504 Sejal Pawar

[FDS mini project Msc.cs Part 1]

Seaborn is a library for making statistical graphics in Python. It is built on top of matplotlib and closely integrated with pandas data structures.

Matplotlib can be used to add to or change Seaborn plots

Imports

see python.org python package index for more info. on modules, etc.

In [9]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from vega_datasets import data as vds
from pydataset import data as pyds
```

Seaborn Data

In [116…
```
sns.get_dataset_names()
```

Out[116]:
```
['anscombe',
 'attention',
 'brain_networks',
 'car_crashes',
 'diamonds',
 'dots',
 'exercise',
 'flights',
 'fmri',
 'gammas',
 'iris',
 'mpg',
 'planets',
 'tips',
 'titanic']
```

In [ ]:
```
# data
# sns.get_dataset_names()
seaborn_data = ['anscombe', 'attention', 'brain_networks', 'car_crashes', 'diamonds', 'dots', 'exercise',
                'flights', 'fmri', 'gammas', 'iris', 'mpg', 'planets', 'tips', 'titanic']
```

Relational Plots

relplot

Figure-level interface for drawing relational plots onto a FacetGrid.

relplot plots include scatter and line

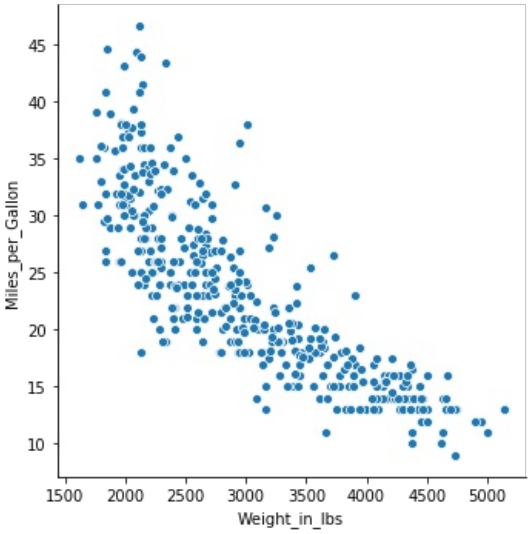
In [12]:
```
# data
cars = vds.cars()
cars['Year'] = cars['Year'].dt.year
cars.tail()
```

Out[12]:

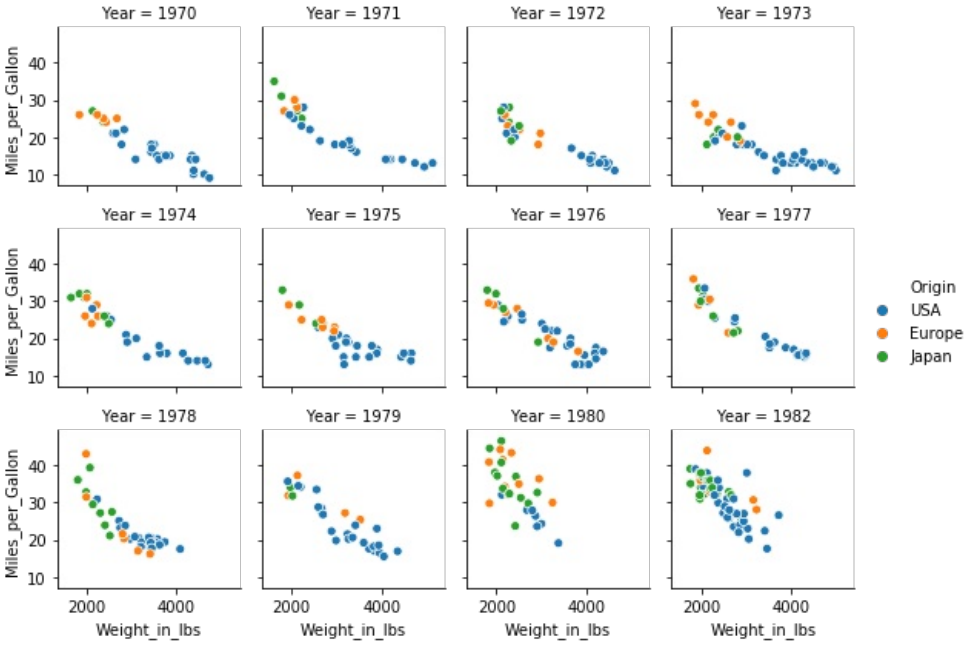
	Acceleration	Cylinders	Displacement	Horsepower	Miles_per_Gallon	Name	Origin	Weight_in_lbs	Year
