3]:
```
plt.style.use('fivethirtyeight')
plt.show()
```

In [4]:
```
data=pd.read_csv('amazon_stock.csv')
```

Inspect top 10 rows

In [5]:
```
data.head(10)
```

Out[5]:

	None	ticker	Date	Open	High	Low	Close	Volume	Adj_Close
0	0	AMZN	3/27/2018	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
1	1	AMZN	3/26/2018	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2	2	AMZN	3/23/2018	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
3	3	AMZN	3/22/2018	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
4	4	AMZN	3/21/2018	1586.45	1590.00	1563.17	1581.86	4667291	1581.86
5	5	AMZN	3/20/2018	1550.34	1587.00	1545.41	1586.51	4507049	1586.51
6	6	AMZN	3/19/2018	1554.53	1561.66	1525.35	1544.93	6376619	1544.93
7	7	AMZN	3/16/2018	1583.45	1589.44	1567.50	1571.68	5145054	1571.68
8	8	AMZN	3/15/2018	1595.00	1596.91	1578.11	1582.32	4026744	1582.32
9	9	AMZN	3/14/2018	1597.00	1606.44	1590.89	1591.00	4164395	1591.00

Remove unwanted columns

In [6]:
```
data.drop(['None','ticker'], axis=1, inplace=True)
```

In [7]:

```
data.head()
```

Out[7]:

	Date	Open	High	Low	Close	Volume	Adj_Close
0	3/27/2018	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
1	3/26/2018	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2	3/23/2018	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
3	3/22/2018	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
4	3/21/2018	1586.45	1590.00	1563.17	1581.86	4667291	1581.86

In [8]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1316 entries, 0 to 1315
Data columns (total 7 columns):
Date         1316 non-null object
Open         1316 non-null float64
High         1316 non-null float64
Low          1316 non-null float64
Close        1316 non-null float64
Volume       1316 non-null int64
Adj_Close    1316 non-null float64
dtypes: float64(5), int64(1), object(1)
memory usage: 72.0+ KB
```

Inspect the datatypes of columns #Convert "Date" string column into actual Date object

In [9]:

```
data=pd.read_csv('amazon_stock.csv',parse_dates=['Date'])
```

In [11]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1316 entries, 0 to 1315
Data columns (total 7 columns):
Date         1316 non-null datetime64[ns]
Open         1316 non-null float64
High         1316 non-null float64
Low          1316 non-null float64
Close        1316 non-null float64
Volume       1316 non-null int64
Adj_Close    1316 non-null float64
dtypes: datetime64[ns](1), float64(5), int64(1)
memory usage: 72.0 KB
```

In [12]:
```
data.head()
```

Out[12]:

	Date	Open	High	Low	Close	Volume	Adj_Close
0	2018-03-27	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
1	2018-03-26	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2	2018-03-23	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
3	2018-03-22	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
4	2018-03-21	1586.45	1590.00	1563.17	1581.86	4667291	1581.86

In [13]:
```
data.set_index('Date',inplace=True)
```

In [14]:
```
data.head()
```

Out[14]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
2018-03-26	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2018-03-23	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
2018-03-22	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
2018-03-21	1586.45	1590.00	1563.17	1581.86	4667291	1581.86

