Hands-on Activity 9.1 Data Visualization using Pandas and Matplotlib

Instructions:

- Create a Python notebook to answer all shown procedures, exercises and analysis in this section.

Resources:

- Download the following datasets: earthquakes-1.csv, fb_stock_prices_2018.csv

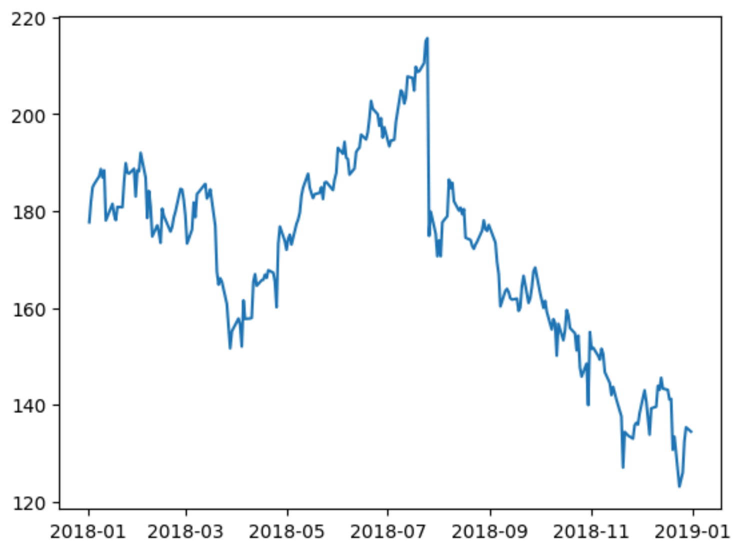
Procedures:

- 9.1 Introduction to Matplotlib
- 9.2 Plotting with Pandas
- 9.3 Pandas Plotting Subpackage

9.1 Introduction to Matplotlib

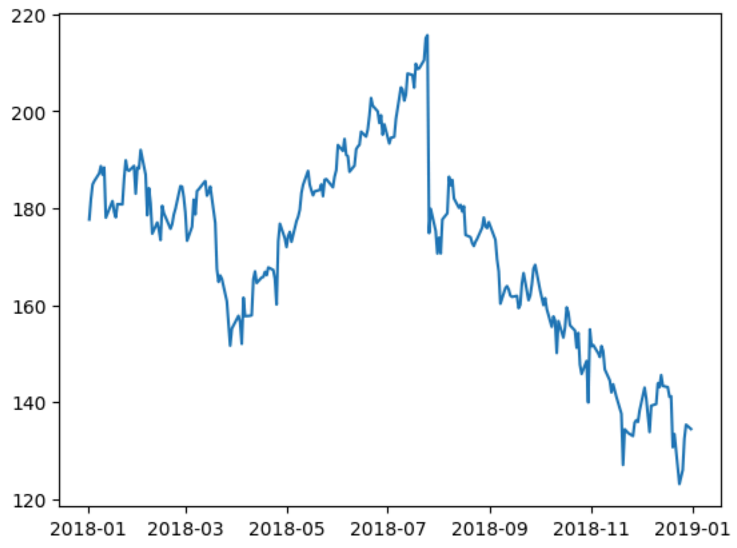
```
import matplotlib.pyplot as plt
import pandas as pd
```

```
# plotting lines

fb = pd.read_csv(
    'data/fb_stock_prices_2018.csv', index_col='date', parse_dates=True
)
plt.plot(fb.index, fb.open)
plt.show()
```



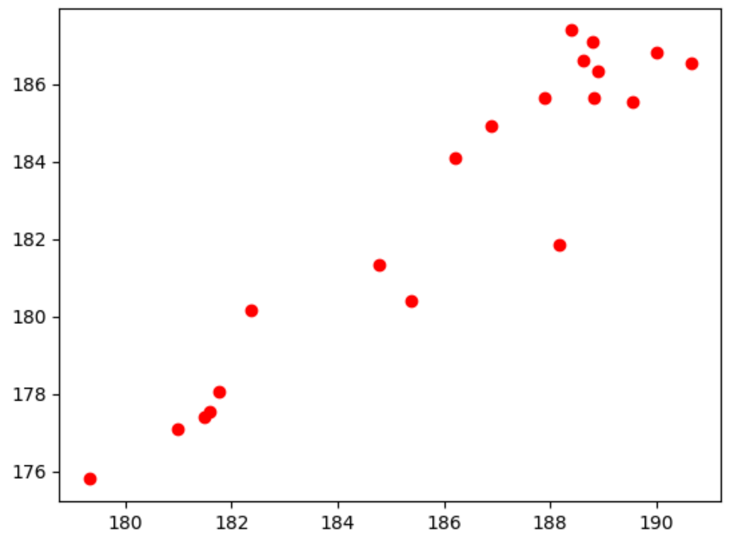
```
%matplotlib inline
import matplotlib.pyplot as plt
import pandas as pd
fb = pd.read_csv(
    'data/fb_stock_prices_2018.csv', index_col='date', parse_dates=True
)
plt.plot(fb.index, fb.open)
```

```
[<matplotlib.lines.Line2D at 0x7ba84456f4c0>]
```



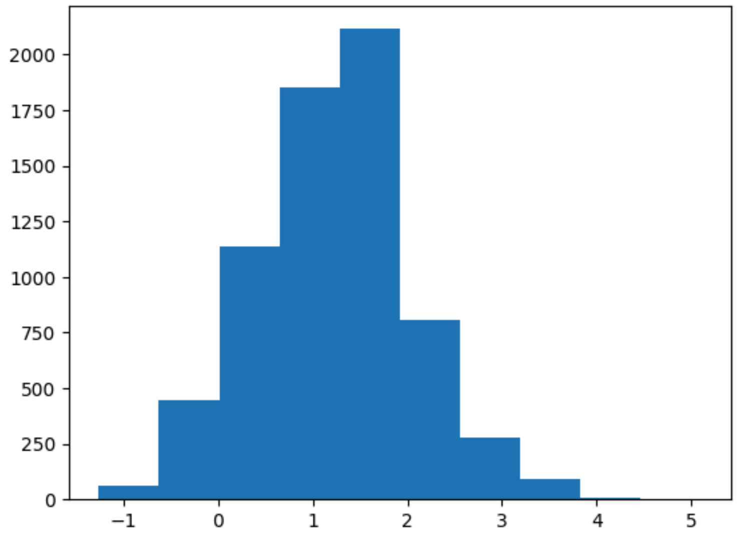
```
# scatter plots

plt.plot('high', 'low', 'ro', data=fb.head(20))
```

```
[<matplotlib.lines.Line2D at 0x7ba83f5b01c0>]
```

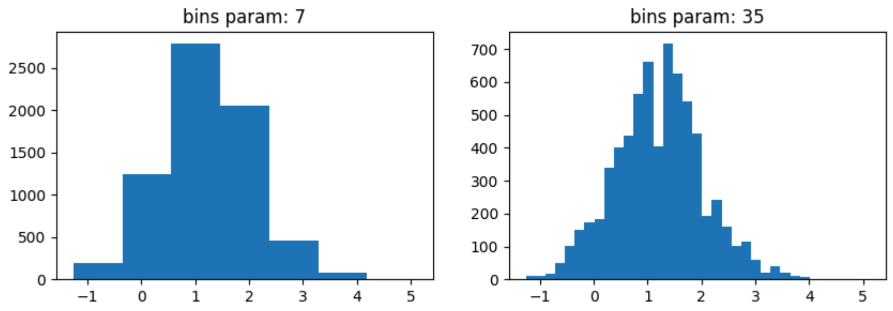


```
# histograms

quakes = pd.read_csv('data/earthquakes.csv')
plt.hist(quakes.query('magType == "ml"').mag)
```

```
(array([6.400e+01, 4.450e+02, 1.137e+03, 1.853e+03, 2.114e+03, 8.070e+02,
        2.800e+02, 9.200e+01, 9.000e+00, 2.000e+00]),
 array([-1.26 , -0.624,  0.012,  0.648,  1.284,  1.92 ,  2.556,  3.192,
         3.828,  4.464,  5.1  ]),
 <BarContainer object of 10 artists>)
```



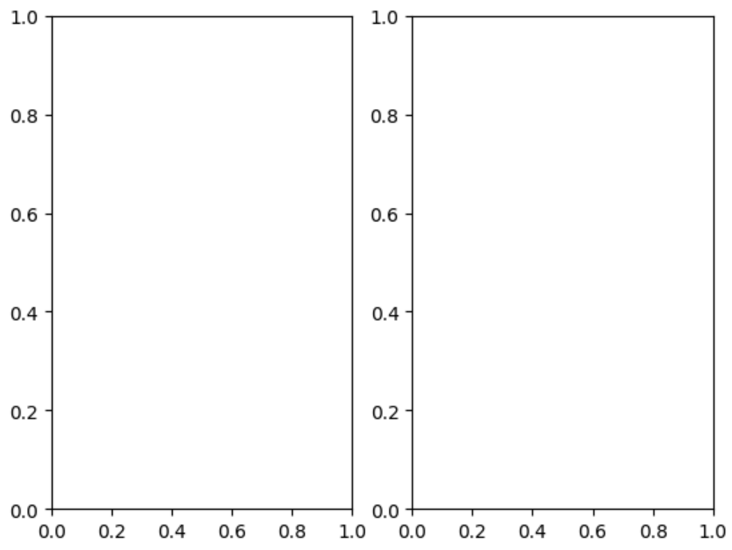
```
# bin size

x = quakes.query('magType == "ml"').mag
fig, axes = plt.subplots(1, 2, figsize=(10, 3))
for ax, bins in zip(axes, [7, 35]):
  ax.hist(x, bins=bins)
  ax.set_title(f'bins param: {bins}')
```



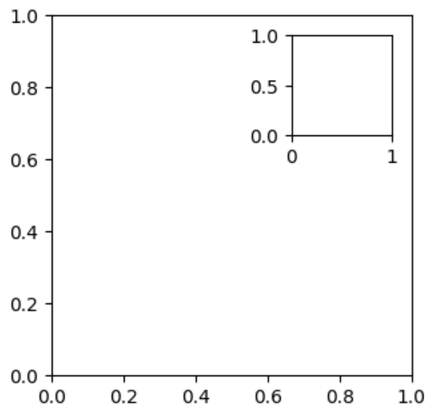
```
# figure

fig = plt.figure()
```

```
<Figure size 640x480 with 0 Axes>
```

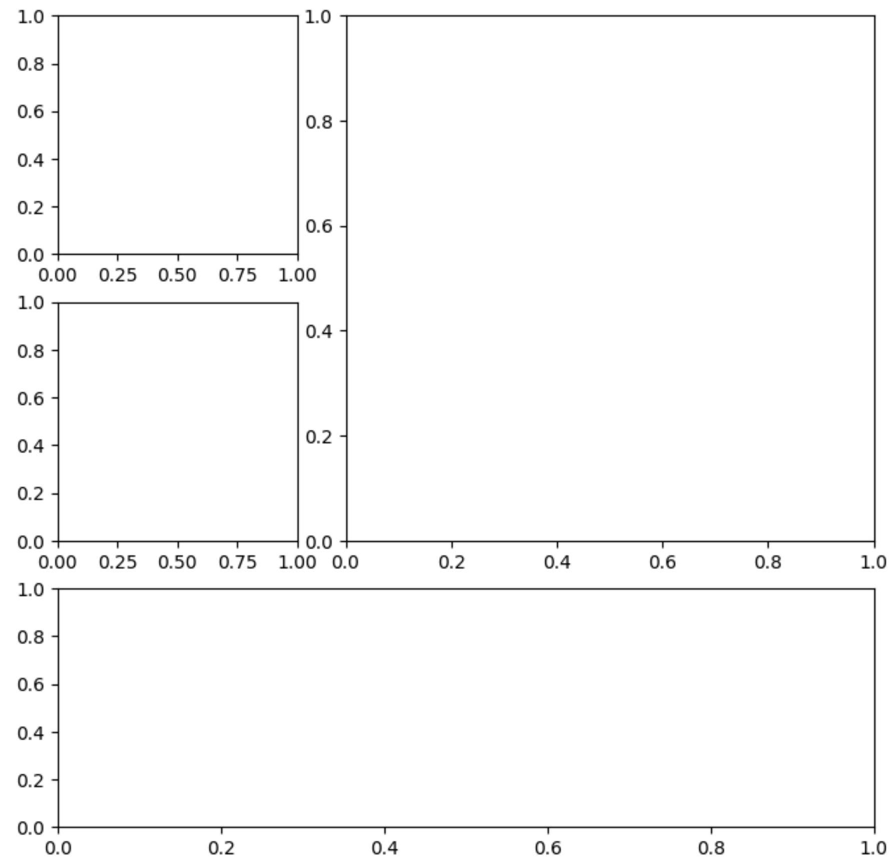
```
# subplots

fig, axes = plt.subplots(1, 2)
```



```
fig = plt.figure(figsize=(3, 3))
outside = fig.add_axes([0.1, 0.1, 0.9, 0.9])
inside = fig.add_axes([0.7, 0.7, 0.25, 0.25])
```



```
# plot layout with gridspec

fig = plt.figure(figsize=(8, 8))
gs = fig.add_gridspec(3, 3)
top_left = fig.add_subplot(gs[0, 0])
mid_left = fig.add_subplot(gs[1, 0])
top_right = fig.add_subplot(gs[:2, 1:])
bottom = fig.add_subplot(gs[2,:])
```



