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LAB-8(Pandas Time Series Analysis)

In [1]:
```
# Importing required modules

import pandas as pd
```

In [2]:
```
# Setting for pretty plots

import matplotlib.pyplot as plt
plt.style.use('fivethirtyeight')
plt.show()
```

In [3]:
```
# Reading in the data

data = pd.read_csv("amazon_stock.csv")
```

Inspect top 10 rows

In [4]:
```
data.head(10)
```

Out[4]:

	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

Remove first two columns (none and ticker) as they dont add any value to the

dataset Then, print head() to check if removed

In [5]:
```
data = data.drop(['None','ticker'],axis=1)
```

In [6]:
```
data.head()
```

Out[6]:

	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 [7]:
```
# Look at the datatypes of the various columns , call info()

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 [8]:
```
data['Date'] = pd.to_datetime(data['Date'])
```

In [9]:
```
data.dtypes
```

Out[9]:
```
Date         datetime64[ns]
Open                float64
High                float64
Low                 float64
Close               float64
Volume                int64
Adj_Close           float64
dtype: object
```

Let us check our data once again,with head()

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

Out[10]:

	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

SET DATE OBJECT TO BE INDEX

Here Date is one of the columns. But we want date to be the index. So, set date as index for the frame. Make inplace= 'True'

In [11]:
```
data.set_index(['Date'], inplace=True)
```

In [12]:
```
# Check with head()

data.head()
```

Out[12]:

Date	Open	High	Low	Close	Volume	Adj_Close
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

Understand Stock Data

In [13]:
```
data['Adj_Close'].plot(figsize=(12,6), title = 'Adjusted Closing Price')
```

Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x18576bbff28>
```

Understand DateTimeIndex

Introduction to datetime module

In [14]:
```
from datetime import datetime
```

In [15]:
```
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[15]:
```
datetime.datetime(2020, 5, 1, 0, 0)
```

In [16]:
```
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 [17]:
```
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
```

In [18]:
```
print("Minimum Date : ",data.index.min())
print("Maximum date : ",data.index.max())
```

```
Minimum Date :  2013-01-02 00:00:00
Maximum date :  2018-03-27 00:00:00
```

Retrieve index of earliest and latest dates using argmin and argmax

In [19]:
```
print("Minimum Date Location : ",data.index.argmin())
```

```
Minimum Date Location :  1315
```

In [20]:
```
print("Maximum date Location : ",data.index.argmax())
```

```
Maximum date Location :  0
```

1. RESAMPLING OPERATION

RESAMPLE ENTIRE DATA FRAME

RESAMPLE DATA WITH YEAR END FREQUENCY ('Y') WITH AVERAGE STOCK PRICE

In [21]:
```
data.resample('Y').mean()
```

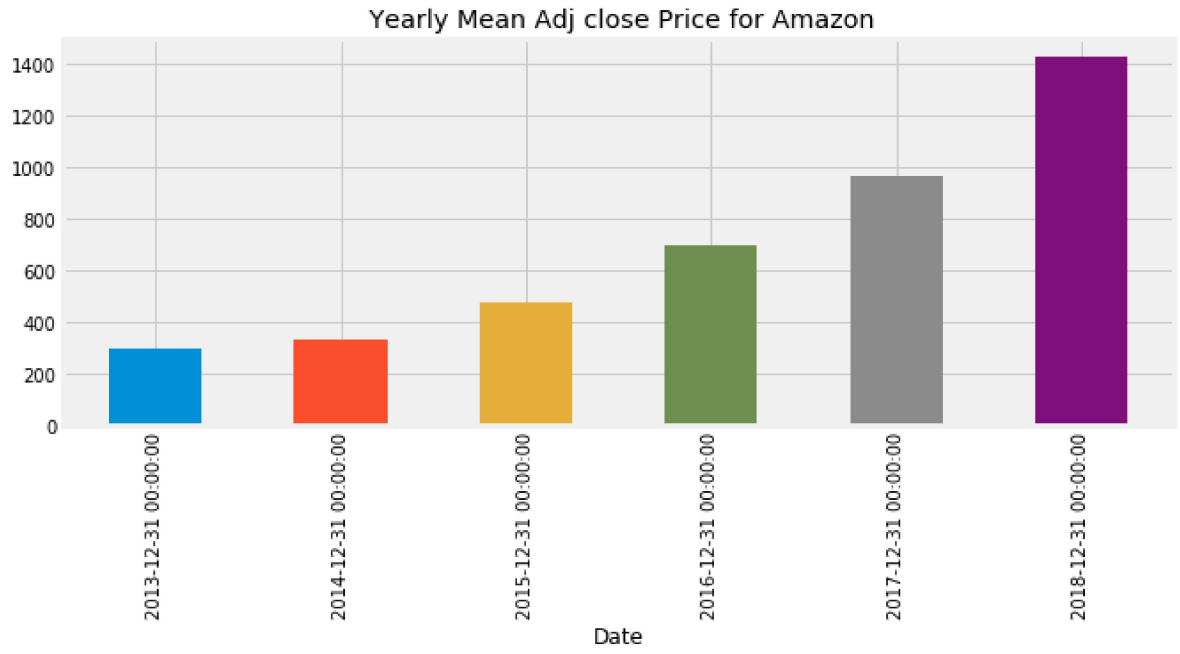
Out[21]:

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

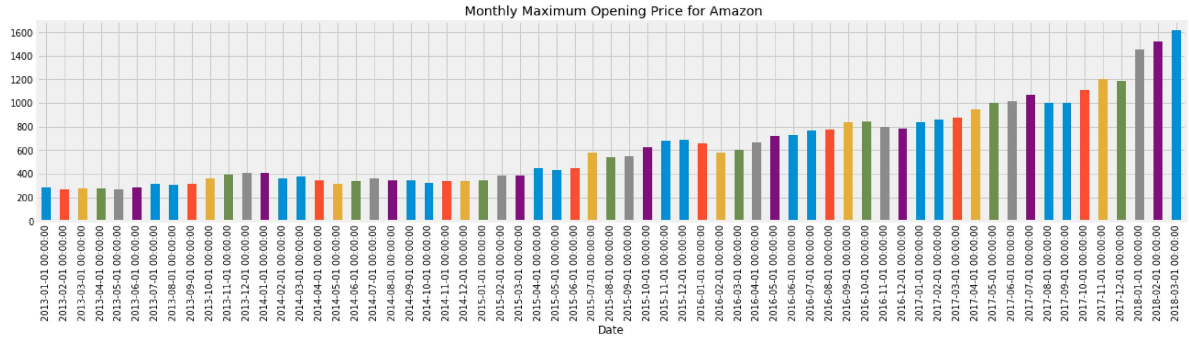
Plot a bar chart to show the yearly (Use "A") mean adjusted close price

In [22]:
```
data['Adj_Close'].resample('A').mean().plot(kind = 'bar', figsize=(10,4))
plt.title(" Yearly Mean Adj close Price for Amazon")
plt.show()
```



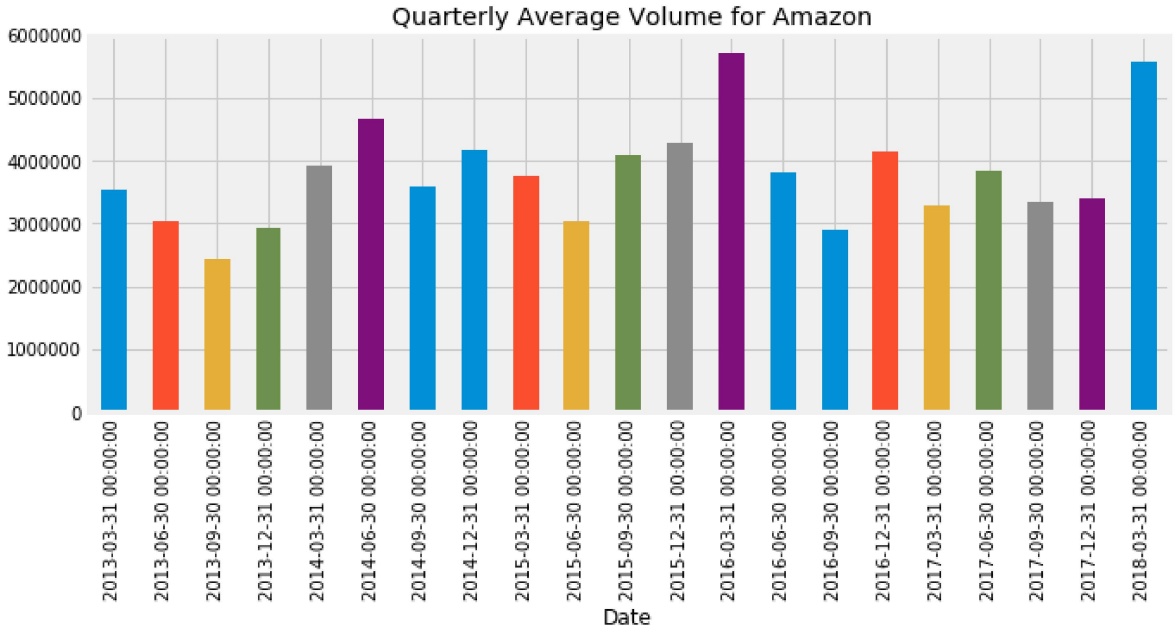
Plot bar chart to show monthly maximum (Use "MS") opening price for all years

