Libraries

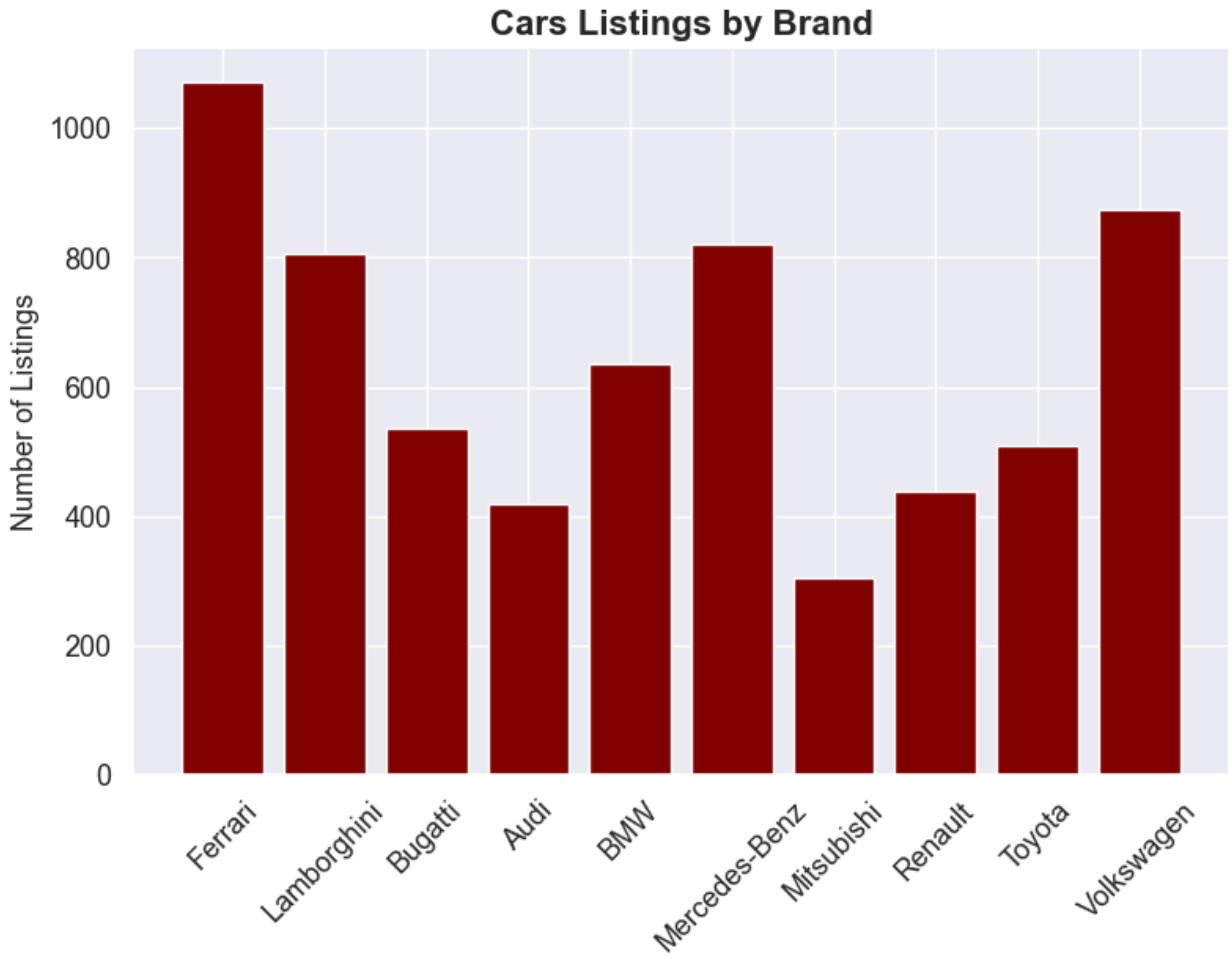
```
import pandas as pd # library for data manipulation
import matplotlib.pyplot as plt # library for visualization
import seaborn as sns # library for visualization
sns.set() # this command sets the seaborn chart style as the default

from matplotlib.ticker import PercentFormatter #converts values into
percentage format
```

Bar Chart

```
# Read the car data csv file for this task.
df_used_cars = pd.read_csv(r"car_data.csv")

df_used_cars
```