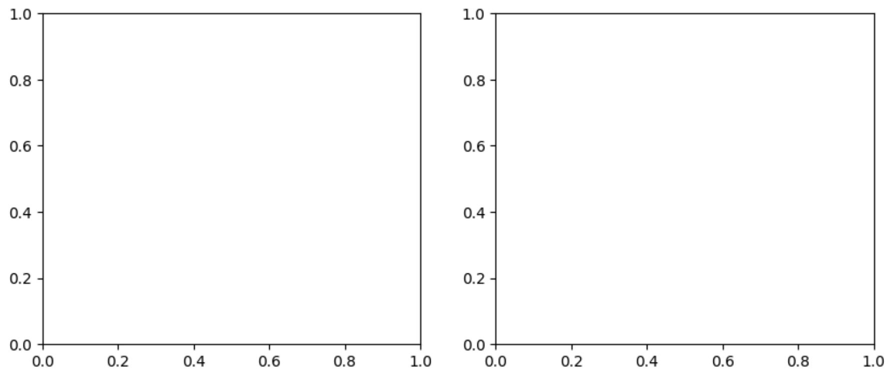
```
# saving plots

fig.savefig('empty.png')
```

```
# clean up

plt.close('all')
```

```
# specify fig size

fig = plt.figure(figsize=(10, 4))
```

```
<Figure size 1000x400 with 0 Axes>
```

```
fig, axes = plt.subplots(1, 2, figsize=(10, 4))
```



```
# rcParams

import random
import matplotlib as mpl
rcparams_list = list(mpl.rcParams.keys())
random.seed(20) # make this repeatable
random.shuffle(rcparams_list)
sorted(rcparams_list[:20])
```

```
['animation.convert_args',
 'axes.edgecolor',
 'axes.formatter.use_locale',
 'axes.spines.right',
 'boxplot.meanprops.markersize',
 'boxplot.showfliers',
 'keymap.home',
 'lines.markerfacecolor',
 'lines.scale_dashes',
 'mathtext.rm',
 'patch.force_edgecolor',
 'savefig.facecolor',
 'svg.fonttype',
 'text.hinting_factor',
 'xtick.alignment',
 'xtick.minor.top',
 'xtick.minor.width',
 'ytick.left',
 'ytick.major.left',
 'ytick.minor.width']
```

```
mpl.rcParams['figure.figsize']
```

```
[6.4, 4.8]
```

```
mpl.rcParams['figure.figsize'] = (300, 10)
mpl.rcParams['figure.figsize']
```

```
[300.0, 10.0]
```

```
mpl.rcdefaults()
mpl.rcParams['figure.figsize']
```

```
[6.4, 4.8]
```

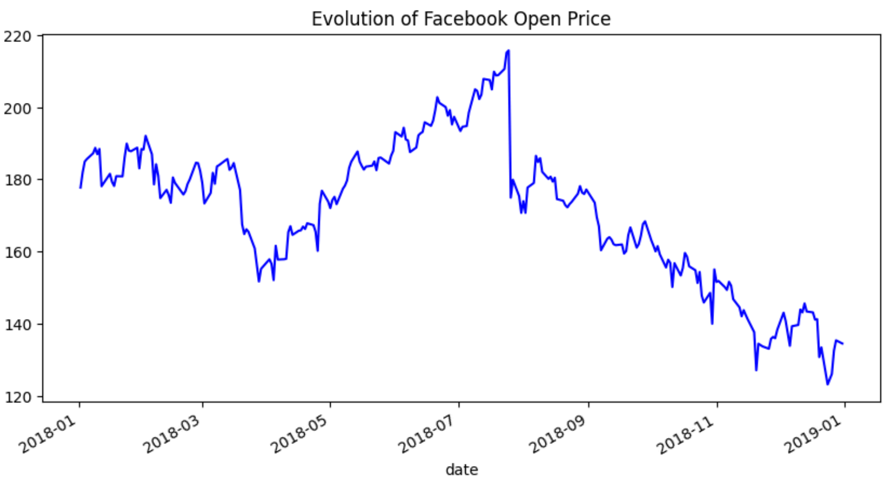
```
plt.rc('figure', figsize=(20, 20)) # change figsize default to (20, 20)
plt.rcdefaults() # reset the default
```

9.2 Plotting with Pandas

```
# setup

%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
fb = pd.read_csv(
    'data/fb_stock_prices_2018.csv', index_col='date', parse_dates=True
)
quakes = pd.read_csv('data/earthquakes.csv')
```

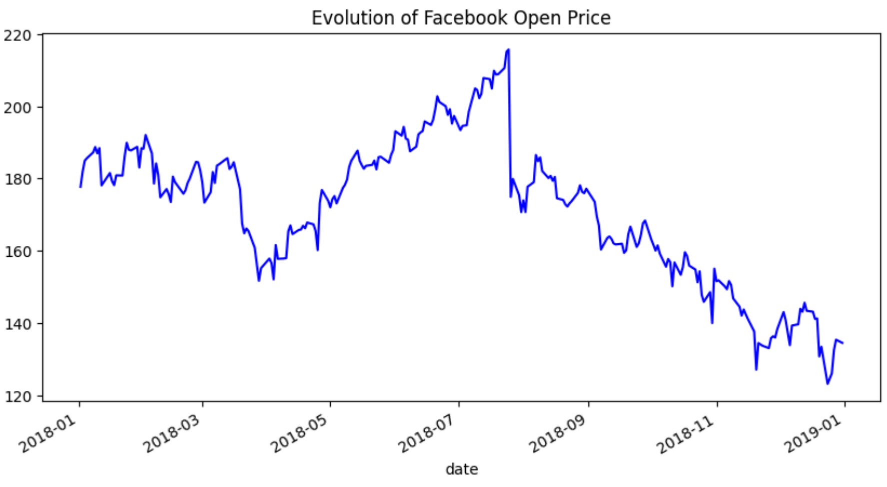
```
# evolution over time

fb.plot(
    kind='line',
    y='open',
    figsize=(10, 5),
    style='b-',
    legend=False,
         title='Evolution of Facebook Open Price'
)
```

```
<Axes: title={'center': 'Evolution of Facebook Open Price'}, xlabel='date'>
```



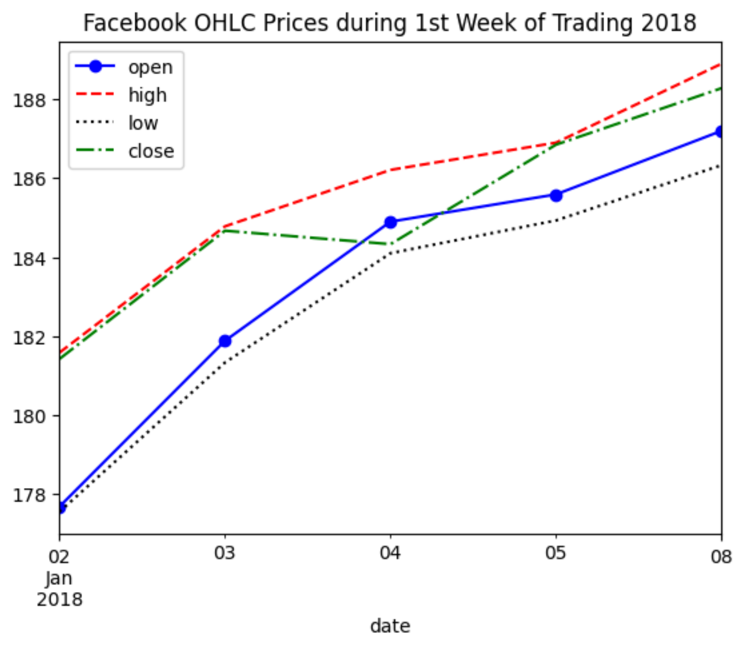
```
fb.plot(
    kind='line',
    y='open',
    figsize=(10, 5),
    color='blue',
    linestyle='solid',
    legend=False,
    title='Evolution of Facebook Open Price'
)
```

```
<Axes: title={'center': 'Evolution of Facebook Open Price'}, xlabel='date'>
```



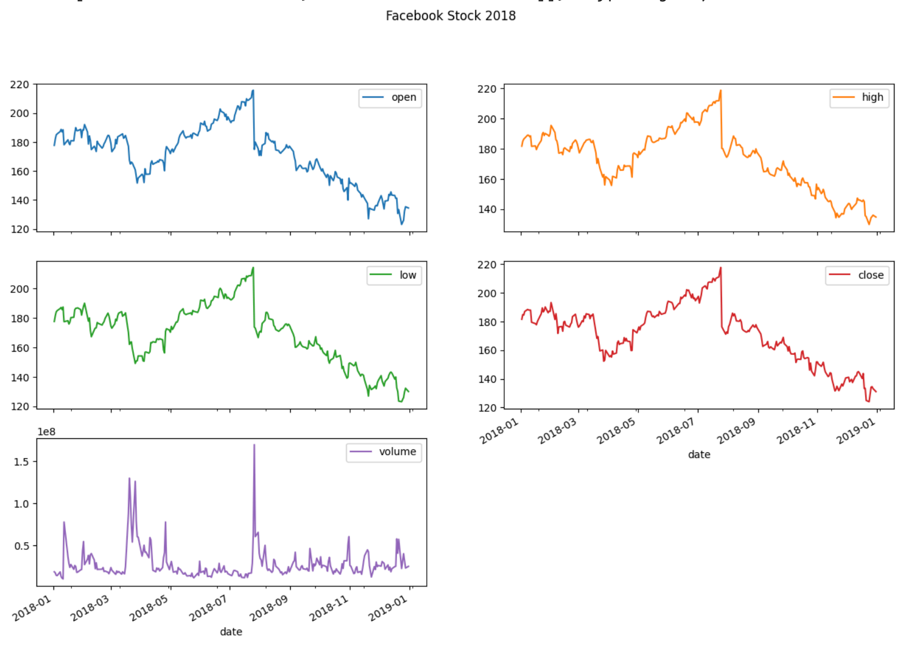
```
fb.iloc[:5,].plot(
    y=['open', 'high', 'low', 'close'],
    style=['b-o', 'r--', 'k:', 'g-.'],
    title='Facebook OHLC Prices during 1st Week of Trading 2018'
)
```

```
<Axes: title={'center': 'Facebook OHLC Prices during 1st Week of Trading 2018'},
xlabel='date'>
```



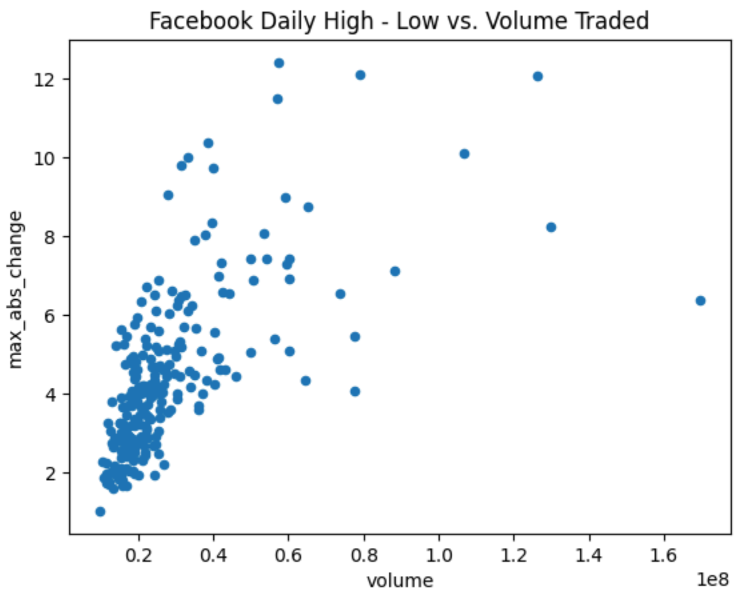
```
# creating subplots

fb.plot(
    kind='line',
    subplots=True,
    layout=(3,2),
    figsize=(15,10),
    title='Facebook Stock 2018'
)
```

```
array([[<Axes: xlabel='date'>, <Axes: xlabel='date'>],
       [<Axes: xlabel='date'>, <Axes: xlabel='date'>],
       [<Axes: xlabel='date'>, <Axes: xlabel='date'>]], dtype=object)
```



