

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.formula.api as smf
```

```
dataset=pd.read_csv('car performance (1).csv')
dataset
```

	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name
0	18.0	8	307.0	130	3504	12.0	70	1	chevrolet chevelle malibu
1	15.0	8	350.0	165	3693	11.5	70	1	buick skylark 320
2	18.0	8	318.0	150	3436	11.0	70	1	plymouth satellite
3	16.0	8	304.0	150	3433	12.0	70	1	amc rebel sst
4	17.0	8	302.0	140	3449	10.5	70	1	ford torino
...
393	27.0	4	140.0	86	2790	15.6	82	1	ford mustang gl
394	44.0	4	97.0	52	2130	24.6	82	2	vw pickup
395	22.0	4	125.0	91	2705	11.6	82	1	dodge

Next steps:

Generate code with dataset

☒ View recommended plots

New interactive sheet

```
dataset.isnull().any()
```

	0
mpg	False
cylinders	False
displacement	False
horsepower	False
weight	False
acceleration	False
model year	False
origin	False
car name	False

```
dataset['horsepower']=dataset['horsepower'].replace('?',np.nan)
```

```
dataset['horsepower'].isnull().sum()
```

↗ 6

```
dataset['horsepower']=dataset['horsepower'].astype('float64')
```

```
dataset['horsepower'].fillna((dataset['horsepower'].mean()),inplace=True)
```

↗ <ipython-input-9-cc4e4918054d>:1: FutureWarning: A value is trying to be set on a copy of a DataFrame. The behavior will change in pandas 3.0. This inplace method will never work because the intermediate c

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inpl

```
dataset['horsepower'].fillna((dataset['horsepower'].mean()),inplace=True)
```

```
dataset.isnull().any()
```

↗

	0
mpg	False
cylinders	False
displacement	False
horsepower	False
weight	False
acceleration	False
model year	False
origin	False
car name	False

```
dataset.info()
```

↗ <class 'pandas.core.frame.DataFrame'>
RangeIndex: 398 entries, 0 to 397
Data columns (total 9 columns):
Column Non-Null Count Dtype
--- -
0 mpg 398 non-null float64
1 cylinders 398 non-null int64
2 displacement 398 non-null float64
3 horsepower 398 non-null float64
4 weight 398 non-null int64
5 acceleration 398 non-null float64
6 model year 398 non-null int64
7 origin 398 non-null int64
8 car name 398 non-null object
dtypes: float64(4), int64(4), object(1)
memory usage: 28.1+ KB

```
dataset.describe()
```



	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	orig
count	398.000000	398.000000	398.000000	398.000000	398.000000	398.000000	398.000000	398.0000
mean	23.514573	5.454774	193.425879	104.469388	2970.424623	15.568090	76.010050	1.5728
std	7.815984	1.701004	104.269838	38.199187	846.841774	2.757689	3.697627	0.8020
min	9.000000	3.000000	68.000000	46.000000	1613.000000	8.000000	70.000000	1.0000
25%	17.500000	4.000000	104.250000	76.000000	2223.750000	13.825000	73.000000	1.0000
50%	23.000000	4.000000	148.500000	95.000000	2803.500000	15.500000	76.000000	1.0000
75%	29.000000	8.000000	262.000000	125.000000	3608.000000	17.175000	79.000000	2.0000
max	46.600000	8.000000	455.000000	230.000000	5140.000000	24.800000	82.000000	3.0000