	Brand	Cars Listings
0	Ferrari	1070
1	Lamborghini	807
2	Bugatti	537
3	Audi	419
4	BMW	636
5	Mercedes-Benz	820
6	Mitsubishi	306
7	Renault	438
8	Toyota	509
9	Volkswagen	875

```
plt.figure(figsize = (9, 6)) #determine the size of the chart
# To create a bar chart with matplotlib you can use the 'bar'
function.
plt.bar(x = df_used_cars["Brand"], #specify the x axis
        height = df_used_cars["Cars Listings"], #specify the y axis
        color = "#800000") # the color for the bars
plt.xticks(rotation = 45, fontsize = 13) # rotate and format the
labels for the x-axis
plt.yticks(fontsize = 13) # format the y-axis
plt.title("Cars Listings by Brand", fontsize = 16, fontweight =
"bold") #add and format the title for the chart
plt.ylabel("Number of Listings", fontsize = 13 ) #add a title for the
y-axis
plt.savefig("Used Cars Bar.png") # you can export your chart as a
picture
plt.show() # depending on which environment you're using without this
line you're chart may not display properly.
```



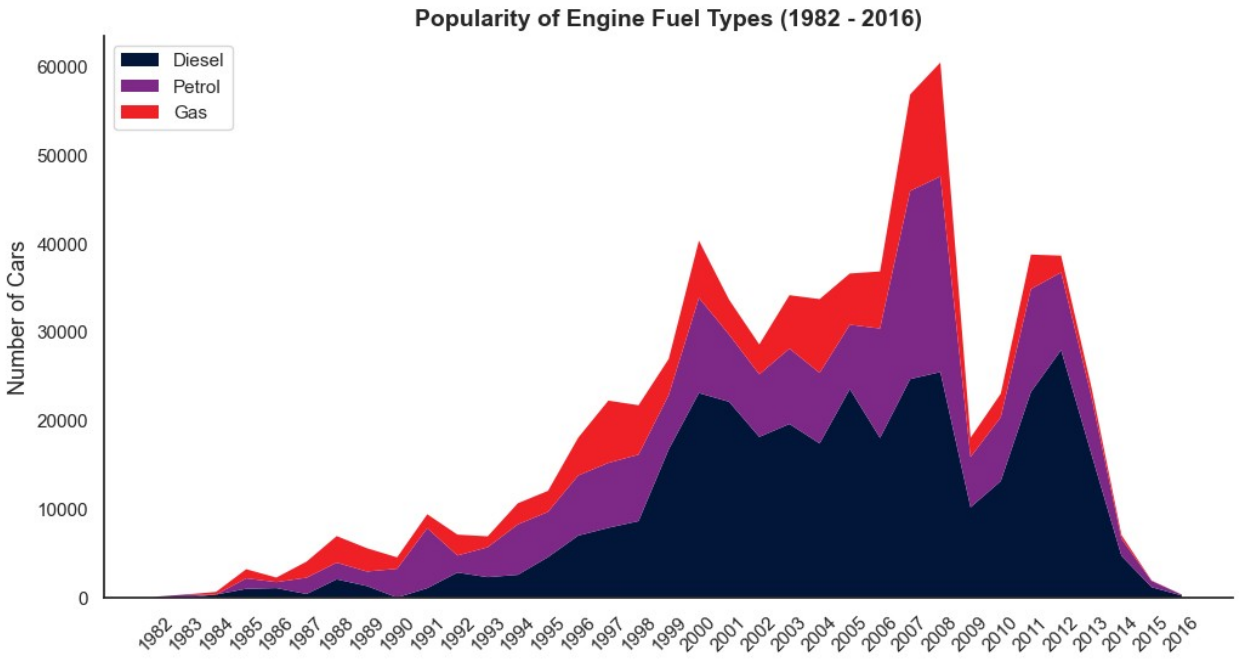
Stacked Area Chart

```
# load data. Engine Fuel Types for used cars. Data is collected from
1982 until 2016
df_fuel_engine_types = pd.read_csv("types_data.csv")

df_fuel_engine_types
```