401	15.6	4	140.0	86.0	27.0	ford mustang gl	USA	2790	1982
402	24.6	4	97.0	52.0	44.0	vw pickup	Europe	2130	1982
403	11.6	4	135.0	84.0	32.0	dodge rampage	USA	2295	1982
404	18.6	4	120.0	79.0	28.0	ford ranger	USA	2625	1982
405	19.4	4	119.0	82.0	31.0	chevy s-10	USA	2720	1982

In [13]:
```
# basic relplot (scatter plot)
# relplot kind can be line
```

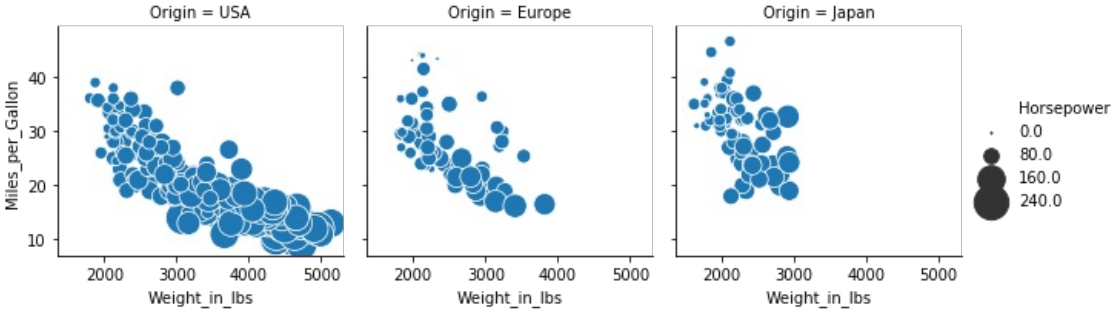
```
sns.relplot(x='Weight_in_lbs', y='Miles_per_Gallon', data=cars, kind='scatter');
```



In [15]:
```
# show Years using column wrap and Origin using hue color
sns.relplot(x='Weight_in_lbs',
            y='Miles_per_Gallon',
            hue='Origin',
            col='Year',
            col_wrap=4,
            height=2,
            data=cars);
```



In [16]:
```
# plot using size (see legend for size scale)
# use sizes to adjust size of bubbles
sns.relplot(x='Weight_in_lbs',
            y='Miles_per_Gallon',
            col='Origin',
            size='Horsepower',
            sizes=(1,500),
            height=3,
            data=cars);
```



scatterplot

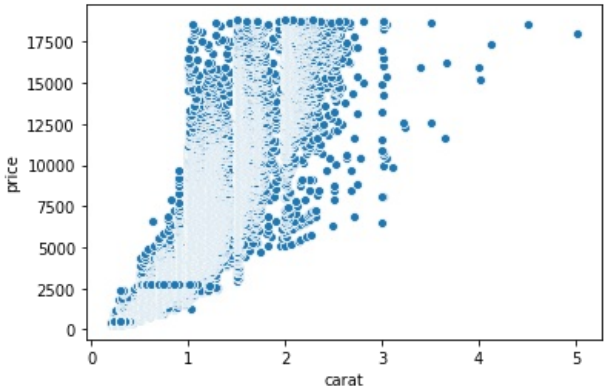
Drawing a scatter plot with possibility of several semantic groupings.

In [21]:
```
diamonds = sns.load_dataset('diamonds')
diamonds.head()
```

Out[21]:

	carat	cut	color	clarity	depth	table	price	x	y	z
0	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
1	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