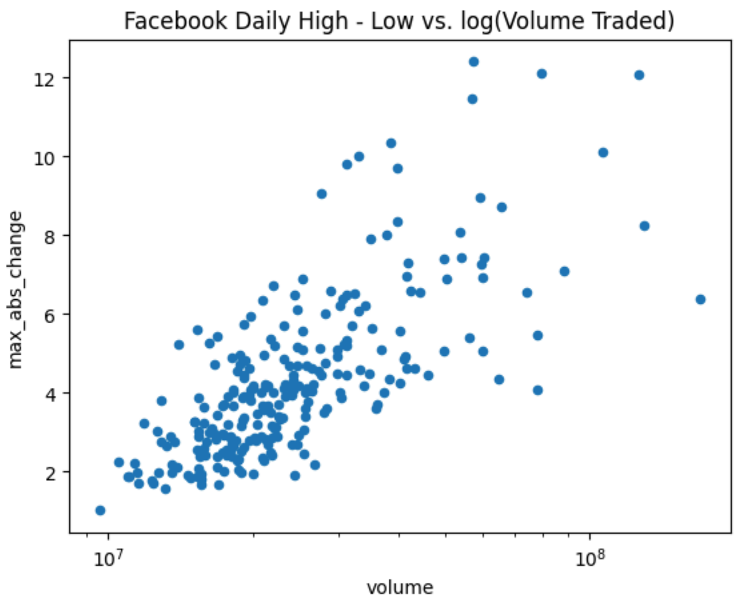
```
# scatter plots

fb.assign(
    max_abs_change=fb.high - fb.low
).plot(
        kind='scatter', x='volume', y='max_abs_change',
        title='Facebook Daily High - Low vs. Volume Traded'
)
```

```
<Axes: title={'center': 'Facebook Daily High - Low vs. Volume Traded'},
xlabel='volume', ylabel='max_abs_change'>
```



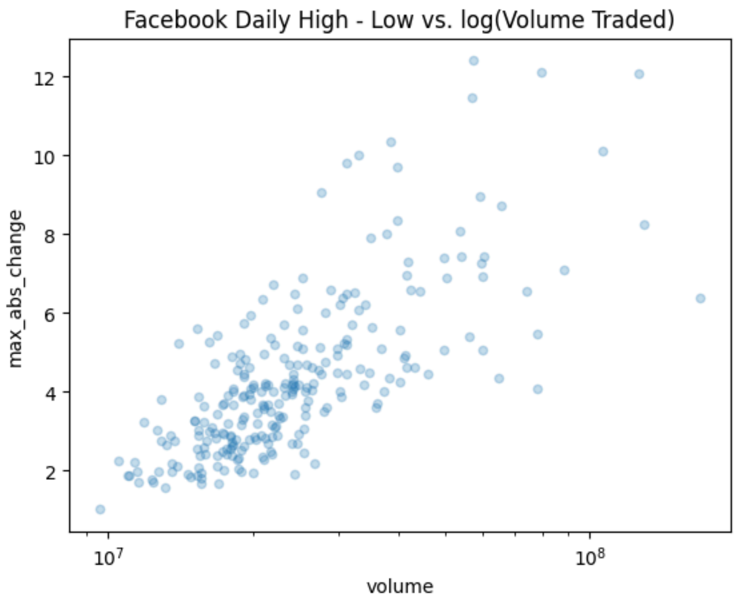
```
fb.assign(
    max_abs_change=fb.high - fb.low
).plot(
    kind='scatter', x='volume', y='max_abs_change',
    title='Facebook Daily High - Low vs. log(Volume Traded)',
    logx=True
)
```

```
<Axes: title={'center': 'Facebook Daily High - Low vs. log(Volume Traded)'},
xlabel='volume', ylabel='max_abs_change'>
```



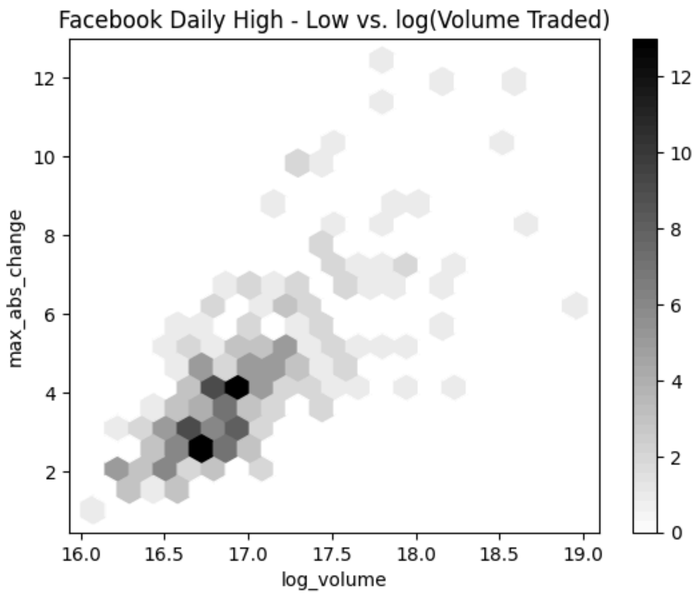
```
# adding transparency to plots with alpha

fb.assign(
    max_abs_change=fb.high - fb.low
).plot(
    kind='scatter', x='volume', y='max_abs_change',
    title='Facebook Daily High - Low vs. log(Volume Traded)',
    logx=True, alpha=0.25
)
```

```
<Axes: title={'center': 'Facebook Daily High - Low vs. log(Volume Traded)'},
xlabel='volume', ylabel='max_abs_change'>
```



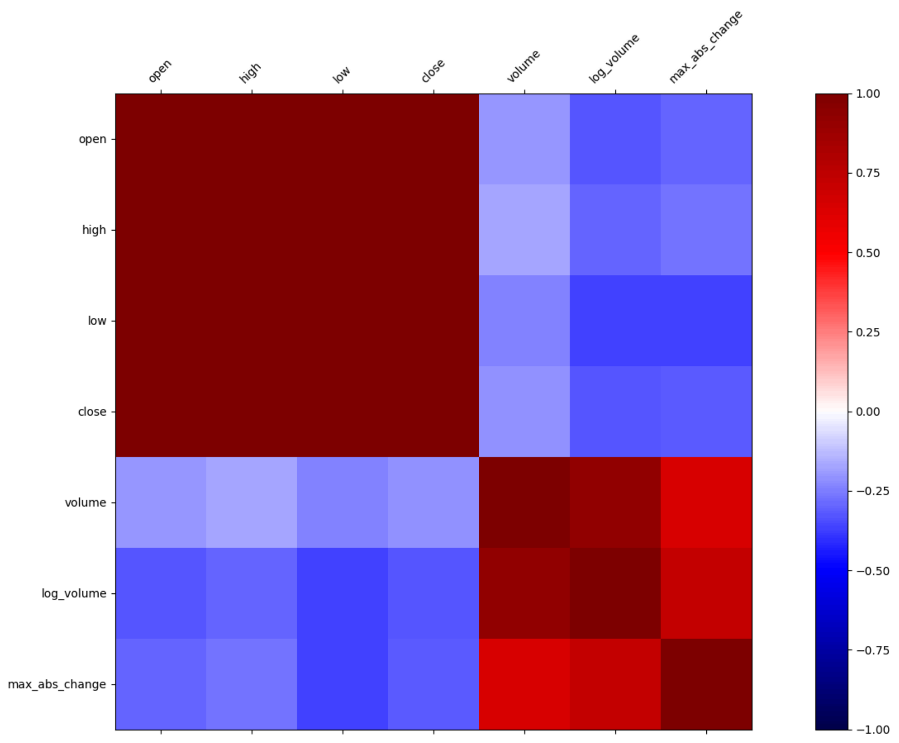
```
# hexbins

fb.assign(
    log_volume=np.log(fb.volume),
    max_abs_change=fb.high - fb.low
).plot(
    kind='hexbin',
    x='log_volume',
    y='max_abs_change',
    title='Facebook Daily High - Low vs. log(Volume Traded)',
    colormap='gray_r',
    gridsize=20,
    sharex=False # we have to pass this to see the x-axis due to a bug in this version of pandas
)
```

```
<Axes: title={'center': 'Facebook Daily High - Low vs. log(Volume Traded)'},
xlabel='log_volume', ylabel='max_abs_change'>
```



```
# visualizing correlations with heatmaps

fig, ax = plt.subplots(figsize=(20, 10))
fb_corr = fb.assign(
    log_volume=np.log(fb.volume),
    max_abs_change=fb.high - fb.low
).corr()

im = ax.matshow(fb_corr, cmap='seismic')
fig.colorbar(im)
im.set_clim(-1, 1)

labels = [col.lower() for col in fb_corr.columns]
ax.set_xticklabels([''] + labels, rotation=45)
ax.set_yticklabels([''] + labels)
```

```
<ipython-input-54-7124fbf28e03>:14: UserWarning: FixedFormatter should only be used toge
  ax.set_xticklabels([''] + labels, rotation=45)
<ipython-input-54-7124fbf28e03>:15: UserWarning: FixedFormatter should only be used toge
  ax.set_yticklabels([''] + labels)
[Text(0, -1.0, ''),
 Text(0, 0.0, 'open'),
 Text(0, 1.0, 'high'),
 Text(0, 2.0, 'low'),
 Text(0, 3.0, 'close'),
 Text(0, 4.0, 'volume'),
 Text(0, 5.0, 'log_volume'),
 Text(0, 6.0, 'max_abs_change'),
 Text(0, 7.0, '')]
```

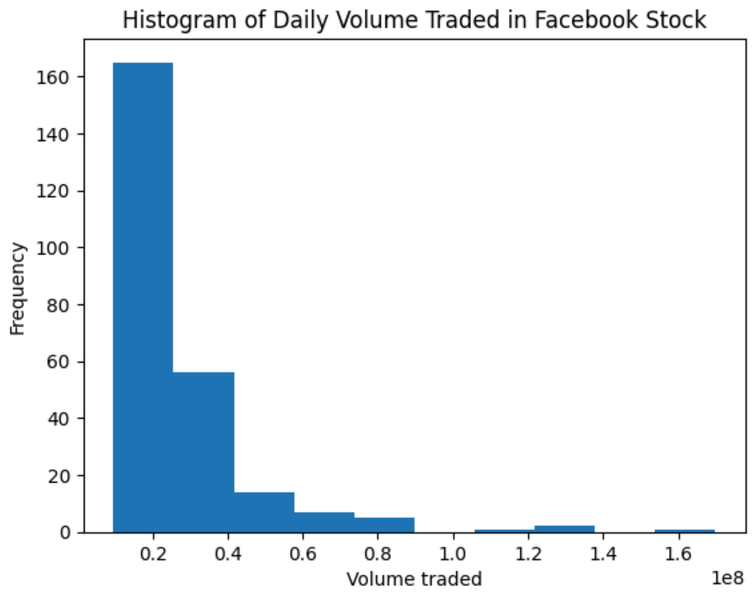


```
fb_corr.loc['max_abs_change', ['volume', 'log_volume']]
```

```
volume        0.642027
log_volume    0.731542
Name: max_abs_change, dtype: float64
```