	Year	Gas	Petrol	Diesel	Other
0	1982	0	94	0	0
1	1983	0	347	0	0
2	1984	300	0	334	0
3	1985	1030	1184	984	0
4	1986	511	681	1066	340
5	1987	1817	1840	400	940
6	1988	2999	1882	2060	1
7	1989	2626	1641	1304	330
8	1990	1290	3247	1	0
9	1991	1566	6776	1063	400
10	1992	2358	1925	2824	350
11	1993	1231	3375	2302	0
12	1994	2386	5691	2569	77
13	1995	2373	5115	4563	666
14	1996	4264	6792	6996	1235
15	1997	7031	7336	7877	370
16	1998	5578	7511	8634	310
17	1999	4069	6147	16742	1493
18	2000	6459	10754	23102	531
19	2001	3932	7590	22115	1029
20	2002	3375	7069	18144	479
21	2003	6032	8518	19605	281
22	2004	8332	7978	17400	1821
23	2005	5785	7269	23551	1918
24	2006	6439	12372	18024	1878
25	2007	10902	21258	24683	1525
26	2008	12876	22090	25471	1516
27	2009	2179	5682	10191	1204
28	2010	2649	7222	13150	442
29	2011	3893	11628	23221	1688
30	2012	1899	8763	27958	1736
31	2013	1055	6517	16255	607
32	2014	409	1942	4703	329
33	2015	50	702	1172	125
34	2016	0	108	220	25

```
# Create a stacked area chart, with pyplots 'stackplot'. On the x-axis
we have the time line - year 1982 to 2016.
# On the y-axis we have the three categories, 'Diesel', 'Petrol' and
'Gas' stacked on top of each other.
# Note that this ordering is chosen specifically so that categories
```

```
are from largest to smallest.
# This helps us compare the size of the catogories, as people have
difficulties determining the size of non-rectangular shapes.

# Provide a color list, so that each category can have a specific
color.
# Color names should appear in the same order as the stacked area plot
categories appear.
colors = ["#011638", "#7e2987", "#ef2026"]
# label list for the legend. Names should appear in the same order as
the stacked area plot categories appear.
labels = ["Diesel", "Petrol", "Gas"]
sns.set_style("white") # Use seaborn's 'white' theme to introduce a
white background, instead of the default grey.
plt.figure(figsize = (12, 6))
plt.stackplot(df_fuel_engine_types["Year"],
              df_fuel_engine_types["Diesel"],
              df_fuel_engine_types["Petrol"],
              df_fuel_engine_types["Gas"],
              colors = colors,
              edgecolor = 'none')
plt.xticks(df_fuel_engine_types["Year"], rotation = 45) # Include x-
axis labels for each year and rotate labels by 45 degrees.
plt.legend(labels = labels, loc = "upper left") # Add a legend and
specify its location on the chart.
plt.ylabel("Number of Cars", fontsize = 13)
plt.title("Popularity of Engine Fuel Types (1982 - 2016)", fontsize =
14, weight = "bold")
sns.despine() # Remove top and right border of the chart.
plt.show()
```



Line Chart

```
# load line chart data
df_spx_ftse_00_10 = pd.read_csv("line_chart_data.csv")

df_spx_ftse_00_10
```

	Date	GSPC500	FTSE100
0	1/3/2000	0.003264	0.000000
1	1/4/2000	-0.009549	0.000000
2	1/5/2000	-0.038345	-0.038137
3	1/6/2000	0.001922	-0.019502
4	1/7/2000	0.000956	-0.013571
...	...	...	...
2865	12/27/2010	-0.002282	0.002135
2866	12/28/2010	0.003539	0.000000
2867	12/29/2010	-0.000254	0.000000
2868	12/30/2010	0.000524	-0.002080
2869	12/31/2010	-0.002128	-0.004236