2	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
3	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
4	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75

In [22]:
```
sns.scatterplot(x='carat', y='price', data=diamonds);
```

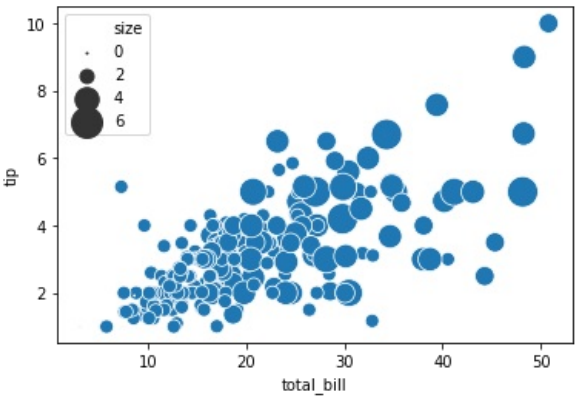


In [23]:
```
tips = sns.load_dataset('tips')
tips.head()
```

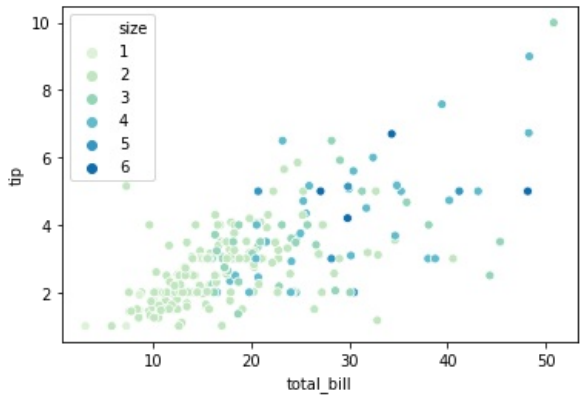
Out[23]:

	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	2
1	10.34	1.66	Male	No	Sun	Dinner	3
2	21.01	3.50	Male	No	Sun	Dinner	3
3	23.68	3.31	Male	No	Sun	Dinner	2
4	24.59	3.61	Female	No	Sun	Dinner	4

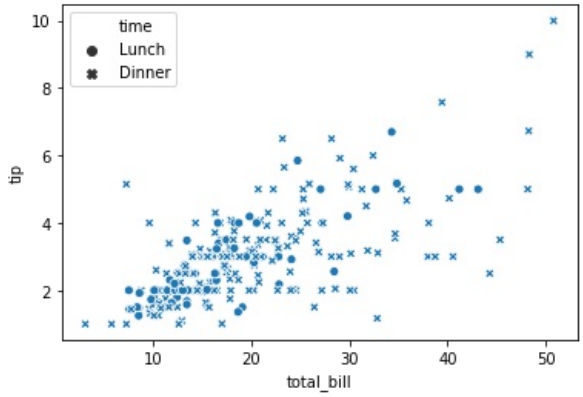
In [24]:
```
# size
sns.scatterplot(x='total_bill', y='tip', data=tips, size='size', sizes=(1,400));
```



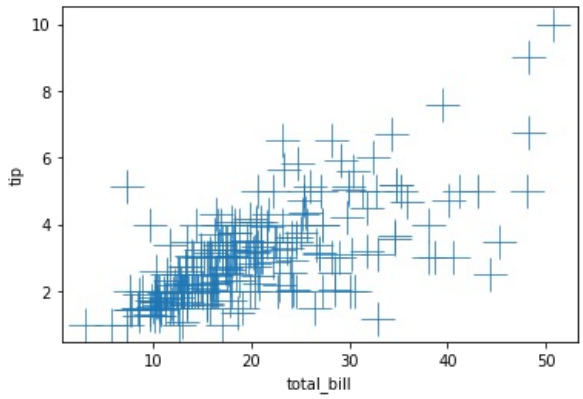
In [25]:
```
# color palette
# use GnBu_r to reverse color palette, GnBu_d for dark colors
# see Seaborn documentation for details on color palettes
sns.scatterplot(x='total_bill', y='tip', data=tips, hue='size', palette=sns.color_palette('GnBu'));
```



In [26]:
```
# style
sns.scatterplot(x='total_bill', y='tip', data=tips, style='time');
```



In [27]:
```
# use matplotlib arguments
# use different way to pass in data (using df column)
sns.scatterplot(x=tips.total_bill, y=tips.tip, s=500, marker='+');
```



lineplot

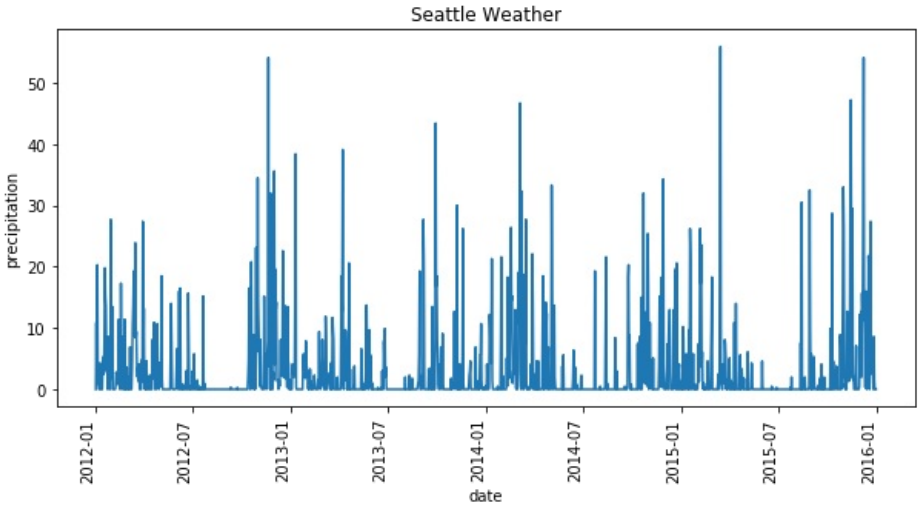
Draw a line plot with possibility of several semantic groupings.