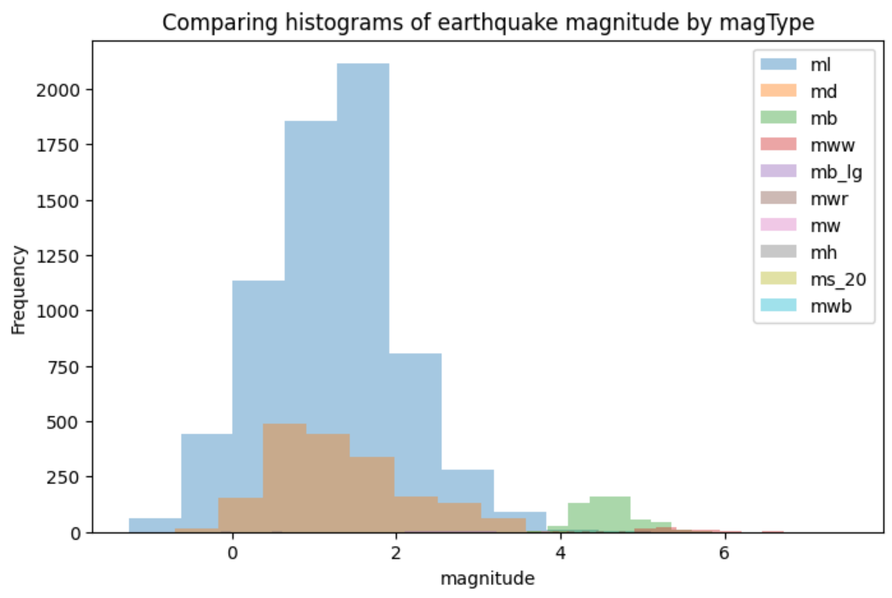
```
# visualizing distributions - histograms

fb.volume.plot(
    kind='hist',
    title='Histogram of Daily Volume Traded in Facebook Stock'
)

plt.xlabel('Volume traded') # label the x-axis (discussed in chapter 6)
```

```
Text(0.5, 0, 'Volume traded')
```



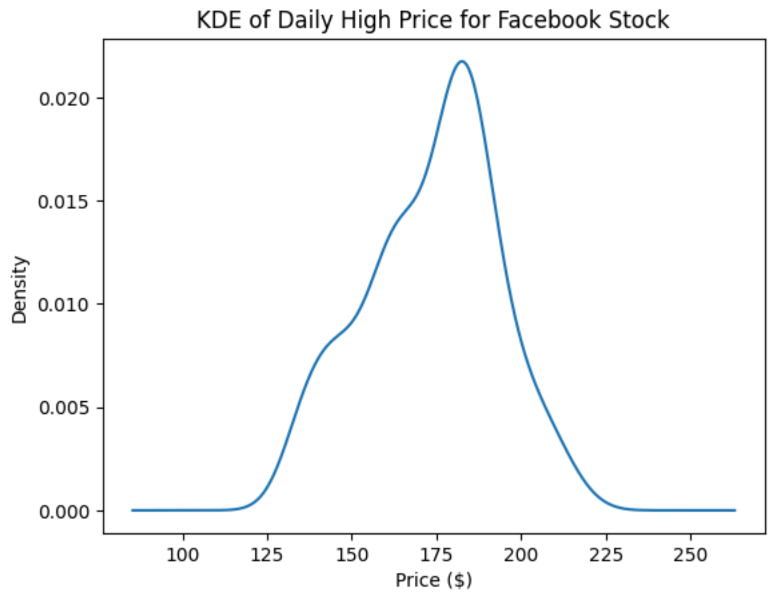
```
fig, axes = plt.subplots(figsize=(8, 5))
for magtype in quakes.magType.unique():
  data = quakes.query(f'magType == "{magtype}"').mag
  if not data.empty:
    data.plot(
        kind='hist', ax=axes, alpha=0.4,
        label=magtype, legend=True,
        title='Comparing histograms of earthquake magnitude by magType'
)

plt.xlabel('magnitude') # label the x-axis (discussed in chapter 6)
```

```
Text(0.5, 0, 'magnitude')
```



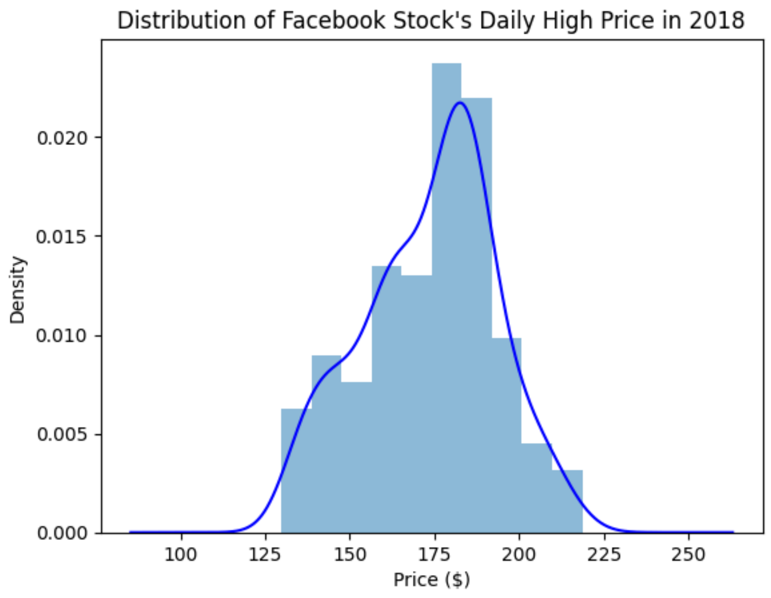
```
# kde

fb.high.plot(
    kind='kde',
    title='KDE of Daily High Price for Facebook Stock'
)

plt.xlabel('Price ($)') # label the x-axis (discussed in chapter 6)
```

```
Text(0.5, 0, 'Price ($)')
```



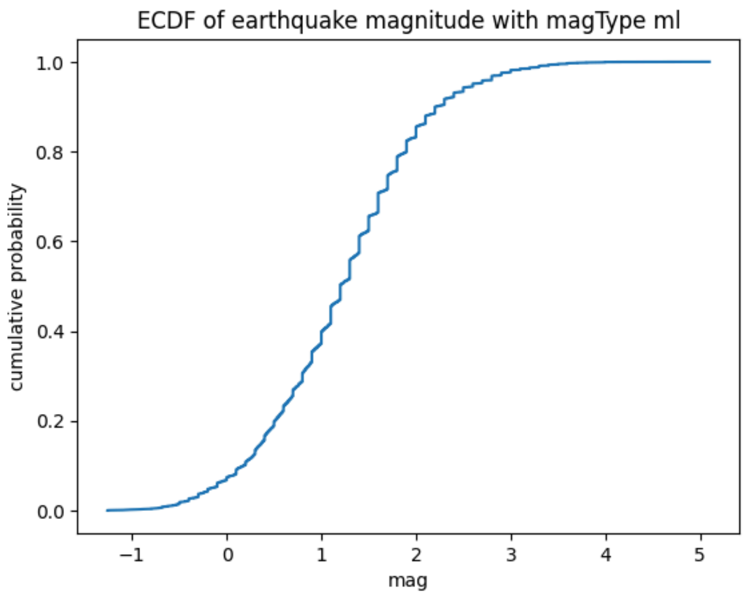
```
# adding result to plot

ax = fb.high.plot(kind='hist', density=True, alpha=0.5)
fb.high.plot(
    ax=ax, kind='kde', color='blue',
    title='Distribution of Facebook Stock\'s Daily High Price in 2018'
)

plt.xlabel('Price ($)') # label the x-axis (discussed in chapter 6)
```

```
Text(0.5, 0, 'Price ($)')
```



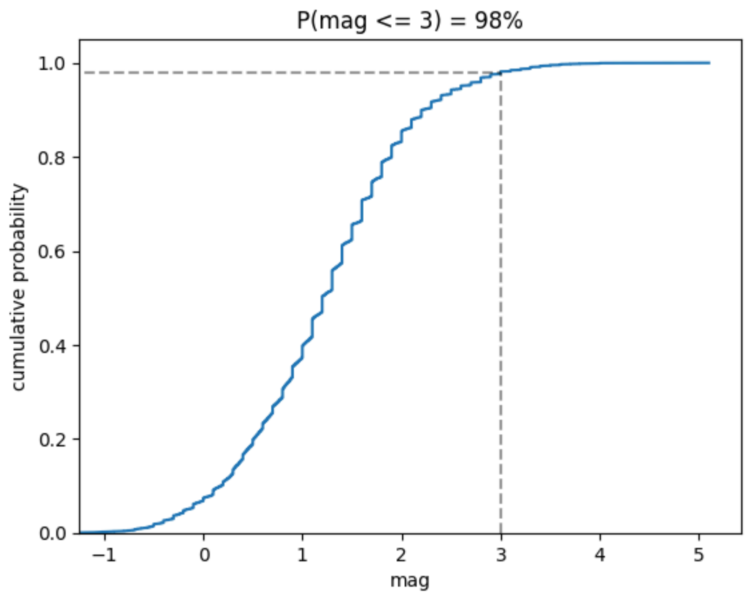
```
# plotting ecdf

from statsmodels.distributions.empirical_distribution import ECDF

ecdf = ECDF(quakes.query('magType == "ml"').mag)
plt.plot(ecdf.x, ecdf.y)

# axis labels (we will cover this in chapter 6)
plt.xlabel('mag') # add x-axis label
plt.ylabel('cumulative probability') # add y-axis label

# add title (we will cover this in chapter 6)
plt.title('ECDF of earthquake magnitude with magType ml')
```

```
Text(0.5, 1.0, 'ECDF of earthquake magnitude with magType ml')
```



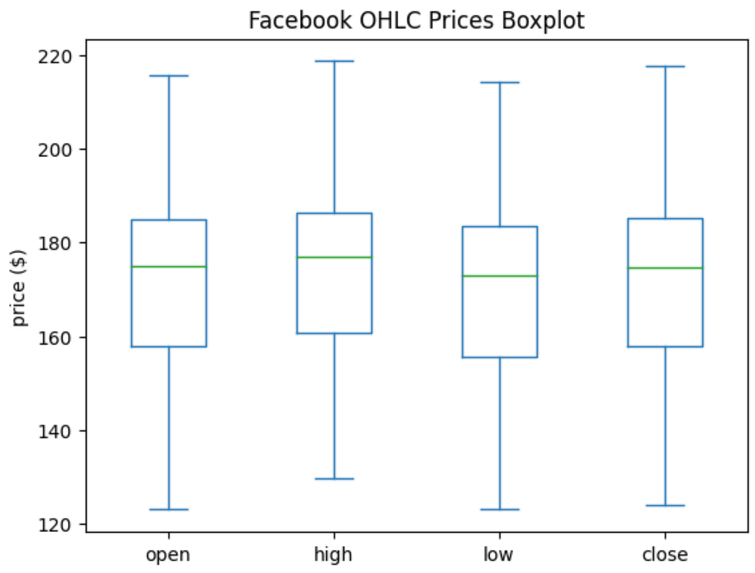
```
from statsmodels.distributions.empirical_distribution import ECDF

ecdf = ECDF(quakes.query('magType == "ml"').mag)
plt.plot(ecdf.x, ecdf.y)

# formatting below will all be covered in chapter 6
# axis labels
plt.xlabel('mag') # add x-axis label
plt.ylabel('cumulative probability') # add y-axis label

# add reference lines for interpreting the ECDF for mag <= 3
plt.plot(
    [3, 3], [0, .98], 'k--',
    [-1.5, 3], [0.98, 0.98], 'k--', alpha=0.4
)
# set axis ranges
plt.ylim(0, None)
plt.xlim(-1.25, None)

# add a title
plt.title('P(mag <= 3) = 98%')
```

```
Text(0.5, 1.0, 'P(mag <= 3) = 98%')
```



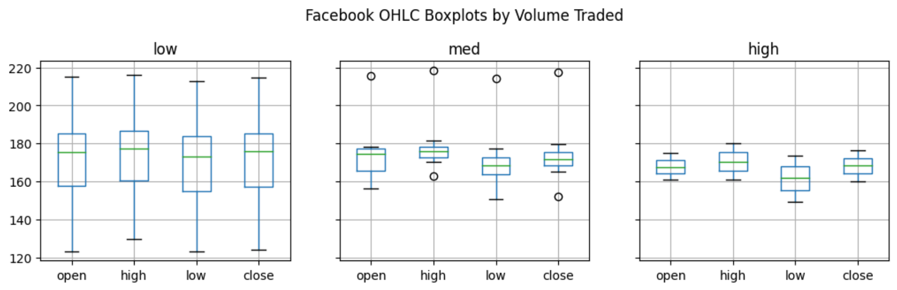
```
# box plots

fb.iloc[:,:4].plot(kind='box', title='Facebook OHLC Prices Boxplot')
plt.ylabel('price ($)') # label the x-axis (discussed in chapter 6)
```

```
Text(0, 0.5, 'price ($)')
```