In [35]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1316 entries, 2018-03-27 to 2013-01-02
Data columns (total 6 columns):
Open         1316 non-null float64
High         1316 non-null float64
Low          1316 non-null float64
Close        1316 non-null float64
Volume       1316 non-null int64
Adj_Close    1316 non-null float64
dtypes: float64(5), int64(1)
memory usage: 112.0 KB
```

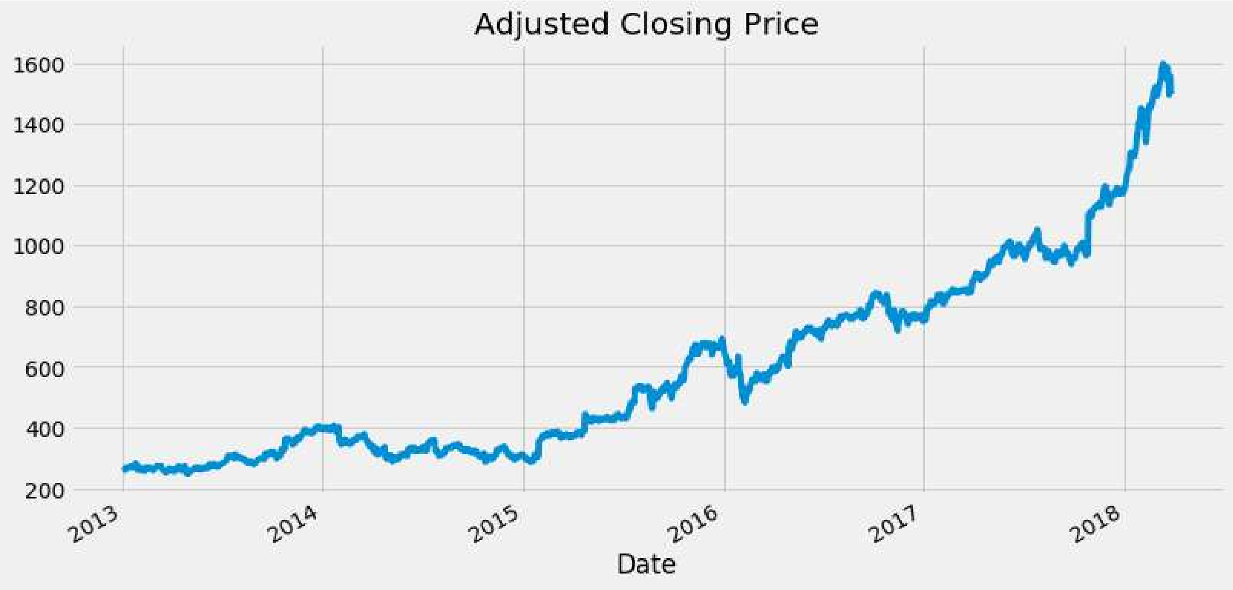
Understand Stock Data

In [15]:

```
data['Adj_Close'].plot(figsize=(12,6),title='Adjusted Closing Price')
```

Out[15]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x201d3c6c358>
```



Understand DateTimeIndex

In [16]:

```
from datetime import datetime
my_year=2020
my_month=5
my_day=1
my_hour=13
my_minute=36
my_second=45
test_date=datetime(my_year,my_month,my_day)
test_date
```

Out[16]:

```
datetime.datetime(2020, 5, 1, 0, 0)
```

In [17]:

```
test_date=datetime(my_year,my_month,my_day,my_hour,my_minute,my_second)
print("The day is :",test_date.day)
print("The hour is :",test_date.hour)
print("The month is :",test_date.month)
```

```
The day is : 1
The hour is : 13
The month is : 5
```

Find minimum and maximum dates from data frame, call info() method

In [18]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1316 entries, 2018-03-27 to 2013-01-02
Data columns (total 6 columns):
Open         1316 non-null float64
High         1316 non-null float64
Low          1316 non-null float64
Close        1316 non-null float64
Volume       1316 non-null int64
Adj_Close    1316 non-null float64
dtypes: float64(5), int64(1)
memory usage: 72.0 KB
```

Print minimum and maximum index value of dataframe

In [19]:

```
print(data.index.max())
print(data.index.min())
```

```
2018-03-27 00:00:00
2013-01-02 00:00:00
```

Retrieve index of earliest and latest dates using argmin and argmax

In [20]:

```
data.index.argmin()
```

Out[20]:

```
1315
```

In [21]:

```
data.index.argmax()
```

Out[21]:

```
0
```

Resampling Operation

Resample data with year end frequency ("Y") with average stock price

In [22]:
```
data.resample('Y').mean()
```

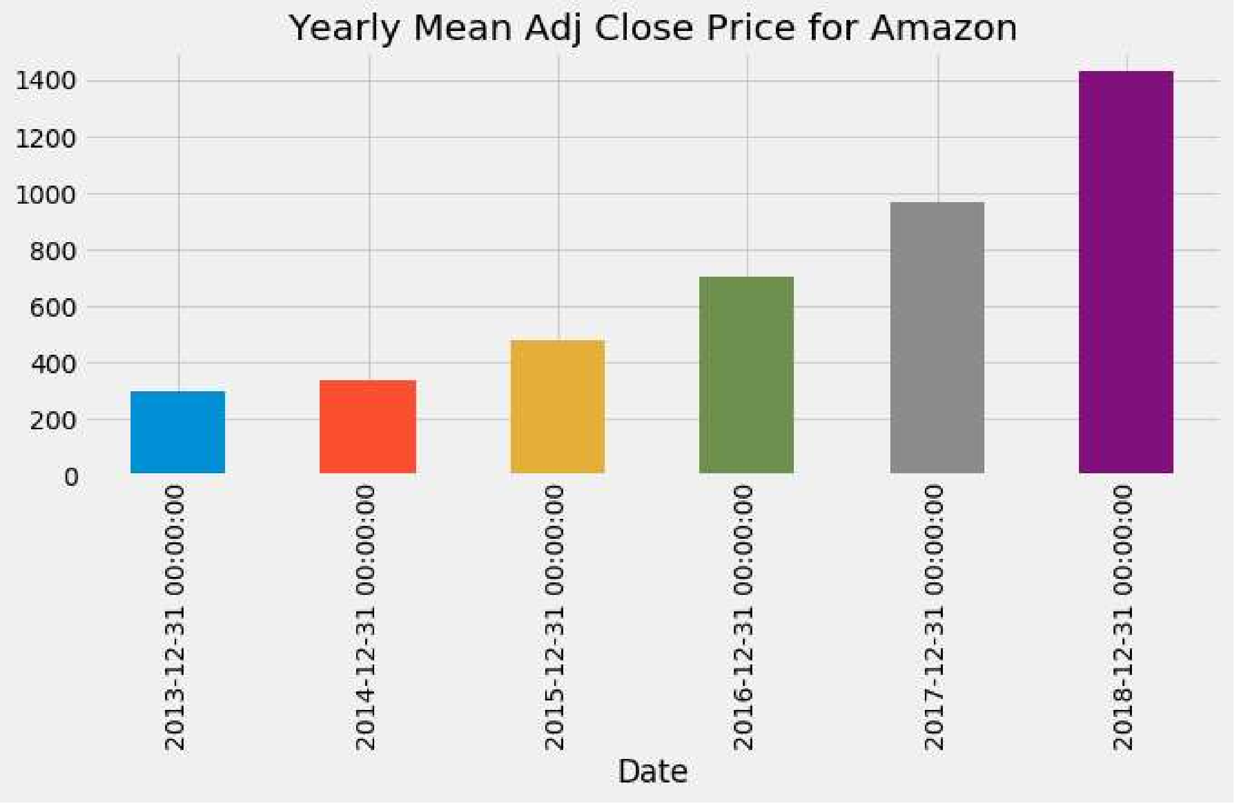
Out[22]:

Date	Open	High	Low	Close	Volume	Adj_Close
2013-12-31	297.877223	300.925966	294.656658	298.032235	2.967880e+06	298.032235
2014-12-31	332.798433	336.317462	328.545440	332.550976	4.083223e+06	332.550976
2015-12-31	478.126230	483.248272	472.875443	478.137321	3.797801e+06	478.137321
2016-12-31	699.669762	705.799103	692.646189	699.523135	4.122043e+06	699.523135
2017-12-31	967.565060	973.789752	959.991826	967.403996	3.466207e+06	967.403996
2018-12-31	1429.770000	1446.701017	1409.469661	1429.991186	5.586829e+06	1429.991186