In [28]:
```
seattle_weather = vds.seattle_weather()
seattle_weather.tail()
```

Out[28]:

	date	precipitation	temp_max	temp_min	wind	weather
1456	2015-12-27	8.6	4.4	1.7	2.9	fog
1457	2015-12-28	1.5	5.0	1.7	1.3	fog
1458	2015-12-29	0.0	7.2	0.6	2.6	fog
1459	2015-12-30	0.0	5.6	-1.0	3.4	sun
1460	2015-12-31	0.0	5.6	-2.1	3.5	sun

In [30]:
```
# seattle weather precipitation by date
fig, ax = plt.subplots(figsize=(10,5))
sns.lineplot(x=seattle_weather.date, y=seattle_weather.precipitation, ax=ax)
ax.set_title('Seattle Weather')
fig.autofmt_xdate(rotation=90)
```

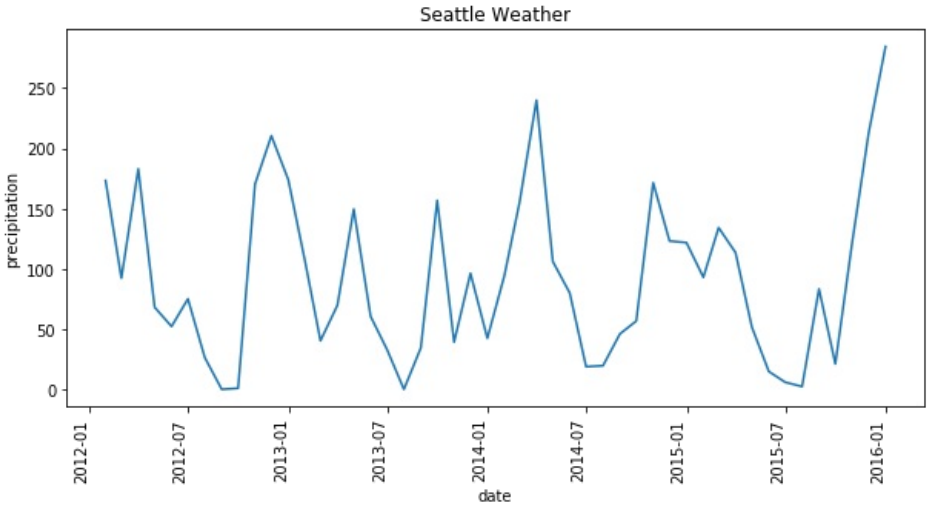


In [31]:
```
weather_aggregation = seattle_weather.set_index('date').resample('M').sum()
# weather_aggregation = seattle_weather.resample('M', on='date').sum()
weather_aggregation.head()
```

Out[31]:

date	precipitation	temp_max	temp_min	wind
2012-01-31	173.3	218.7	47.8	120.9
2012-02-29	92.3	269.0	92.9	113.2
2012-03-31	183.0	296.2	88.0	131.7
2012-04-30	68.1	446.2	179.8	101.2
2012-05-31	52.2	547.5	253.9	104.0

In [32]:
```
# seattle weather precipitation by month
fig, ax = plt.subplots(figsize=(10,5))
sns.lineplot(x=weather_aggregation.index, y=weather_aggregation.precipitation, ax=ax)
ax.set_title('Seattle Weather')
fig.autofmt_xdate(rotation=90)
```



In [34]:
```
sf_temps = vds.sf_temps()
# remove time
sf_temps['date'] = pd.to_datetime(sf_temps['date'].dt.date)
sf_temps.tail()
```

Out[34]:

	temp	date
8754	50.4	2010-12-31
8755	49.9	2010-12-31
8756	49.4	2010-12-31
8757	48.8	2010-12-31
8758	48.3	2010-12-31

In [36]:
```
# reaction times in a sleep deprivation study
# reaction is average reaction time (ms)
# days are number of days of sleep deprivation

sleepstudy = pyds('sleepstudy')
```

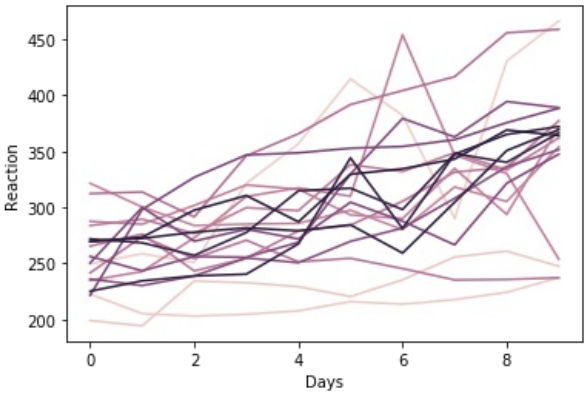
```
sleepstudy.tail()
```

Out[36]:

	Reaction	Days	Subject
176	329.6076	5	372
177	334.4818	6	372
178	343.2199	7	372
179	369.1417	8	372
180	364.1236	9	372

In [37]:
```
# pyds('sleepstudy', show_doc=True)
```

In [38]:
```
# using hue (color) to plot subjects as seprate lines instead of one line with ci
# sns.lineplot(x=sleepstudy.Days, y=sleepstudy.Reaction, legend=False);
sns.lineplot(x=sleepstudy.Days, y=sleepstudy.Reaction, hue=sleepstudy.Subject, legend=False);
```



Categorical Plots

catplot

Figure-level interface for drawing categorical plots onto a FacetGrid.

kinds include: point, bar, count, strip, swarm, box, violin, boxen

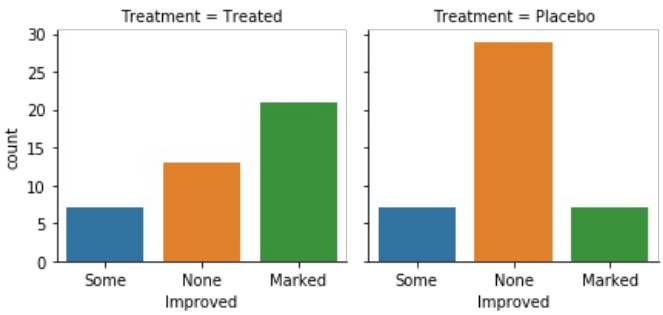
Note, when using certain plots such as catplot, data must be passed using 'x', 'y', dataframe form like in this example.