In [23]:
```
data['Open'].resample('MS').max().plot(kind = 'bar', figsize=(20,4))
plt.title(" Monthly Maximum Opening Price for Amazon")
plt.show()
```



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

In [24]:
```
data['Volume'].resample('Q').mean().plot(kind = 'bar', figsize=(10,4))
plt.title(" Quarterly Average Volume for Amazon")
plt.show()
```



2.Time Shifting Operations

Shifting data forward and backward

Show head of data

In [25]:
```
data.head()
```

Out[25]:

Date	Open	High	Low	Close	Volume	Adj_Close
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(periods = 1).head()
```

Out[26]:

Date	Open	High	Low	Close	Volume	Adj_Close
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(periods = -1).head()
```

Out[27]:

Date	Open	High	Low	Close	Volume	Adj_Close
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

Shifting Time Index

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

Out[28]:

Date	Open	High	Low	Close	Volume	Adj_Close
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

Shift Time Index by 3 Months

In [29]:
```
data.shift(periods = 3,freq='MS')
data.head(5)
```

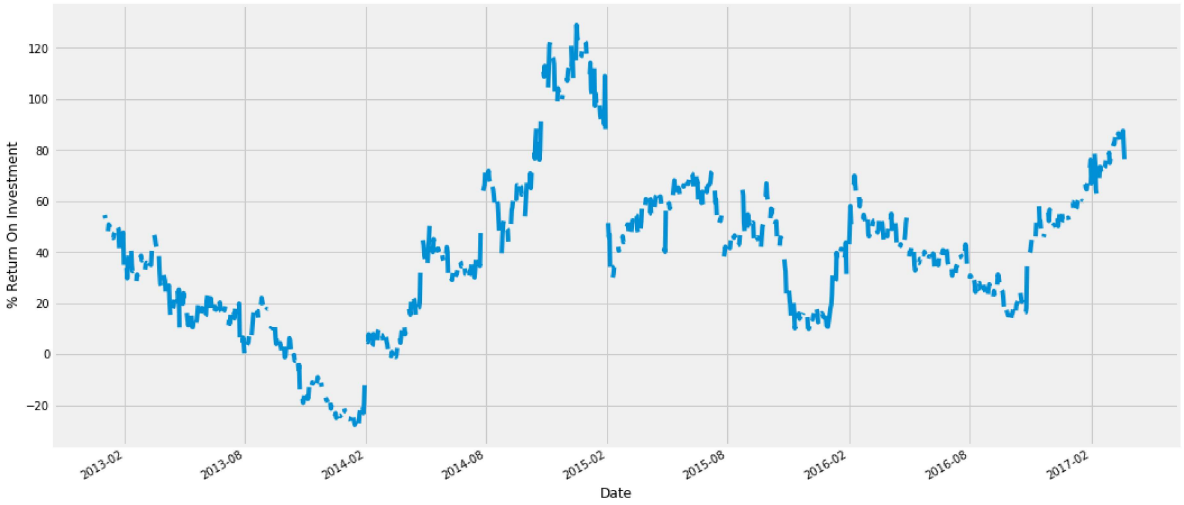
Out[29]:

Date	Open	High	Low	Close	Volume	Adj_Close
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

Application: Computing Return on investment

In [30]:
```
ROI = 100* (data['Adj_Close'].tshift(periods = - 365, freq ='D')/data['Adj_Clo
ROI.plot(figsize=(16,8))
plt.ylabel('% Return On Investment')
```

Out[30]:
```
Text(0,0.5,'% Return On Investment')
```



3. Rolling Window or Moving Window Operations

In [31]:
```
data['Adj_Close'].plot(figsize=(12,8), color='red')
```

Out[31]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x185784f9cc0>
```

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

In [32]:
```
data.rolling(7).mean().head(10)
```

Out[32]:

Date	Open	High	Low	Close	Volume	Adj_Close
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

Followed by,average rolling window of 30 days on the same "Open" column

In [33]:
```
data['Open'].plot(figsize=(12,8))
data['Open'].rolling(30).mean().plot(figsize=(12,8), color='red')
```

Out[33]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x18577136400>
```