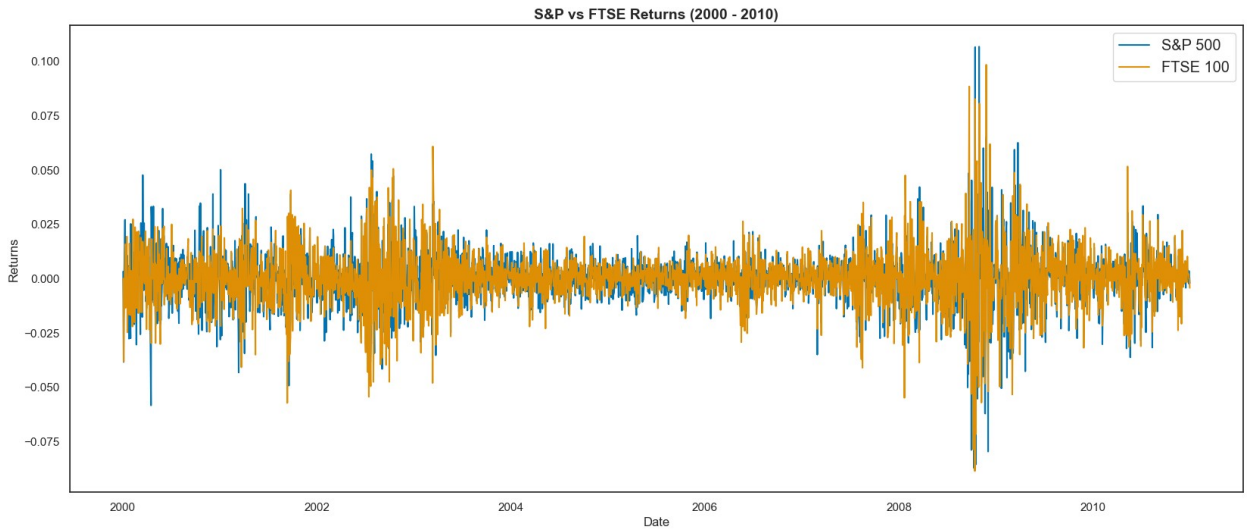
[2870 rows x 3 columns]

```
# Convert 'Date' into datetime format. Otherwise it will be regarded
as a simple string
# and it's highly likely that many operations or transformations on
the date column won't have the desired result.
# This is a crucial step in any time series analysis.
df_spx_ftse_00_10["new_date"] =
pd.to_datetime(df_spx_ftse_00_10["Date"])
```

```
df_spx_ftse_00_10["new_date"]
```

```
0       2000-01-03
1       2000-01-04
2       2000-01-05
3       2000-01-06
4       2000-01-07
           ...
2865    2010-12-27
2866    2010-12-28
2867    2010-12-29
2868    2010-12-30
2869    2010-12-31
Name: new_date, Length: 2870, dtype: datetime64[ns]
```

```
# line chart for the two indices: S&P 500 (in blue) vs FTSE 100 (in
orange). The time frame is from 2000 until end of 2010
labels = ["S&P 500", "FTSE 100"] # legend labels list
plt.figure(figsize = (20, 8))
plt.plot(df_spx_ftse_00_10["new_date"], df_spx_ftse_00_10["GSPC500"])
plt.plot(df_spx_ftse_00_10["new_date"], df_spx_ftse_00_10["FTSE100"])
# chart formatting elements: title, labels and legend
plt.title("S&P vs FTSE Returns (2000 - 2010)", fontsize = 14,
fontweight = "bold")
plt.ylabel("Returns")
plt.xlabel("Date")
plt.legend(labels = labels, fontsize = "large")
plt.show()
```



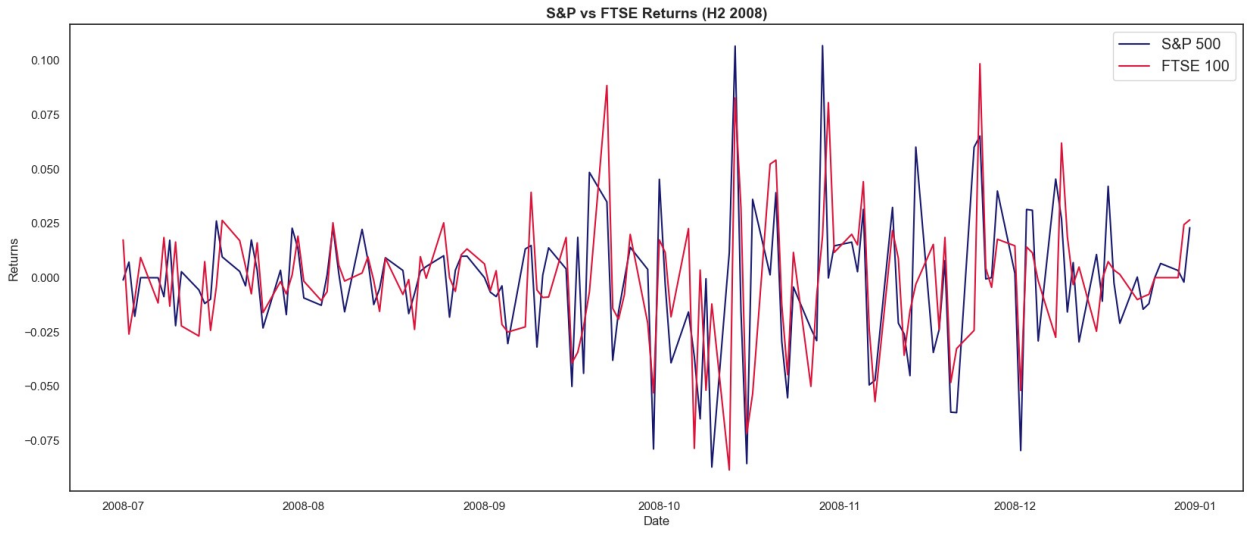

```
# introduce a new data frame for a specific time frame. Starts
07/01/2008 and ends 12/31/2008
df_spx_ftse_H2_08 = df_spx_ftse_00_10[(df_spx_ftse_00_10.new_date >=
```

```
'2008-07-01') &
                                        (df_spx_ftse_00_10.new_date <=
'2008-12-31')]

df_spx_ftse_H2_08
```