In [44]:
```
# data
Arthritis = pyds('Arthritis')
Arthritis.head()
```

Out[44]:

	ID	Treatment	Sex	Age	Improved
1	57	Treated	Male	27	Some
2	46	Treated	Male	29	None
3	77	Treated	Male	30	None
4	17	Treated	Male	32	Marked
5	36	Treated	Male	46	Marked

In [45]:
```
# add col and/or row arguments to split data in different ways and add detail
# col / row helps visualize data in different ways
sns.catplot(x='Improved',
            col='Treatment',
            height=3,
            data=Arthritis,
            kind='count');
```



stripplot

Draw a scatterplot where one variable is categorical.

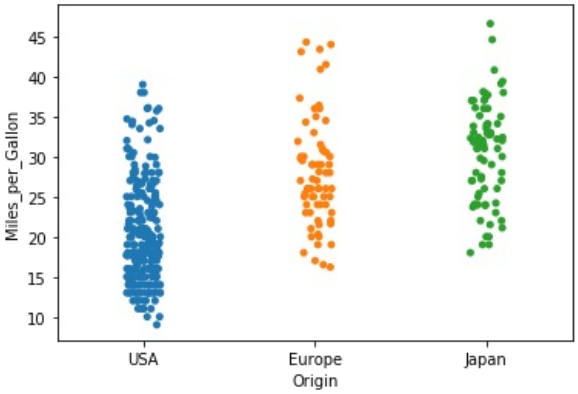
In [46]:
```
cars.tail()
```

Out[46]:

	Acceleration	Cylinders	Displacement	Horsepower	Miles_per_Gallon	Name	Origin	Weight_in_lbs	Year
401	15.6	4	140.0	86.0	27.0	ford mustang gl	USA	2790	1982
402	24.6	4	97.0	52.0	44.0	vw pickup	Europe	2130	1982
403	11.6	4	135.0	84.0	32.0	dodge rampage	USA	2295	1982
404	18.6	4	120.0	79.0	28.0	ford ranger	USA	2625	1982
405	19.4	4	119.0	82.0	31.0	chevy s-10	USA	2720	1982

The jitter argument offsets points so they don't overlap. This makes it easier to see the distribution. Default is True.

In [47]:
```
sns.stripplot(x='Origin', y='Miles_per_Gallon', data=cars, jitter=True);
```



boxplot

Draw a box plot to show distributions with respect to categories.

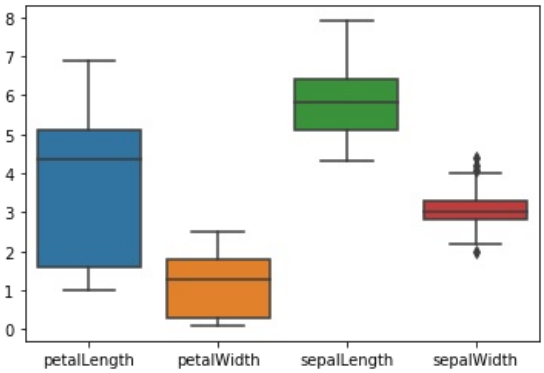
shows minimum, maximum, median, first quartile (25th percentile), third quartile (75th percentile), and outliers

In [50]:
```
iris = vds.iris()
iris.tail()
```

Out[50]:

	petalLength	petalWidth	sepalLength	sepalWidth	species
145	5.2	2.3	6.7	3.0	virginica
146	5.0	1.9	6.3	2.5	virginica
147	5.2	2.0	6.5	3.0	virginica
148	5.4	2.3	6.2	3.4	virginica
149	5.1	1.8	5.9	3.0	virginica

In [51]:
```
sns.boxplot(data=iris);
```



Distribution Plots

distplot

Flexibly plot a univariate distribution of observations.

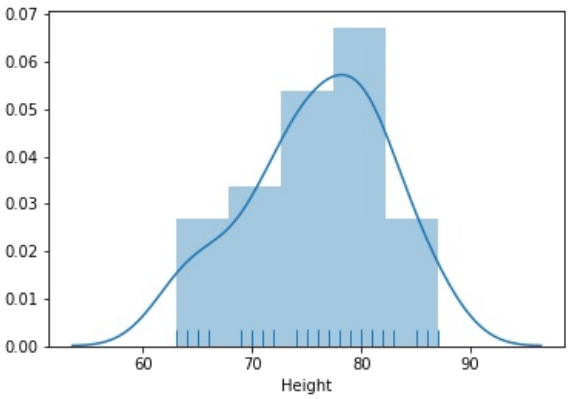
In [65]:
```
# measurements for black cherry trees
trees = pyds('trees')
```

```
trees.head()
```

Out[65]:

	Girth	Height	Volume
1	8.3	70	10.3
2	8.6	65	10.3
3	8.8	63	10.2
4	10.5	72	16.4
5	10.7	81	18.8

In [66]:
```
# kernel density estimate and histogram
# use rug to draw small vertical lines to show each observation in a distribution
# kde=False to show just histogram
sns.distplot(trees.Height, rug=True, kde=True);
```



Regression Plots

lmplot

Plot data and regression model fits across a FacetGrid.