Resample a specific column

Plot a bar chart to show the yearly (Use "A") mean adjusted close price

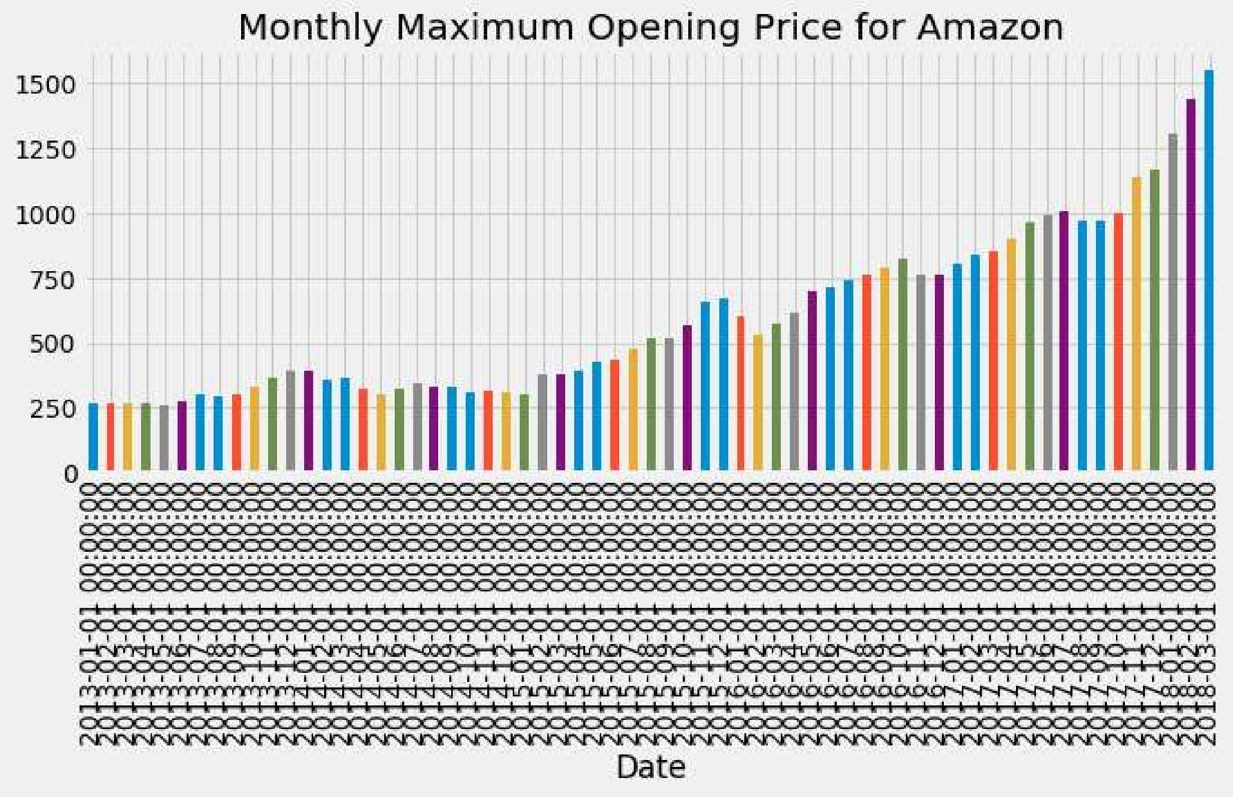
In [36]:
```
data['Adj_Close'].resample('A').mean().plot(kind='bar', figsize=(10,4))
plt.title('Yearly Mean Adj Close Price for Amazon')
plt.show()
```



Plot bar chart to show monthly maximum (Use "MS") opening price for all years

In [24]:

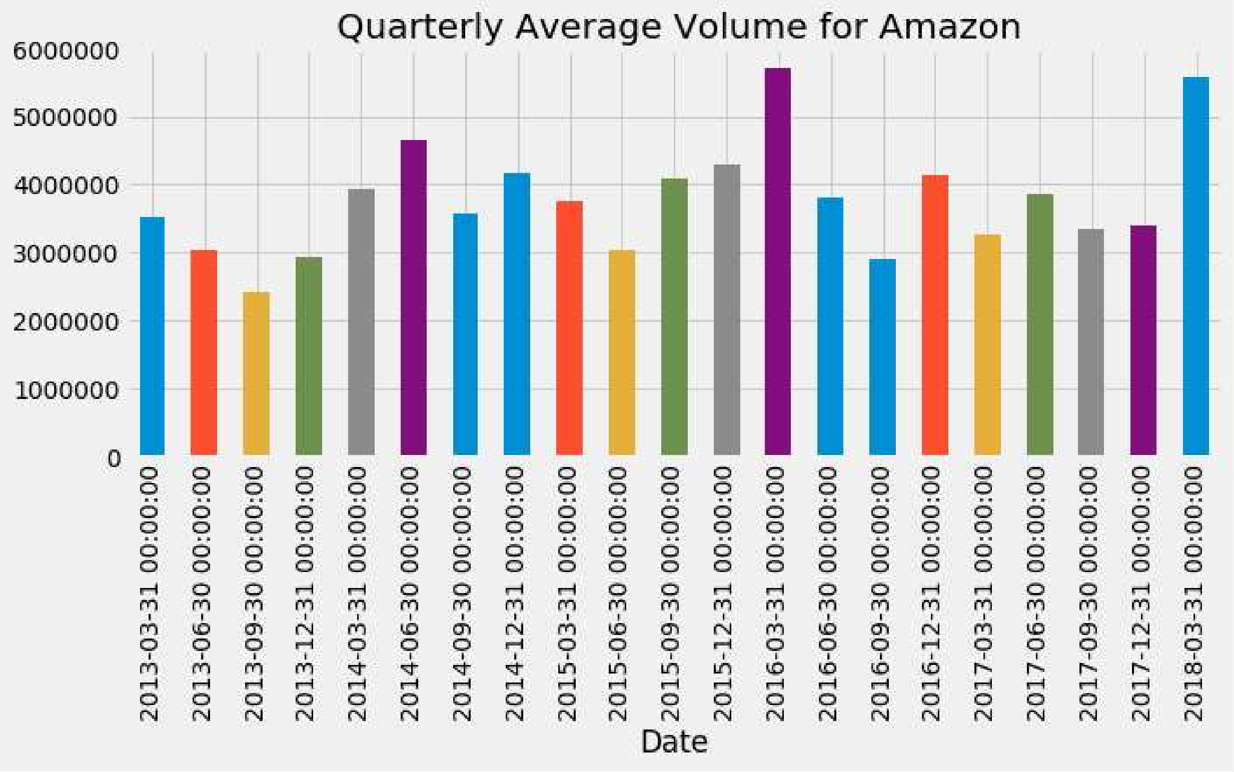
```
data['Adj_Close'].resample('MS').mean().plot(kind='bar', figsize=(10,4))
plt.title('Monthly Maximum Opening Price for Amazon')
plt.show()
```



Plot bar chart of Quarterly (Use "Q") Average Volume for all years

In [37]:

```
data['Volume'].resample('Q').mean().plot(kind = 'bar', figsize=(10,4))
plt.title(" Quarterly Average Volume for Amazon")
plt.show()
```



Time Shifting Operations

In [25]:

```
data.head()
```

Out[25]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
2018-03-26	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2018-03-23	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
2018-03-22	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
2018-03-21	1586.45	1590.00	1563.17	1581.86	4667291	1581.86

Shift data by 1 Day forward

In [26]:

```
data.shift(1, axis=0).head(5)
```

Out[26]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-26	1572.40	1575.96	1482.32	1497.05	6793279.0	1497.05
2018-03-23	1530.00	1556.99	1499.25	1555.86	5547618.0	1555.86
2018-03-22	1539.01	1549.02	1495.36	1495.56	7843966.0	1495.56
2018-03-21	1565.47	1573.85	1542.40	1544.10	6177737.0	1544.10

Shift data by 1 Day Backward

In [27]:

```
data.shift(-1, axis=0).head(5)
```

Out[27]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	1530.00	1556.99	1499.25	1555.86	5547618.0	1555.86
2018-03-26	1539.01	1549.02	1495.36	1495.56	7843966.0	1495.56
2018-03-23	1565.47	1573.85	1542.40	1544.10	6177737.0	1544.10
2018-03-22	1586.45	1590.00	1563.17	1581.86	4667291.0	1581.86
2018-03-21	1550.34	1587.00	1545.41	1586.51	4507049.0	1586.51

In [28]:
```
data.head(10)
```

Out[28]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