	Date	GSPC500	FTSE100	new_date
2216	7/1/2008	-0.001072	0.017360	2008-07-01
2217	7/2/2008	0.007151	-0.025951	2008-07-02
2218	7/3/2008	-0.017779	-0.009781	2008-07-03
2219	7/4/2008	0.000000	0.009270	2008-07-04
2220	7/7/2008	-0.000048	-0.011650	2008-07-07
...	...	...	...	...
2343	12/25/2008	0.000000	0.000000	2008-12-25
2344	12/26/2008	0.006529	0.000000	2008-12-26
2345	12/29/2008	0.003289	0.000000	2008-12-29
2346	12/30/2008	-0.002052	0.024380	2008-12-30
2347	12/31/2008	0.022985	0.026578	2008-12-31

[132 rows x 4 columns]

```
# line chart for the two indices S&P 500 (in dark blue) vs FTSE 100
(in crimson red). The time frame is H2(second half) of 2008
plt.figure(figsize = (20, 8))
plt.plot(df_spx_ftse_H2_08["new_date"], df_spx_ftse_H2_08["GSPC500"],
color = "midnightblue")
plt.plot(df_spx_ftse_H2_08["new_date"], df_spx_ftse_H2_08["FTSE100"],
color = "crimson")
plt.title("S&P vs FTSE Returns (H2 2008)", fontsize = 14, fontweight =
"bold")
plt.ylabel("Returns")
plt.xlabel("Date")
plt.legend(labels = labels, fontsize = "large")
plt.show()
```



Histogram

```
# Load real estate data set for the histogram
df_real_estate = pd.read_csv("realestate_data.csv")

df_real_estate
```

```
       ID  Building Type  Year of sale  Month of sale Type of property
\
0    1030              1        2005.0           11.0        Apartment

1    1029              1        2005.0           10.0        Apartment

2    2002              2        2007.0            7.0        Apartment

3    2031              2        2007.0           12.0        Apartment

4    1049              1        2004.0           11.0        Apartment

..    ...            ...           ...            ...              ...

262  5044              5           NaN            NaN        Apartment

263  5047              5           NaN            NaN        Apartment

264  5048              5           NaN            NaN        Apartment

265  5050              5           NaN            NaN        Apartment

266  5051              5           NaN            NaN        Apartment


     Property #  Area (ft.)  Price
0            30      743.09    246
1            29      756.21    246
2             2      587.28    209
3            31     1604.75    453
4            49     1375.45    467
..          ...         ...    ...
262          44     1238.58    323
263          47      794.52    279
264          48     1013.27    288
265          50     1074.71    366
266          51      789.25    199

[267 rows x 8 columns]
```

```
sns.set_style("white") # override the default matplotlib style, to
avoid the grey background and grid
plt.figure(figsize = (8, 6)) # determine the size of the figure
plt.hist(df_real_estate["Price"], # the variable on which to create
```

```
the histogram
         bins = 8, # create a histogram with 8 bins
         color = "#108A99")
plt.title("Distribution of Real Estate Prices", fontsize = 14, weight
= "bold")
plt.xlabel("Price in (000's $)")
plt.ylabel("Number of Properties")
sns.despine() # removes the top and right border of our graph
plt.show()
```