In [72]:
```
# pyds('Cars93', show_doc=True)
pd.set_option('display.max_rows', 1000)
pd.set_option('display.max_columns', 30)

# data
Cars93 = pyds('Cars93')
Cars93.tail()
```

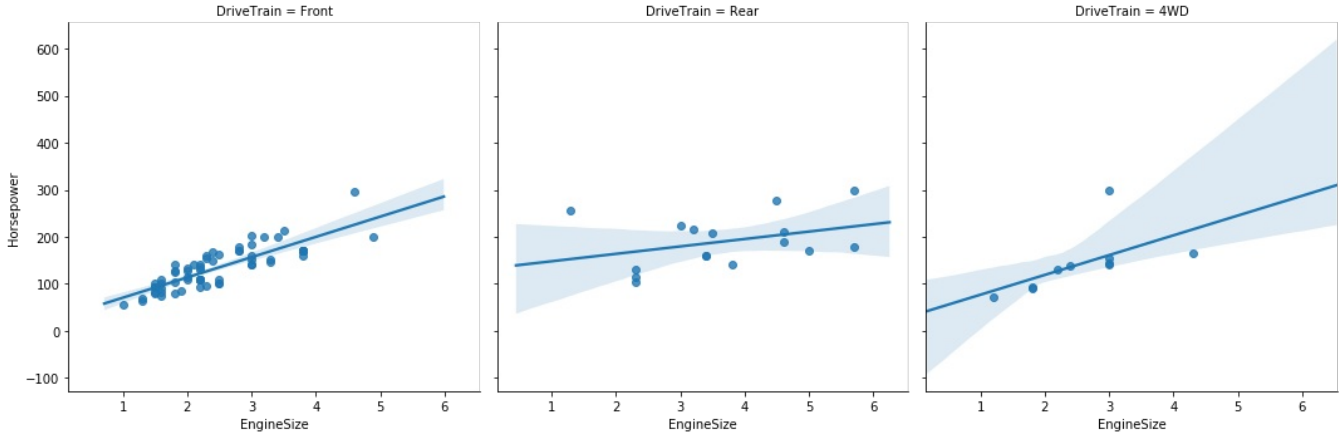
Out[72]:

	Manufacturer	Model	Type	Min.Price	Price	Max.Price	MPG.city	MPG.highway	AirBags	DriveTrain	Cylinders	EngineSize	Hors
89	Volkswagen	Eurovan	Van	16.6	19.7	22.7	17	21	None	Front	5	2.5	
90	Volkswagen	Passat	Compact	17.6	20.0	22.4	21	30	None	Front	4	2.0	
91	Volkswagen	Corrado	Sporty	22.9	23.3	23.7	18	25	None	Front	6	2.8	
92	Volvo	240	Compact	21.8	22.7	23.5	21	28	Driver only	Rear	4	2.3	
93	Volvo	850	Midsize	24.8	26.7	28.5	20	28	Driver & Passenger	Front	5	2.4	

In [73]:
```
Cars93.columns
```

Out[73]:
```
Index(['Manufacturer', 'Model', 'Type', 'Min.Price', 'Price', 'Max.Price',
       'MPG.city', 'MPG.highway', 'AirBags', 'DriveTrain', 'Cylinders',
       'EngineSize', 'Horsepower', 'RPM', 'Rev.per.mile', 'Man.trans.avail',
       'Fuel.tank.capacity', 'Passengers', 'Length', 'Wheelbase', 'Width',
       'Turn.circle', 'Rear.seat.room', 'Luggage.room', 'Weight', 'Origin',
       'Make'],
      dtype='object')
```

In [74]:
```
# add col and/or row arguments to split data in different ways and add detail
# col / row helps visualize data in different ways
sns.lmplot(x='EngineSize',
           y='Horsepower',
           col='DriveTrain',
           height=5,
           data=Cars93);
```



regplot

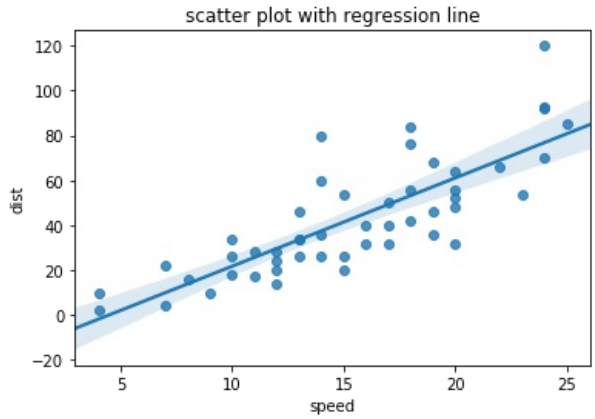
Plot data and a linear regression model fit.