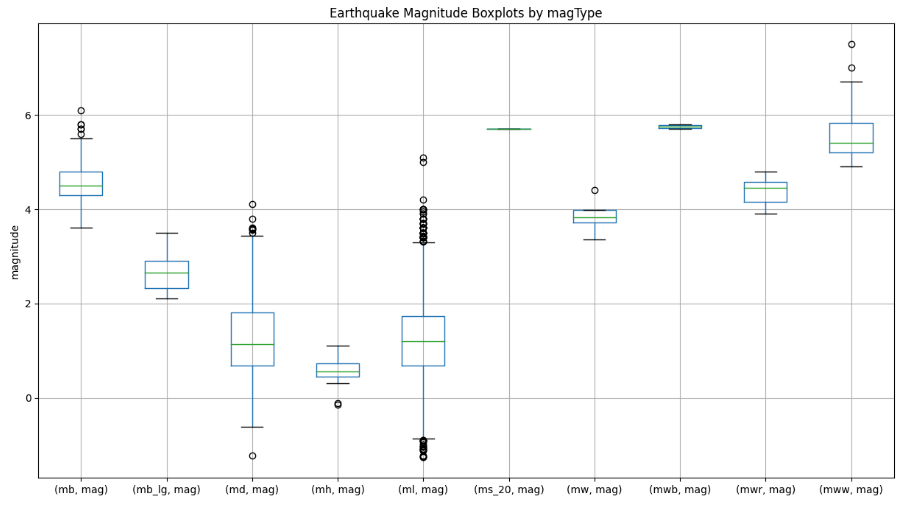
```
fb.assign(
    volume_bin=pd.cut(fb.volume, 3, labels=['low', 'med', 'high'])
).groupby('volume_bin').boxplot(
    column=['open', 'high', 'low', 'close'],
    layout=(1, 3), figsize=(12, 3)
)
plt.suptitle('Facebook OHLC Boxplots by Volume Traded', y=1.1)
```

```
Text(0.5, 1.1, 'Facebook OHLC Boxplots by Volume Traded')
```



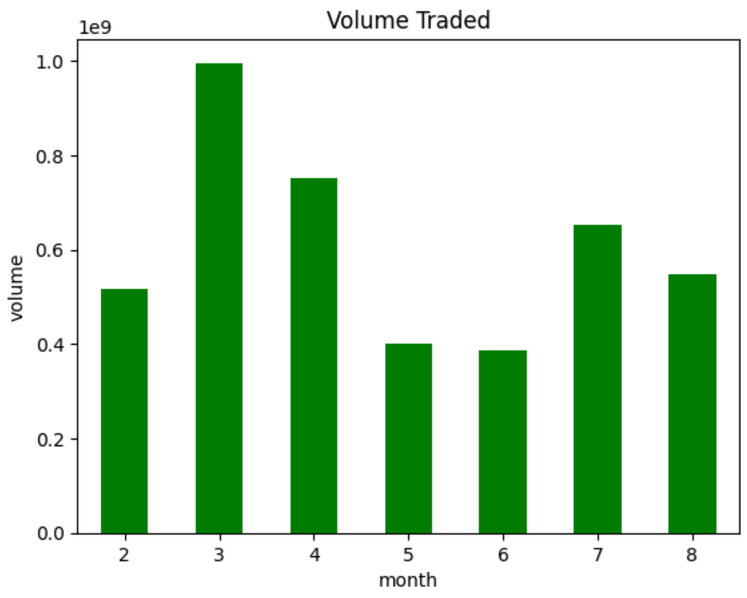
```
quakes[['mag', 'magType']].groupby('magType').boxplot(
    figsize=(15, 8), subplots=False
)
plt.title('Earthquake Magnitude Boxplots by magType')
plt.ylabel('magnitude') # label the y-axis (discussed in chapter 6)
```

```
Text(0, 0.5, 'magnitude')
```



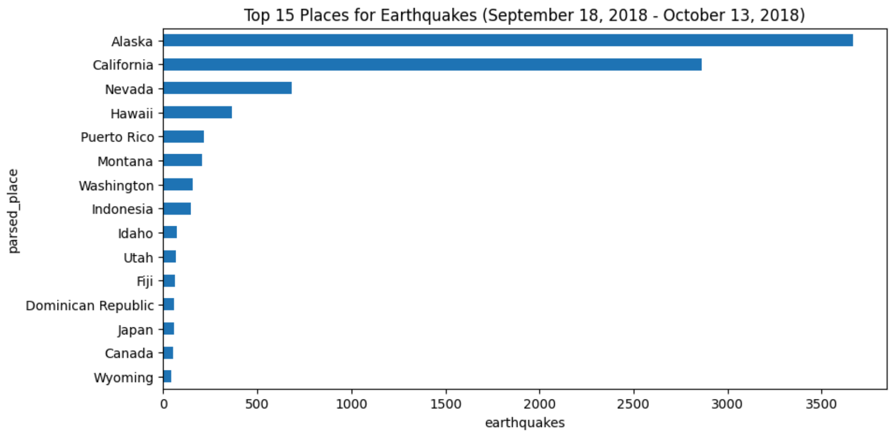
```
# bar charts

fb['2018-02':'2018-08'].assign(
    month=lambda x: x.index.month
).groupby('month').sum().volume.plot.bar(
    color='green', rot=0, title='Volume Traded'
)
plt.ylabel('volume') # label the y-axis (discussed in chapter 6)
```

```
Text(0, 0.5, 'volume')
```



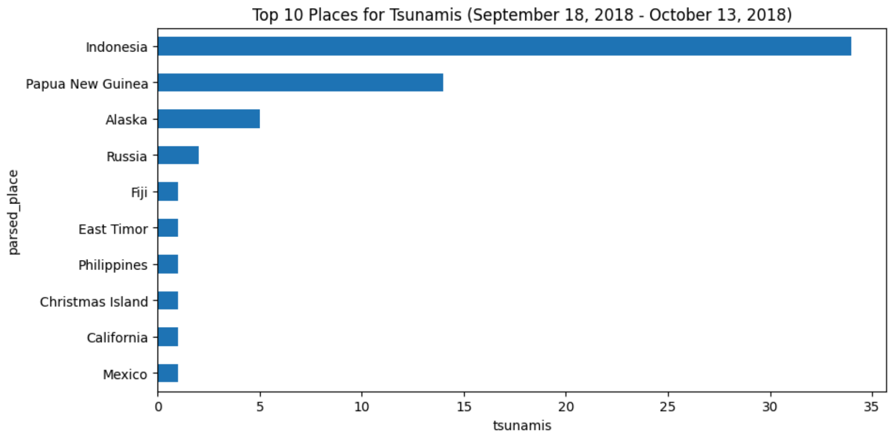
```
quakes.parsed_place.value_counts().iloc[14::-1,].plot(
    kind='barh', figsize=(10, 5),
    title='Top 15 Places for Earthquakes '\
    '(September 18, 2018 - October 13, 2018)'
)
plt.xlabel('earthquakes') # label the x-axis (discussed in chapter 6)
```

```
Text(0.5, 0, 'earthquakes')
```



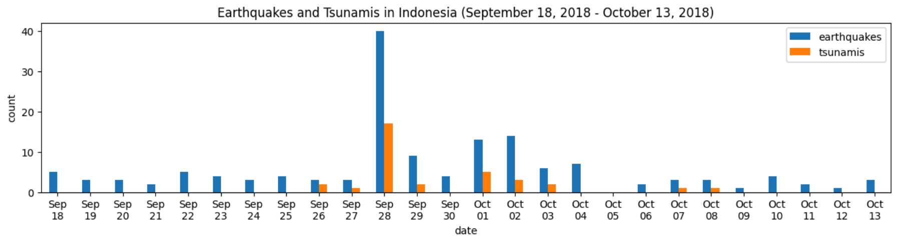
```
quakes.groupby('parsed_place').tsunami.sum().sort_values().iloc[-10::,].plot(
    kind='barh', figsize=(10, 5),
    title='Top 10 Places for Tsunamis '\
    '(September 18, 2018 - October 13, 2018)'
)
plt.xlabel('tsunamis') # label the x-axis (discussed in chapter 6
```

```
Text(0.5, 0, 'tsunamis')
```



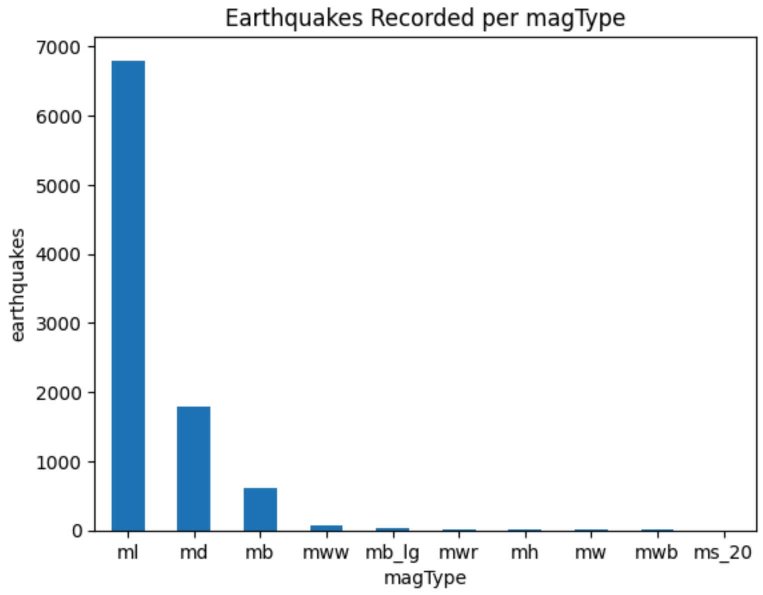
```
indonesia_quakes = quakes.query('parsed_place == "Indonesia"').assign(
    time=lambda x: pd.to_datetime(x.time, unit='ms'),
    earthquake=1
).set_index('time').resample('1D').sum()

indonesia_quakes.index = indonesia_quakes.index.strftime('%b\n%d')

indonesia_quakes.plot(
    y=['earthquake', 'tsunami'], kind='bar', figsize=(15, 3), rot=0,
    label=['earthquakes', 'tsunamis'],
    title='Earthquakes and Tsunamis in Indonesia '\
    '(September 18, 2018 - October 13, 2018)'
)

# label the axes (discussed in chapter 6)
plt.xlabel('date')
plt.ylabel('count')
```

```
Text(0, 0.5, 'count')
```



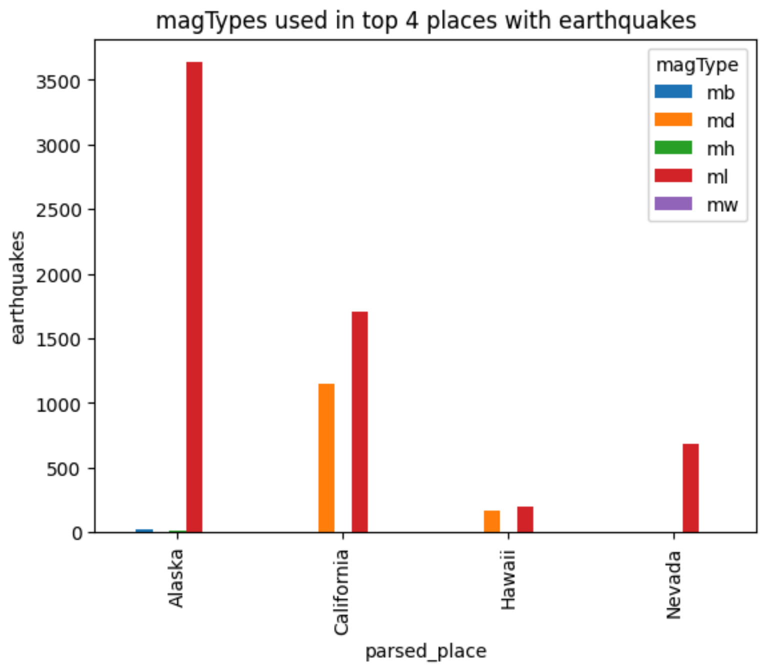
```
quakes.magType.value_counts().plot(
    kind='bar', title='Earthquakes Recorded per magType', rot=0
)
# label the axes (discussed in chapter 6)
plt.xlabel('magType')
plt.ylabel('earthquakes')
```

```
Text(0, 0.5, 'earthquakes')
```