2018-03-26	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2018-03-23	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
2018-03-22	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
2018-03-21	1586.45	1590.00	1563.17	1581.86	4667291	1581.86
2018-03-20	1550.34	1587.00	1545.41	1586.51	4507049	1586.51
2018-03-19	1554.53	1561.66	1525.35	1544.93	6376619	1544.93
2018-03-16	1583.45	1589.44	1567.50	1571.68	5145054	1571.68
2018-03-15	1595.00	1596.91	1578.11	1582.32	4026744	1582.32
2018-03-14	1597.00	1606.44	1590.89	1591.00	4164395	1591.00

Shifting Time Index

In [29]:
```
data.shift(periods=3, freq='M').head()
```

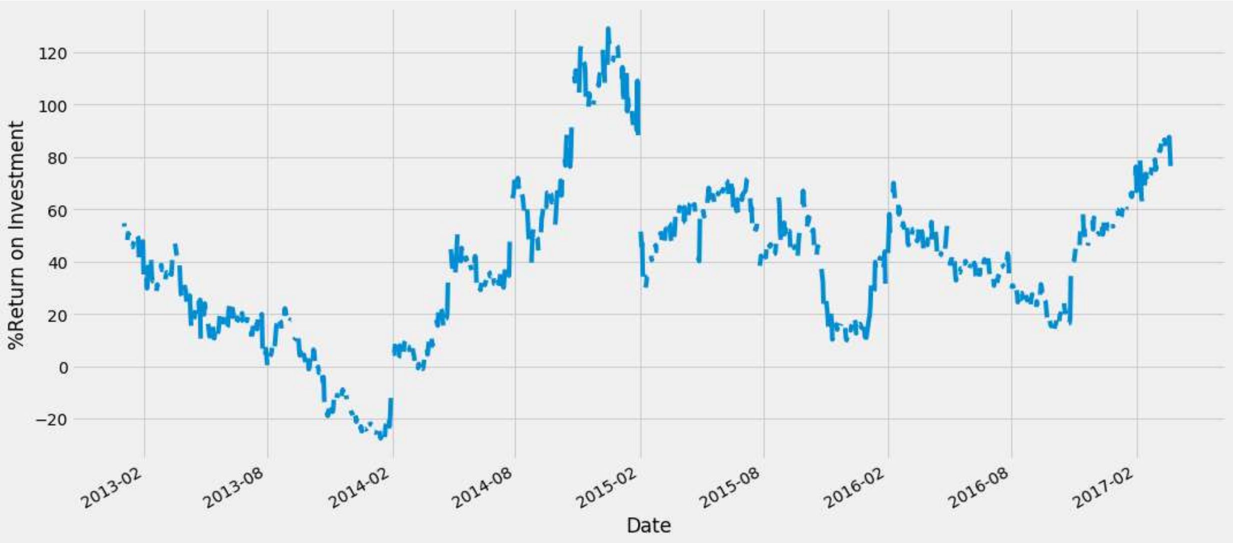
Out[29]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-05-31	1572.40	1575.96	1482.32	1497.05	6793279	1497.05
2018-05-31	1530.00	1556.99	1499.25	1555.86	5547618	1555.86
2018-05-31	1539.01	1549.02	1495.36	1495.56	7843966	1495.56
2018-05-31	1565.47	1573.85	1542.40	1544.10	6177737	1544.10
2018-05-31	1586.45	1590.00	1563.17	1581.86	4667291	1581.86

Application: Computing Return on investment

In [31]:
```
ROI = 100*(data['Adj_Close'].tshift(periods=-365, freq='D')/data['Adj_Close']-1)
ROI.plot(figsize=(16,8))
plt.ylabel('%Return on Investment')
```

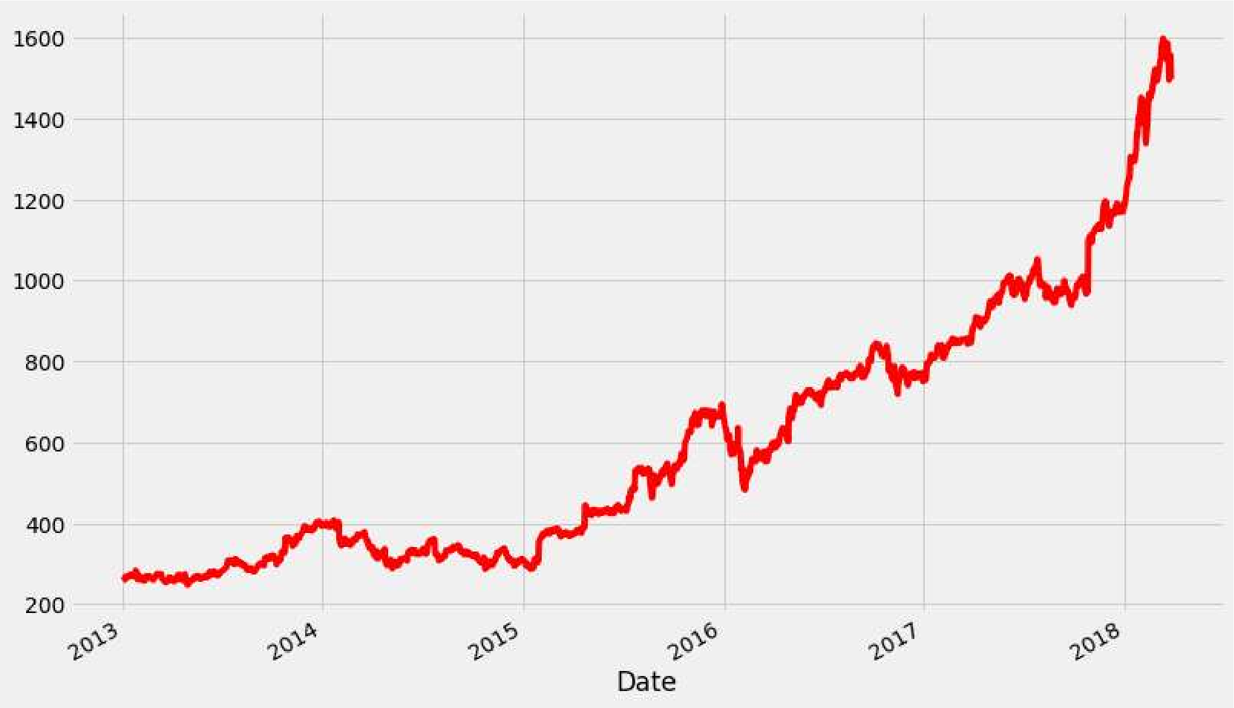
Out[31]:
```
Text(0,0.5,'%Return on Investment')
```



Rolling Window or Moving Window Operations

In [32]:
```
data['Adj_Close'].plot(figsize=(12,8), color='red')
```

Out[32]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x201d3f556a0>
```