In [75]:
```
# data for speed of cars and distances needed to stop (data from 1920s)
speed_distance = pyds('cars')
speed_distance.head()
```

Out[75]:

	speed	dist
1	4	2
2	4	10
3	7	4
4	7	22
5	8	16

In [76]:
```
sns.regplot(x='speed', y='dist', data=speed_distance, ci=95);
# plt.ylim([0,125])
plt.title('scatter plot with regression line');
```



pairplot

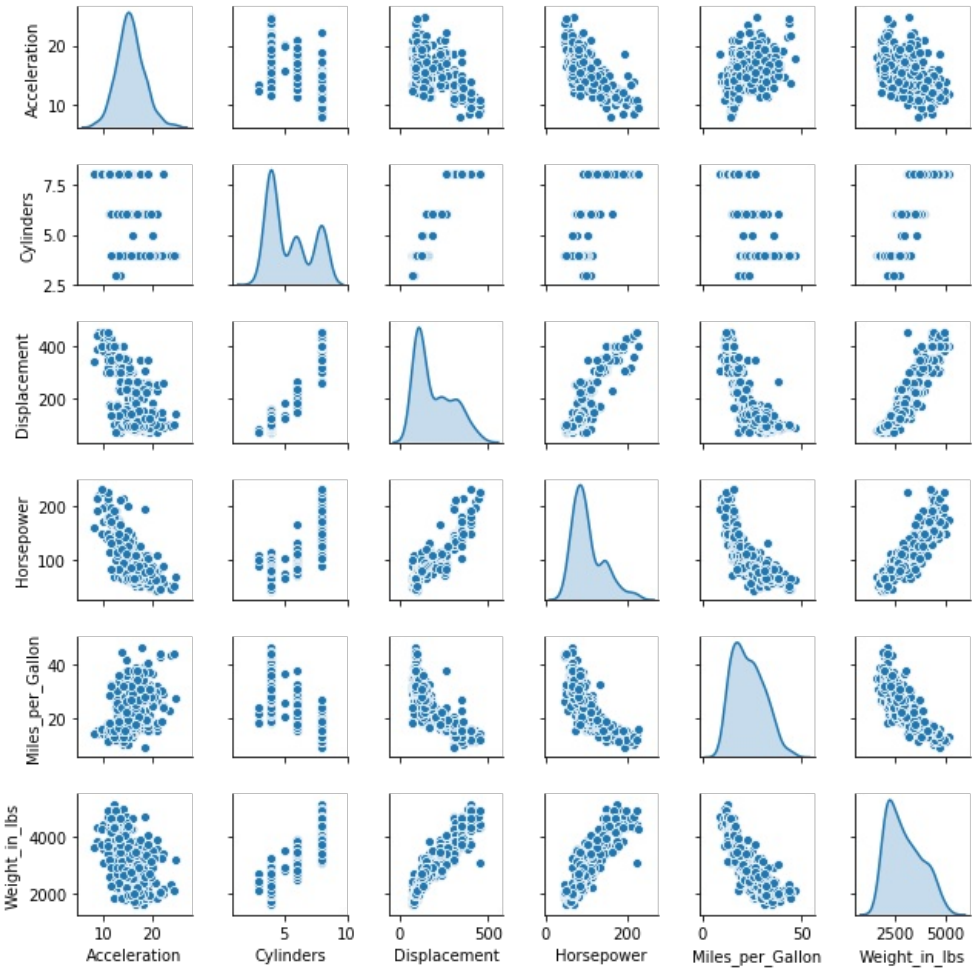
Plot pairwise relationships in a dataset.

In [150…
```
cars_pairplot = vds.cars()
# drop year
cars_pairplot.drop(['Year'], axis=1, inplace=True)
cars_pairplot.tail()
```

Out[150]:

	Acceleration	Cylinders	Displacement	Horsepower	Miles_per_Gallon	Name	Origin	Weight_in_lbs
401	15.6	4	140.0	86.0	27.0	ford mustang gl	USA	2790
402	24.6	4	97.0	52.0	44.0	vw pickup	Europe	2130
403	11.6	4	135.0	84.0	32.0	dodge rampage	USA	2295
404	18.6	4	120.0	79.0	28.0	ford ranger	USA	2625
405	19.4	4	119.0	82.0	31.0	chevy s-10	USA	2720

In [151…
```
# quick way to show relationships between data elements
# kind and diag_kind arguments can be changed to change plot types
# kind='reg' to fit linear regression model
sns.pairplot(cars_pairplot.dropna(), diag_kind='kde', height=1.5);
```



PairGrid

Subplot grid for plotting pairwise relationships in a dataset.