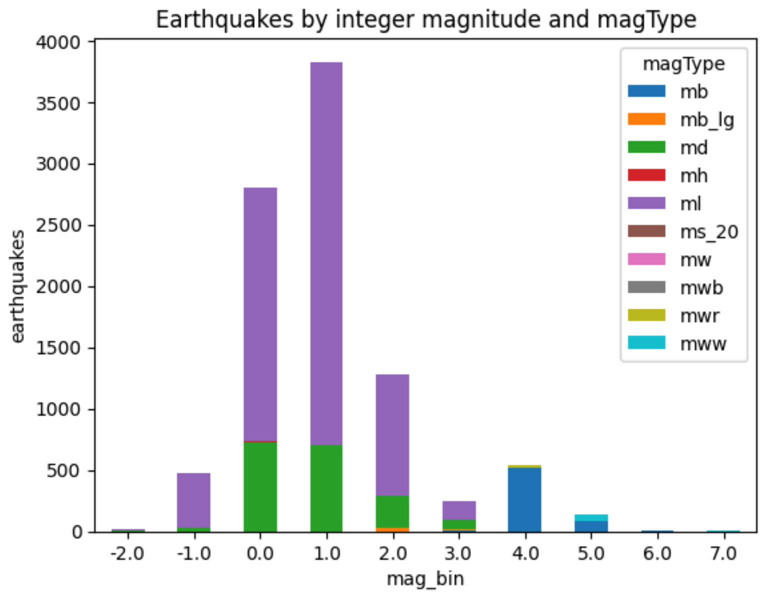
```
quakes[
    quakes.parsed_place.isin(['California', 'Alaska', 'Nevada', 'Hawaii'])
].groupby(['parsed_place', 'magType']).mag.count().unstack().plot.bar(
    title='magTypes used in top 4 places with earthquakes'
)
plt.ylabel('earthquakes') # label the axes (discussed in chapter 6)
```

```
Text(0, 0.5, 'earthquakes')
```



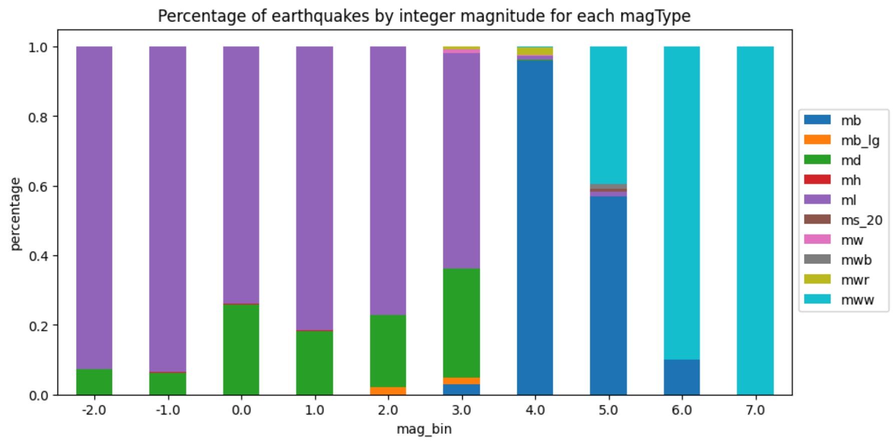
```
# stacked bar chart

pivot = quakes.assign(
    mag_bin=lambda x: np.floor(x.mag)
).pivot_table(
    index='mag_bin', columns='magType', values='mag', aggfunc='count'
)
pivot.plot.bar(
    stacked=True, rot=0,
    title='Earthquakes by integer magnitude and magType'
)
plt.ylabel('earthquakes') # label the axes (discussed in chapter 6)
```

```
Text(0, 0.5, 'earthquakes')
```



```
# normalized stacked bars

normalized_pivot = pivot.fillna(0).apply(lambda x: x/x.sum(), axis=1)
ax = normalized_pivot.plot.bar(
    stacked=True, rot=0, figsize=(10, 5),
    title='Percentage of earthquakes by integer magnitude for each magType'
)
ax.legend(bbox_to_anchor=(1, 0.8)) # move legend to the right of the plot
plt.ylabel('percentage') # label the axes (discussed in chapter 6)
```

```
Text(0, 0.5, 'percentage')
```

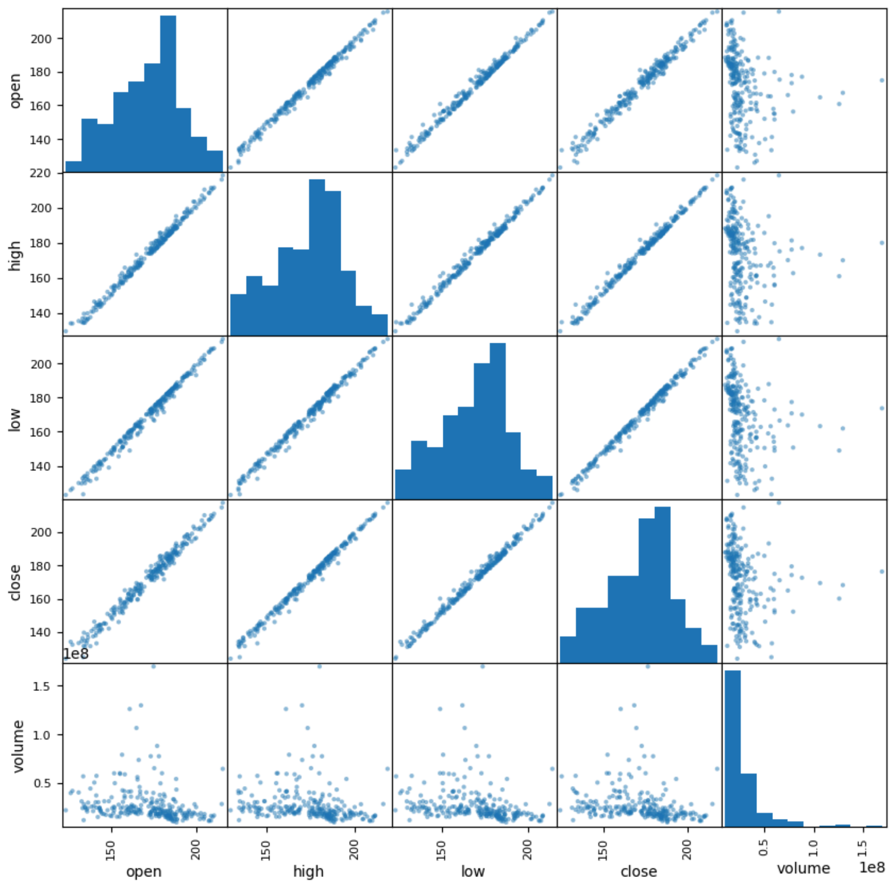


9.3 Pandas Plotting Subpackage

```
# setup

%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
fb = pd.read_csv(
    'data/fb_stock_prices_2018.csv', index_col='date', parse_dates=True
)
```

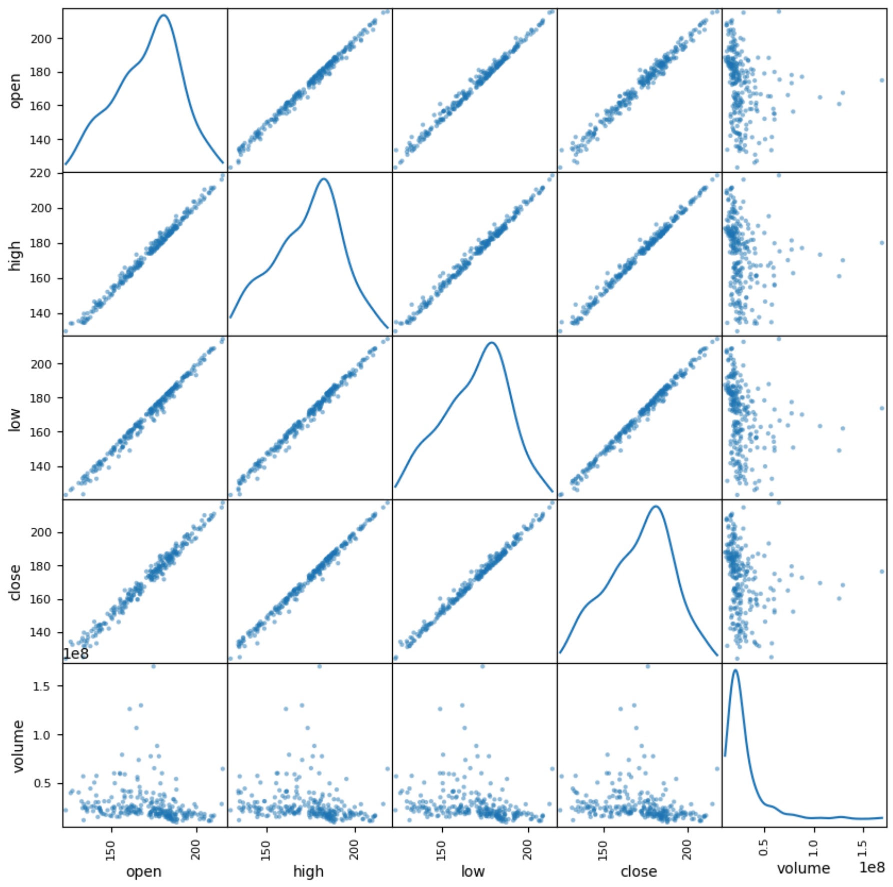
```
# scatter matrix

from pandas.plotting import scatter_matrix
scatter_matrix(fb, figsize=(10, 10))
```

```
array([[<Axes: xlabel='open', ylabel='open'>,
        <Axes: xlabel='high', ylabel='open'>,
        <Axes: xlabel='low', ylabel='open'>,
        <Axes: xlabel='close', ylabel='open'>,
        <Axes: xlabel='volume', ylabel='open'>],
       [<Axes: xlabel='open', ylabel='high'>,
        <Axes: xlabel='high', ylabel='high'>,
        <Axes: xlabel='low', ylabel='high'>,
        <Axes: xlabel='close', ylabel='high'>,
        <Axes: xlabel='volume', ylabel='high'>],
       [<Axes: xlabel='open', ylabel='low'>,
        <Axes: xlabel='high', ylabel='low'>,
        <Axes: xlabel='low', ylabel='low'>,
        <Axes: xlabel='close', ylabel='low'>,
        <Axes: xlabel='volume', ylabel='low'>],
       [<Axes: xlabel='open', ylabel='close'>,
        <Axes: xlabel='high', ylabel='close'>,
        <Axes: xlabel='low', ylabel='close'>,
        <Axes: xlabel='close', ylabel='close'>,
        <Axes: xlabel='volume', ylabel='close'>],
       [<Axes: xlabel='open', ylabel='volume'>,
        <Axes: xlabel='high', ylabel='volume'>,
        <Axes: xlabel='low', ylabel='volume'>,
        <Axes: xlabel='close', ylabel='volume'>,
        <Axes: xlabel='volume', ylabel='volume'>]], dtype=object)
```



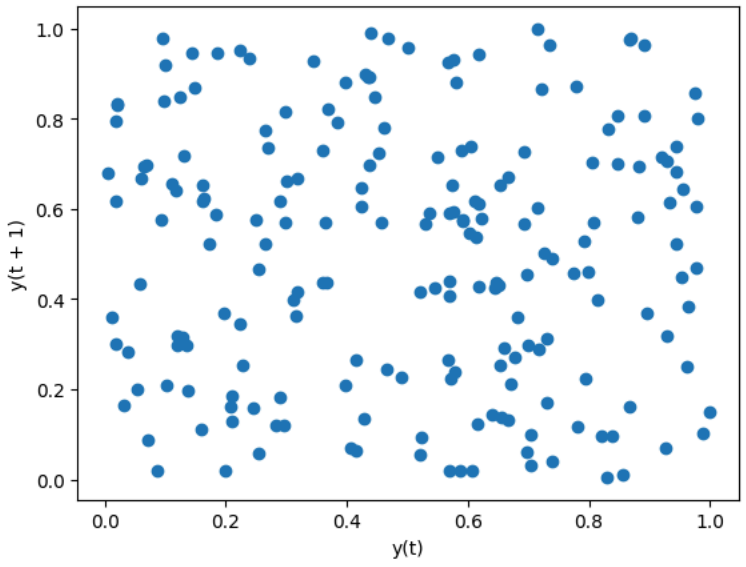
```
scatter_matrix(fb, figsize=(10, 10), diagonal='kde')
```

```
array([[<Axes: xlabel='open', ylabel='open'>,
        <Axes: xlabel='high', ylabel='open'>,
        <Axes: xlabel='low', ylabel='open'>,
        <Axes: xlabel='close', ylabel='open'>,
        <Axes: xlabel='volume', ylabel='open'>],
       [<Axes: xlabel='open', ylabel='high'>,
        <Axes: xlabel='high', ylabel='high'>,
        <Axes: xlabel='low', ylabel='high'>,
        <Axes: xlabel='close', ylabel='high'>,
        <Axes: xlabel='volume', ylabel='high'>],
       [<Axes: xlabel='open', ylabel='low'>,
        <Axes: xlabel='high', ylabel='low'>,
        <Axes: xlabel='low', ylabel='low'>,
        <Axes: xlabel='close', ylabel='low'>,
        <Axes: xlabel='volume', ylabel='low'>],
       [<Axes: xlabel='open', ylabel='close'>,
        <Axes: xlabel='high', ylabel='close'>,
        <Axes: xlabel='low', ylabel='close'>,
        <Axes: xlabel='close', ylabel='close'>,
        <Axes: xlabel='volume', ylabel='close'>],
       [<Axes: xlabel='open', ylabel='volume'>,
        <Axes: xlabel='high', ylabel='volume'>,
        <Axes: xlabel='low', ylabel='volume'>,
        <Axes: xlabel='close', ylabel='volume'>,
        <Axes: xlabel='volume', ylabel='volume'>]], dtype=object)
```