Scatter Plot

```
#load the real estate data for the scatter plot
df_real_estate = pd.read_csv("realestate_data.csv")

df_real_estate
```

```
       ID  Building Type  Year of sale  Month of sale Type of property
\
```

```
0    1030                1        2005.0            11.0         Apartment
1    1029                1        2005.0            10.0         Apartment
2    2002                2        2007.0             7.0         Apartment
3    2031                2        2007.0            12.0         Apartment
4    1049                1        2004.0            11.0         Apartment
..    ...              ...           ...             ...              ...
262  5044                5           NaN             NaN         Apartment
263  5047                5           NaN             NaN         Apartment
264  5048                5           NaN             NaN         Apartment
265  5050                5           NaN             NaN         Apartment
266  5051                5           NaN             NaN         Apartment


     Property #  Area (ft.)  Price
0            30      743.09    246
1            29      756.21    246
2             2      587.28    209
3            31     1604.75    453
4            49     1375.45    467
..          ...         ...    ...
262          44     1238.58    323
263          47      794.52    279
264          48     1013.27    288
265          50     1074.71    366
266          51      789.25    199

[267 rows x 8 columns]
```

```
# scatter plot with matplotlib's pyplot. Depending on what features
you'd like to include,
# this version might not give as many high level options as seaborn.
However, technically, it should perform just as well.
plt.figure(figsize = (12, 8)) # size of the figure
scatter = plt.scatter(df_real_estate['Area (ft.)'],
            df_real_estate['Price'],
            alpha = 0.6, #transparency level of points on the plot.
Used to avoid overplotting
            c = df_real_estate['Building Type'], # additional third
feature
            cmap = 'viridis') #color map for the third variable
# add and format additional elements, such as legends, titles and axis
```

```
labels
plt.legend(*scatter.legend_elements(),
           loc = "upper left",
           title = "Building Type")
plt.title("Relationship between Area and Price of California Real
Estate",
          fontsize = 14,
          weight = "bold")
plt.xlabel("Area (sq. ft.)", weight = "bold")
plt.ylabel("Price (000's of $)")
plt.show()
```

Regression Plot

```
#load the marketing data set for the regression plot
df_ad_expenditure = pd.read_csv("budget_data.csv")

df_ad_expenditure
```