PairGrid.map

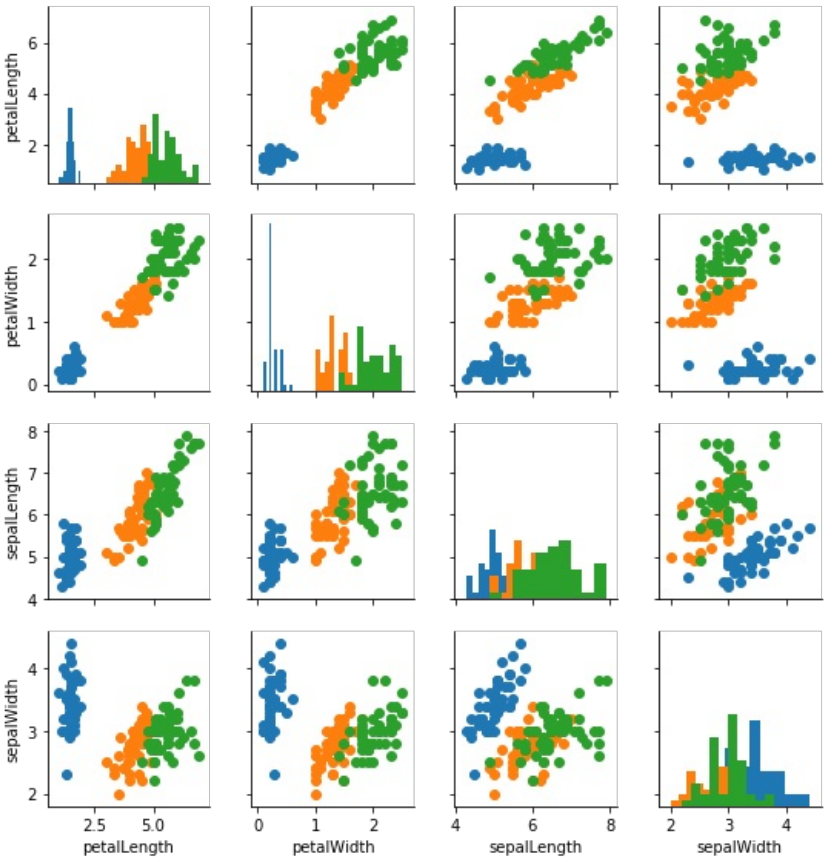
Plot with the same function in every subplot.

In [103…
```
iris.head()
```

Out[103]:

	petalLength	petalWidth	sepalLength	sepalWidth	species
0	1.4	0.2	5.1	3.5	setosa
1	1.4	0.2	4.9	3.0	setosa
2	1.3	0.2	4.7	3.2	setosa
3	1.5	0.2	4.6	3.1	setosa
4	1.4	0.2	5.0	3.6	setosa

In [105…
```
pair_grid = sns.PairGrid(iris, height=2, hue='species')
pair_grid.map_diag(plt.hist);
pair_grid.map_offdiag(plt.scatter);
```



Joint Grids

In [169…
```
# sales prices of houses in the city of Windsor from 1987
Housing = pyds('Housing')
Housing.head()
```

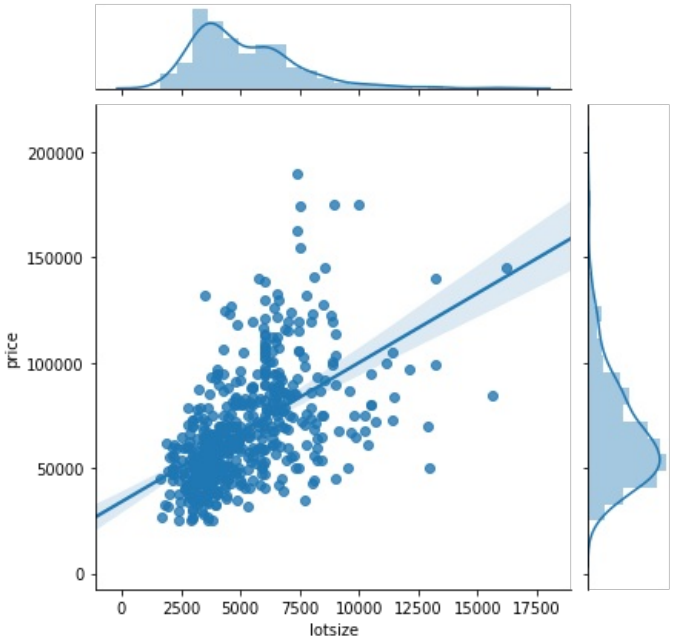
Out[169]:

	price	lotsize	bedrooms	bathrms	stories	driveway	recroom	fullbase	gashw	airco	garagepl	prefarea
1	42000.0	5850	3	1	2	yes	no	yes	no	no	1	no
2	38500.0	4000	2	1	1	yes	no	no	no	no	0	no
3	49500.0	3060	3	1	1	yes	no	no	no	no	0	no
4	60500.0	6650	3	1	2	yes	yes	no	no	no	0	no
5	61000.0	6360	2	1	1	yes	no	no	no	no	0	no

JointGrid.plot

Shortcut to draw the full plot.

In [110…
```
sns.JointGrid(x='lotsize', y='price', data=Housing).plot(sns.regplot, sns.distplot);
```



JointGrid.plot_marginals

Draw univariate plots for x and y separately.

In [113…

```
joint_grid = sns.JointGrid(x='lotsize', y='price', data=Housing)
joint_grid = joint_grid.plot_joint(sns.scatterplot)
joint_grid = joint_grid.plot_joint(sns.kdeplot)
joint_grid = joint_grid.plot_marginals(sns.kdeplot)
```