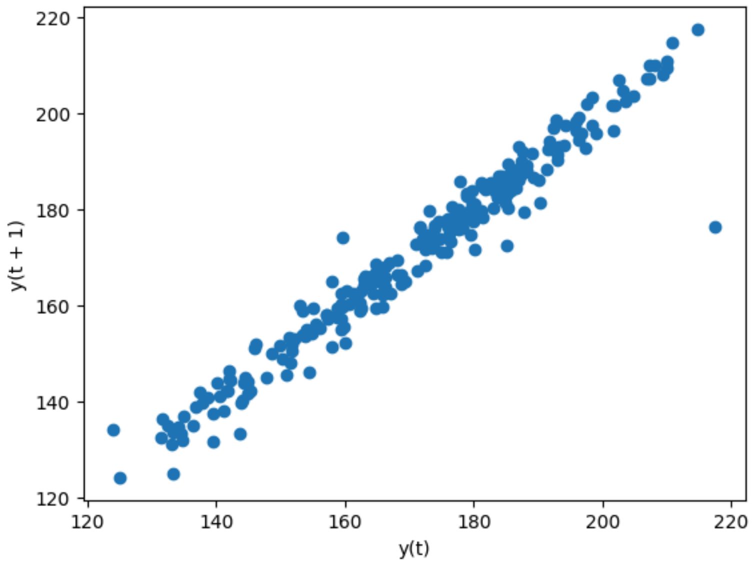
```
# lag plot

from pandas.plotting import lag_plot
np.random.seed(0) # make this repeatable
lag_plot(pd.Series(np.random.random(size=200)))
```

```
<Axes: xlabel='y(t)', ylabel='y(t + 1)'>
```



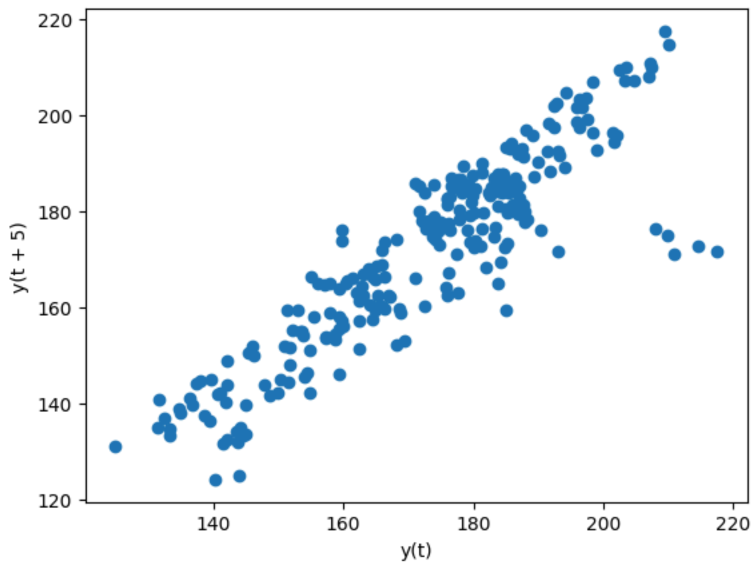
```
lag_plot(fb.close)
```

```
<Axes: xlabel='y(t)', ylabel='y(t + 1)'>
```



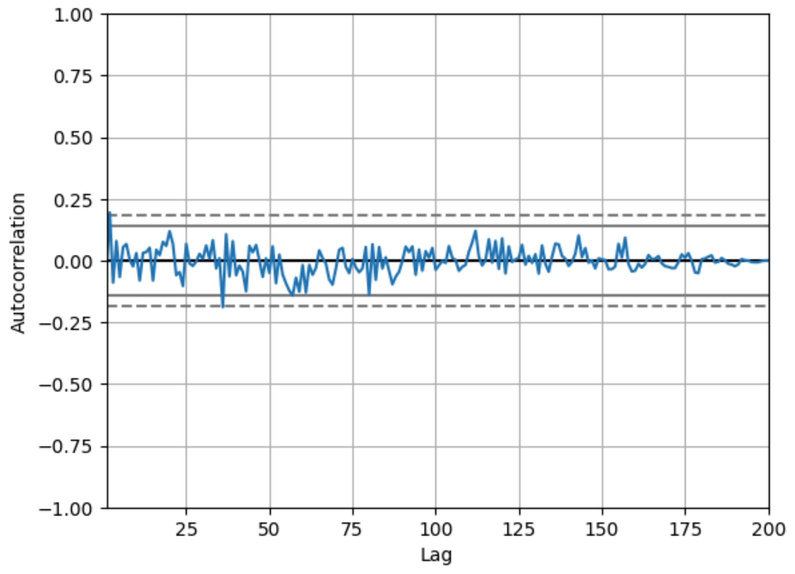
```
lag_plot(fb.close, lag=5)
```

```
<Axes: xlabel='y(t)', ylabel='y(t + 5)'>
```



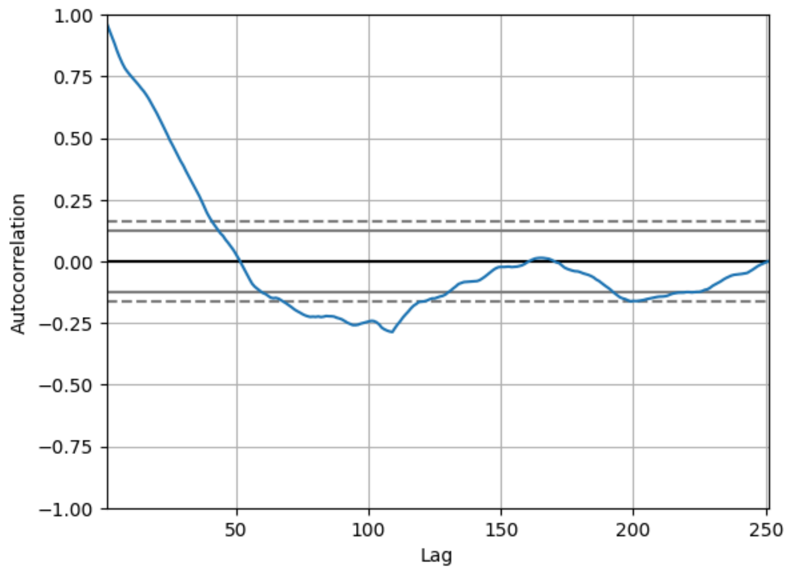
```
# autocorrelation plots

from pandas.plotting import autocorrelation_plot
np.random.seed(0) # make this repeatable
autocorrelation_plot(pd.Series(np.random.random(size=200)))
```

```
<Axes: xlabel='Lag', ylabel='Autocorrelation'>
```

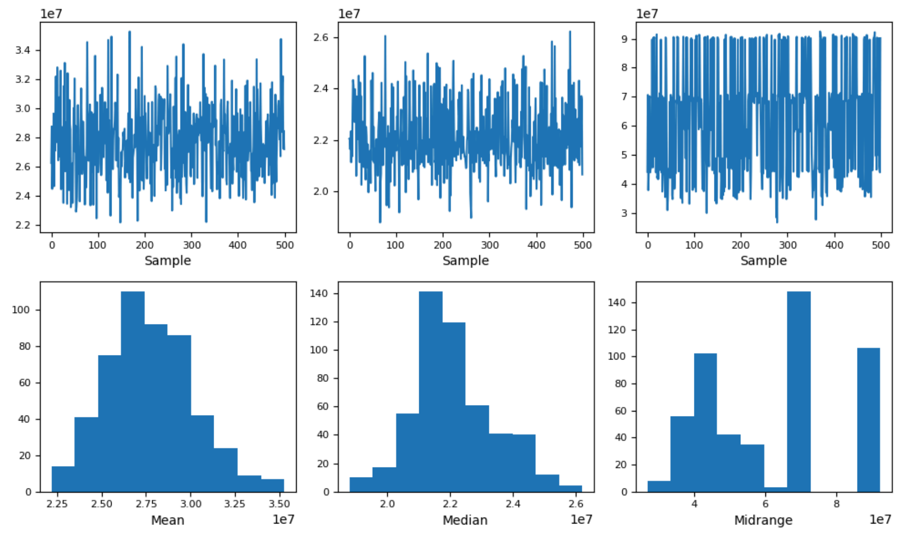


```
autocorrelation_plot(fb.close)
```

```
<Axes: xlabel='Lag', ylabel='Autocorrelation'>
```



```
# bootstrap plot

from pandas.plotting import bootstrap_plot
fig = bootstrap_plot(fb.volume, fig=plt.figure(figsize=(10, 6)))
```



Supplementary Activity

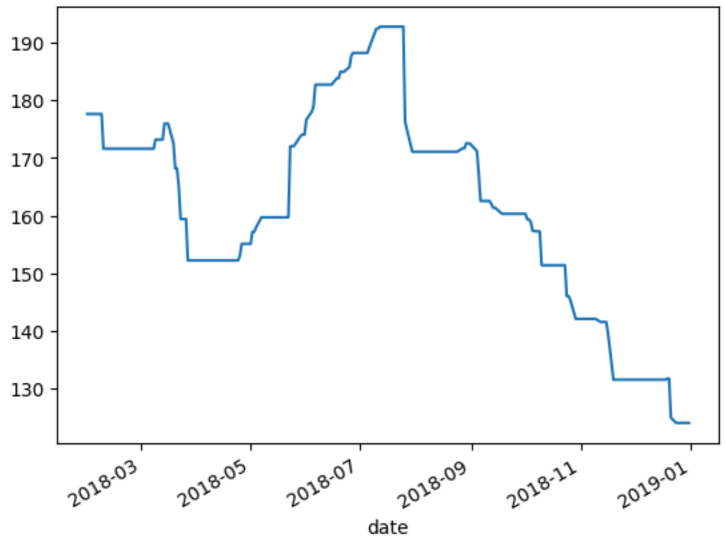
Using the CSV files provided and what we have learned so far in this module complete the following exercises:

1. Plot the rolling 20-day minimum of the Facebook closing price with the pandas plot() method.
2. Create a histogram and KDE of the change from open to close in the price of Facebook stock.
3. Using the earthquake data, create box plots for the magnitudes of each magType used in Indonesia.
4. Make a line plot of the difference between the weekly maximum high price and the weekly minimum low price for Facebook. This should be a single line.

5. Using matplotlib and pandas, create two subplots side-by-side showing the effect that after-hours trading has had on Facebook's stock price:
    - The first subplot will contain a line plot of the daily difference between that day's opening price and the prior day's closing price (be sure to review the Time series section of Aggregating Pandas DataFrames for an easy way to do this).
    - The second subplot will be a bar plot showing the net effect this had monthly, using resample().
    - Bonus #1: Color the bars according to whether they are gains in the stock price (green) or drops in the stock price (red).
    - Bonus #2: Modify the x-axis of the bar plot to show the threeletter abbreviation for the month.