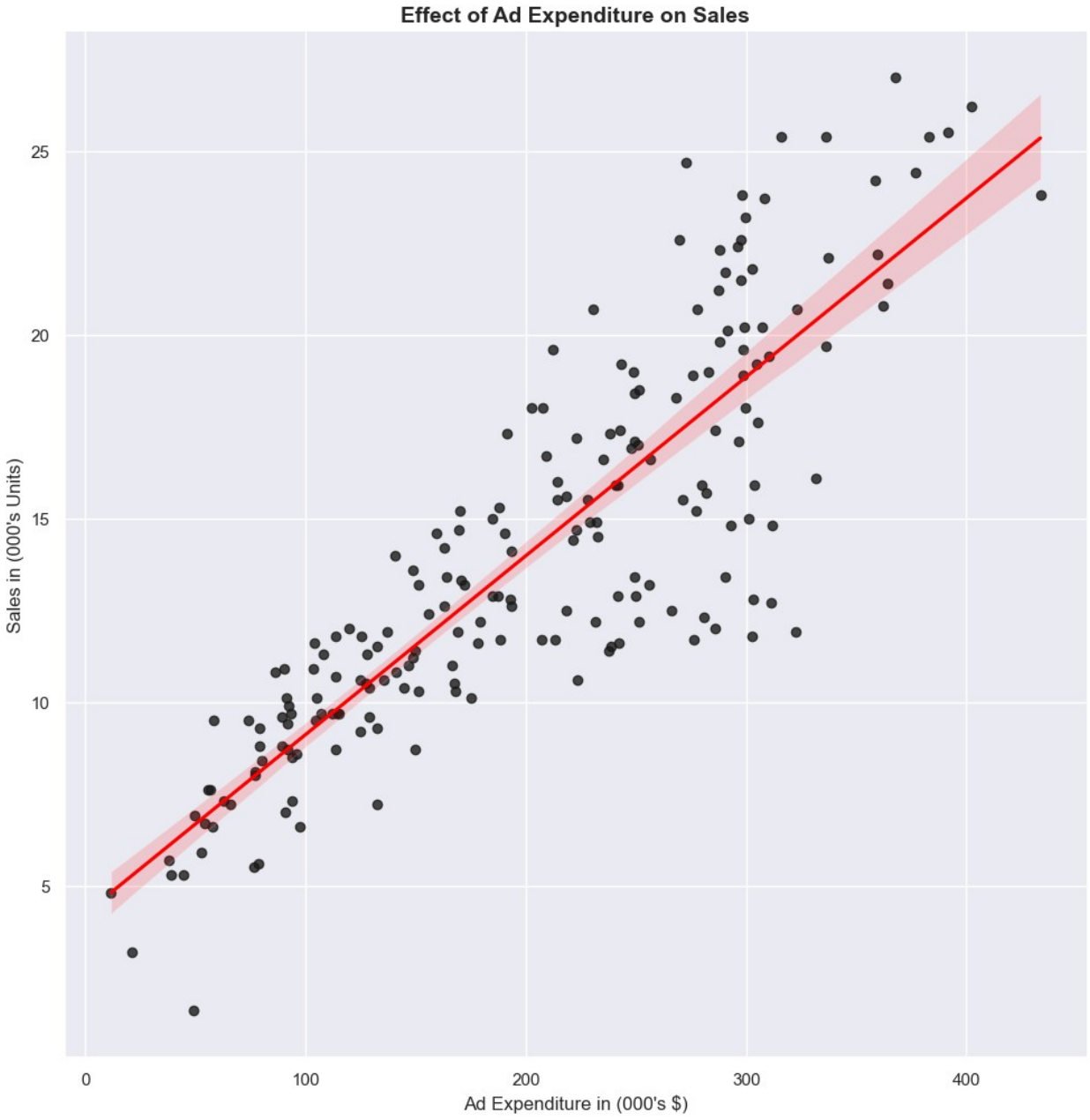
	Budget	Sales
0	337.1	22.1
1	128.9	10.4
2	132.4	9.3

```
3     251.3   18.5
4     250.0   12.9
..      ...    ...
195    55.7    7.6
196   107.2    9.7
197   192.7   12.8
198   391.8   25.5
199   249.4   13.4

[200 rows x 2 columns]
```

```
# A regplot accepts x and y in a variety of formats. For the lmplot
the data need to be strings in the so called 'long-form'.
#plt.figure(figsize = (10, 8))
sns.set(rc = {'figure.figsize': (9,6)}) # control the size of the
figure with the rc dictionary
sns.regplot(x = "Budget",
            y = "Sales",
            data = df_ad_expenditure,
            scatter_kws = {'color': 'k'}, # color for the points
            line_kws = {'color': 'red'}) # color for the regression
line
plt.xlabel("Ad Expenditure in (000's $)")
plt.ylabel("Sales in (000's Units)")
plt.title("Effect of Ad Expenditure on Sales", fontsize = 14, weight =
"bold")
plt.show()
```


```
sns.lmplot(x = "Budget",
           y = "Sales",
           data = df_ad_expenditure,
           height = 10, # height and width of the plot
           scatter_kws = {'color': 'k'}, # color for the points
           line_kws = {'color': 'red'}) # color for the regression
line
plt.xlabel("Ad Expenditure in (000's $)")
plt.ylabel("Sales in (000's Units)")
plt.title("Effect of Ad Expenditure on Sales", fontsize = 14, weight =
"bold")
plt.show()
```

```
D:\anaconda3\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning:
The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

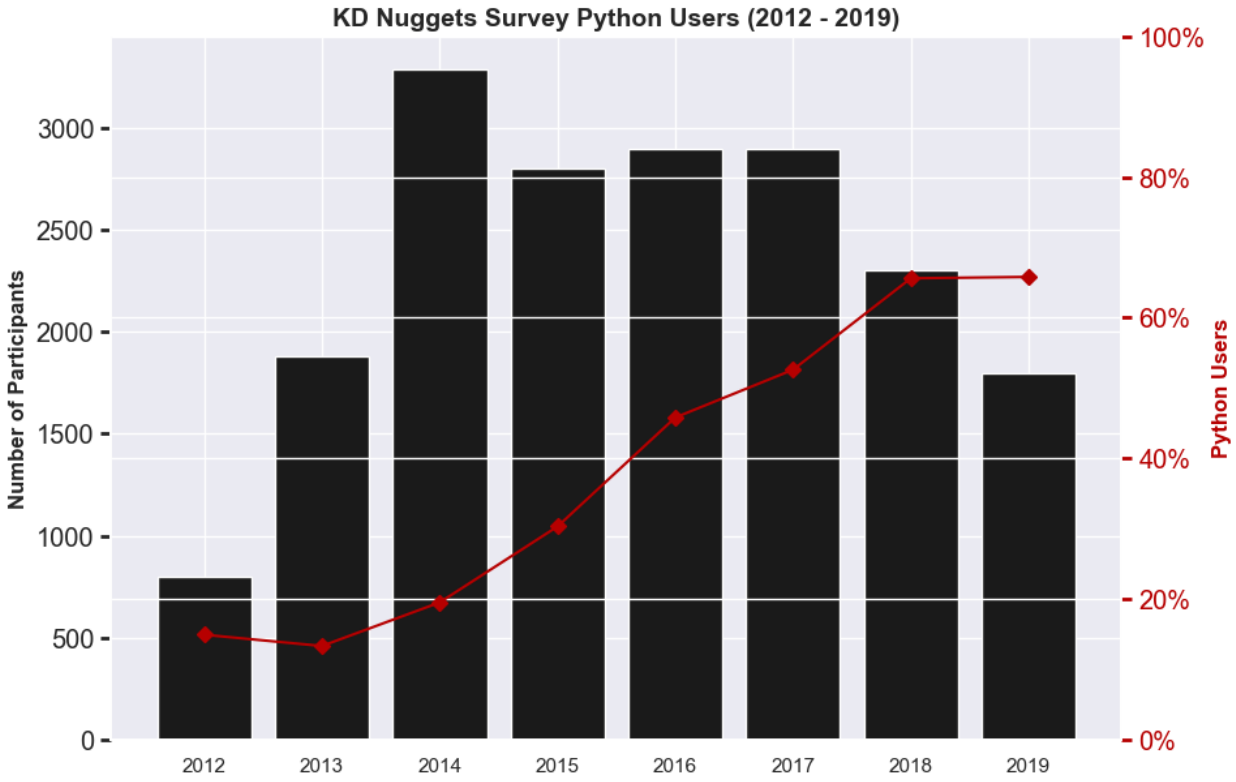


Bar and Line Chart