Find rolling mean for 7 days and show top-10 rows

In [33]:
```
data.rolling(7).mean().head(10)
```

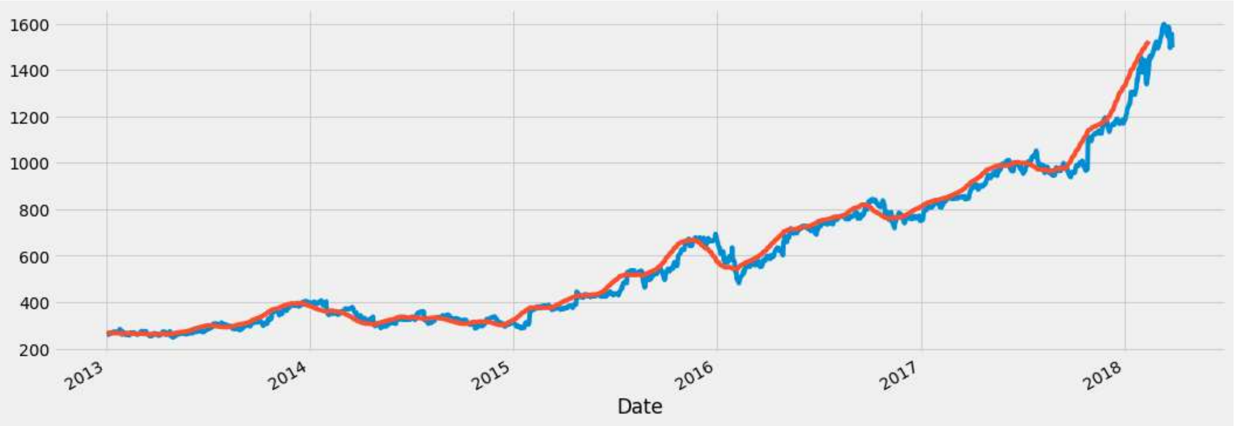
Out[33]:

	Open	High	Low	Close	Volume	Adj_Close
Date						
2018-03-27	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-26	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-23	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-22	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-21	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-20	NaN	NaN	NaN	NaN	NaN	NaN
2018-03-19	1556.885714	1570.640000	1521.894286	1543.695714	5.987651e+06	1543.695714
2018-03-16	1558.464286	1572.565714	1534.062857	1554.357143	5.752191e+06	1554.357143
2018-03-15	1567.750000	1578.268571	1545.328571	1558.137143	5.534923e+06	1558.137143
2018-03-14	1576.034286	1586.471429	1558.975714	1571.771429	5.009270e+06	1571.771429

Plot a line char for "Open" column.

In [34]:
```
data['Adj_Close'].plot()
data.rolling(window=30).mean()['Adj_Close'].plot(figsize=(16,6))
```

Out[34]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x201d43b3e10>
```


Date