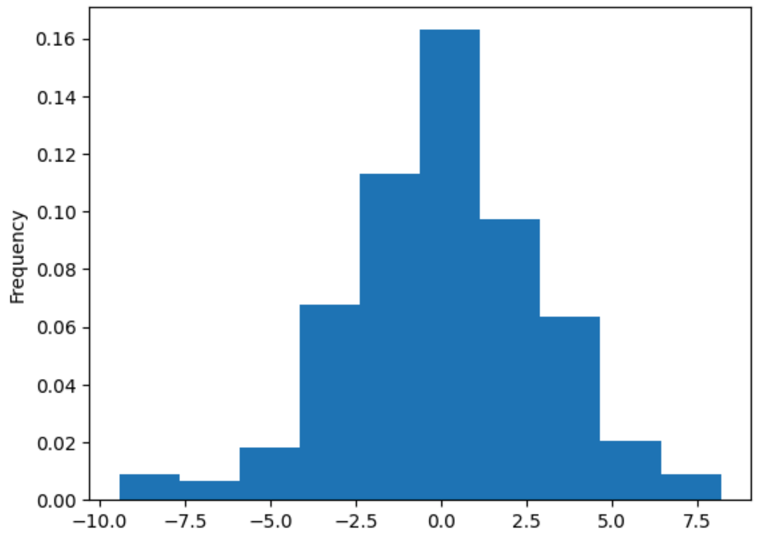
```
# plot the rolling 20-day minimum of the Facebook closing price with the pandas plot() method.

fb.rolling(window=20).min().close.plot()
```

```
<Axes: xlabel='date'>
```



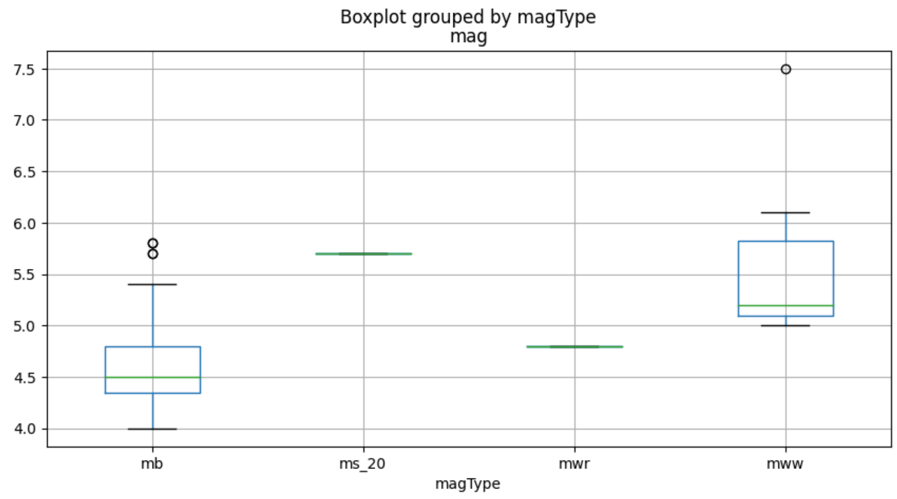
```
# create a histogram and KDE of the change from open to close in the price of Facebook stock.

fb.assign(
    change=fb.close - fb.open
).change.plot(kind='hist', density=True)
```

```
<Axes: ylabel='Frequency'>
```



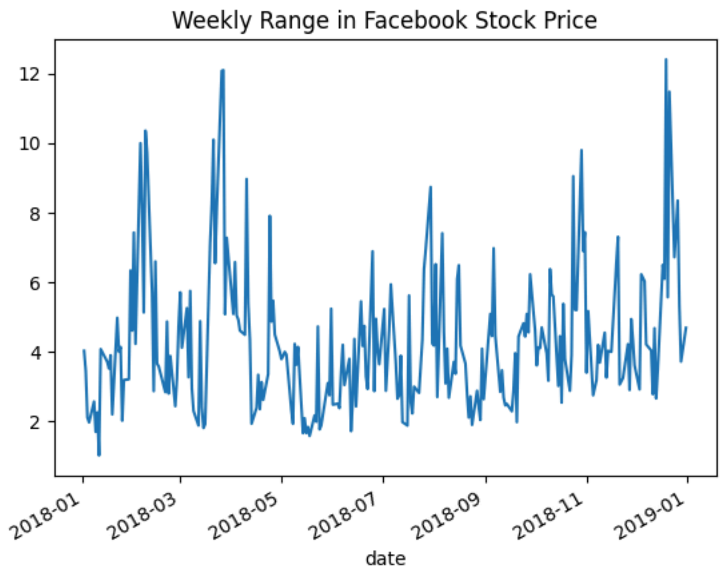
```
# using the earthquake data, create box plots for the magnitudes of each magType used in Indonesia.

quakes.query('parsed_place == "Indonesia"').boxplot(
    column='mag', by='magType', figsize=(10, 5)
)
```

```
<Axes: title={'center': 'mag'}, xlabel='magType'>
```



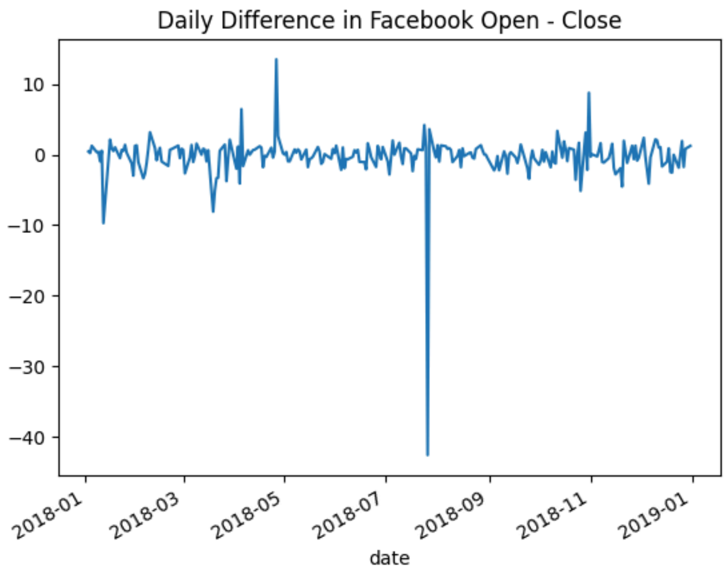
```
# make a line plot of the difference between the weekly maximum high price and the weekly minimum low price for Facebook. this should be a s
# line.

fb.assign(
    weekly_range=fb.high - fb.low
).weekly_range.plot(
    kind='line', title='Weekly Range in Facebook Stock Price'
)
```

```
<Axes: title={'center': 'Weekly Range in Facebook Stock Price'}, xlabel='date'>
```



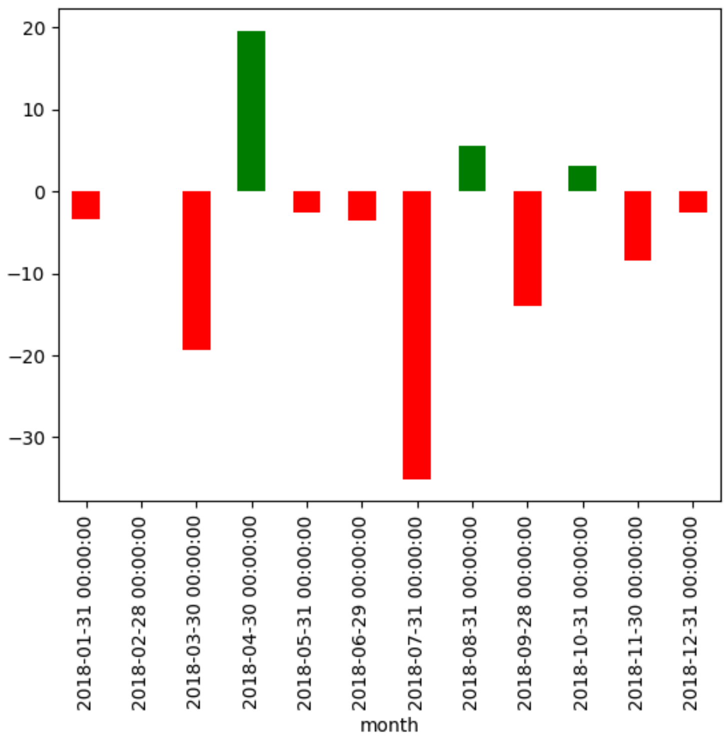
```
# the first subplot will contain a line plot of the daily difference between that day's opening price and the prior day's closing price.

fb.assign(
    daily_diff=fb.open - fb.close.shift(1)
).daily_diff.plot(title='Daily Difference in Facebook Open - Close')
```

```
<Axes: title={'center': 'Daily Difference in Facebook Open - Close'}, xlabel='date'>
```



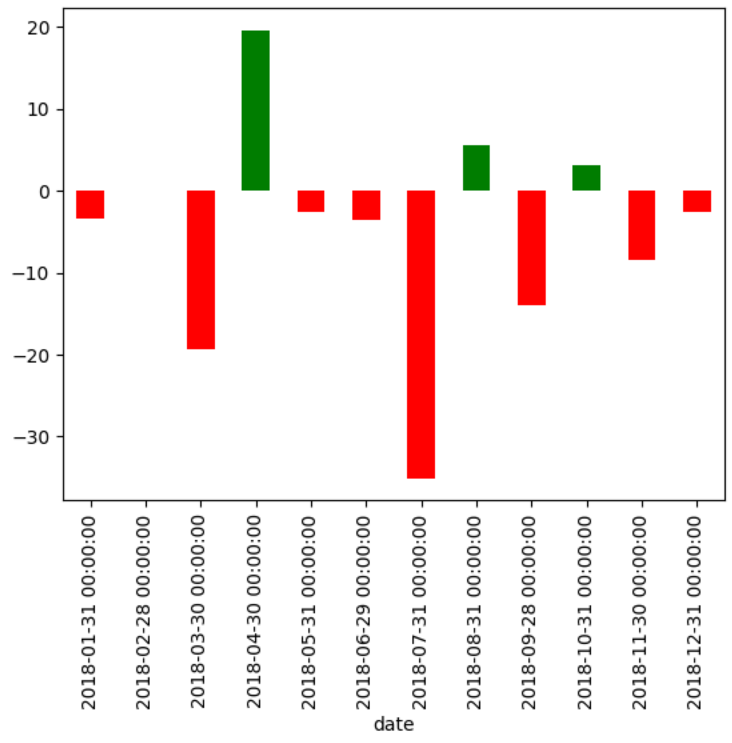
```
# the second subplot will be a bar plot showing the net effect this had monthly, using resample().

daily_diff = fb.assign(daily_diff=fb.open - fb.close.shift(1)).daily_diff
monthly_diff = daily_diff.resample('BM').sum()

monthly_diff.plot(
    kind='bar',
    color=['green' if x > 0 else 'red' for x in monthly_diff]
)

plt.xlabel('month')
```

```
Text(0.5, 0, 'month')
```



```
# color the bars according to whether they are gains in the stock price (green) or drops in the stock price (red).

monthly_diff.plot(
    kind='bar',
    color=['green' if x > 0 else 'red' for x in monthly_diff]
)
```

```
<Axes: xlabel='date'>
```



```
# modify the x-axis of the bar plot to show the threeletter abbreviation for the month.

monthly_diff.plot(
    kind='bar',
    color=['green' if x > 0 else 'red' for x in monthly_diff]
)
plt.xlabel('month')
plt.xticks(monthly_diff.index, monthly_diff.index.strftime('%b'))
```

```
([<matplotlib.axis.XTick at 0x7ba82de5b730>,
  <matplotlib.axis.XTick at 0x7ba82de5b700>,
  <matplotlib.axis.XTick at 0x7ba82de5a6b0>,
  <matplotlib.axis.XTick at 0x7ba82dcb0f70>,
  <matplotlib.axis.XTick at 0x7ba82dcb18a0>,
  <matplotlib.axis.XTick at 0x7ba82dcb0be0>,
  <matplotlib.axis.XTick at 0x7ba82dcb22c0>,
  <matplotlib.axis.XTick at 0x7ba82dcb2aa0>,
  <matplotlib.axis.XTick at 0x7ba82de5b610>,
  <matplotlib.axis.XTick at 0x7ba82dcb3cd0>,
  <matplotlib.axis.XTick at 0x7ba82dcb3e20>,
  <matplotlib.axis.XTick at 0x7ba82dcb28f0>],
```

Conclusion

In conclusion to this activity, I have learned about data visualization using it in Pandas and Matplotlib libraries of Python. Furthermore, I used the provided datasets to answer all the procedures. By having the knowledge from it, I was able to finish the supplementary activities since I have applied some techniques to it. Lastly, data visualization is important and useful for various topics because it can represent some graphical representations of datasets and other types of data.

```
  Text(17865.0, 0, 'Nov'),
```