```
df_kdnuggets = pd.read_csv("python_data.csv") #read in the KDnuggets survey data file

# The data frame, which we'll use to create the combo plot. The two charts will share the x-axis which is Year.
# The bar chart will have the number of Participants on the primary x-axis(on the lefthandside of the chart)
# The line chart will have the Python Users in percentages on a secondary y-axis(on the righthandside of the chart)
df_kdnuggets
```

```
   Year  Python Users  Participants
0  2012         0.149           798
1  2013         0.133          1880
2  2014         0.195          3285
3  2015         0.303          2800
4  2016         0.458          2895
5  2017         0.526          2900
6  2018         0.656          2300
7  2019         0.658          1800
```

```
# Creating the combination chart. Here we use a figure with axes.
# The first axes or subplot is the bar chart, the second is the line
chart.
fig, ax = plt.subplots(figsize = (10, 7))

#creating and styling the bar chart
ax.bar(df_kdnuggets["Year"],
       df_kdnuggets["Participants"],
       color = "k")
ax.set_ylabel("Number of Participants",
              weight = "bold")
ax.tick_params(axis = "y",
               width = 2,
               labelsize = "large")
ax1 = ax.twinx()
#changing the secondary y-axis to display percentages on a scale from
0% to 100%
ax1.set_ylim(0, 1)
ax1.yaxis.set_major_formatter(PercentFormatter(xmax = 1.0))
#creating and styling the line chart
ax1.plot(df_kdnuggets["Year"],
         df_kdnuggets["Python Users"],
         color = "#b60000",
         marker = "D")
ax1.set_ylabel("Python Users",
               color = "#b60000",
               weight = "bold")
ax1.tick_params(axis = "y",
                colors = "#b60000",
                width = 2,
                labelsize = "large")
ax.set_title("KD Nuggets Survey Python Users (2012 - 2019)", fontsize
= "14", weight = "bold")
plt.show()
```


KD Nuggets Survey Python Users (2012 - 2019)
Number of Participants
Python Users
0
500
1000
1500
2000
2500
3000
0%
20%
40%
60%
80%
100%
2012
2013
2014
2015
2016
2017
2018
2019