```
dataset=dataset.drop('car name',axis=1)
```

```
corr_table=dataset.corr()  
corr_table
```

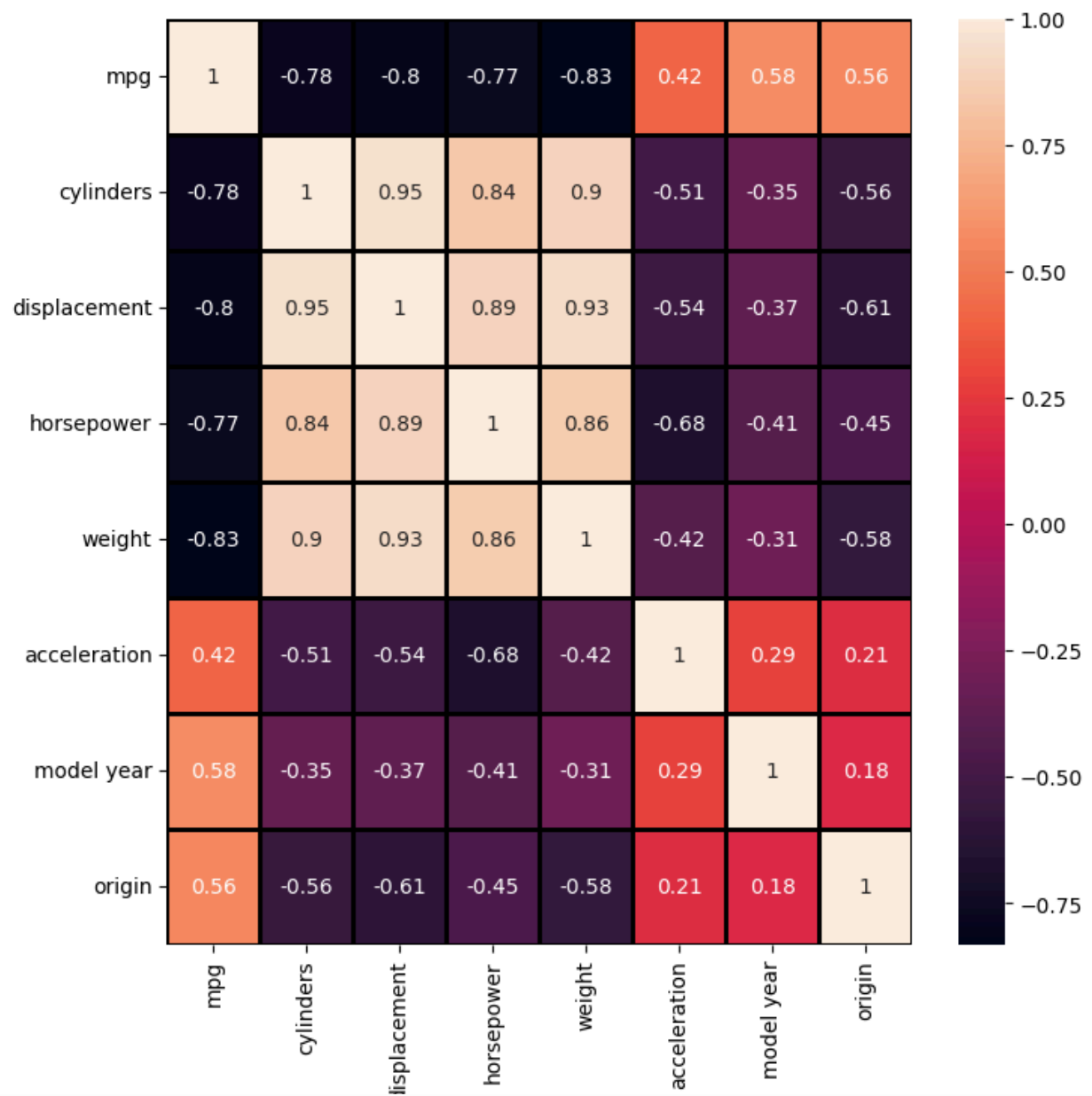


	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin
mpg	1.000000	-0.775396	-0.804203	-0.771437	-0.831741	0.420289	0.579267	0.563450
cylinders	-0.775396	1.000000	0.950721	0.838939	0.896017	-0.505419	-0.348746	-0.562543
displacement	-0.804203	0.950721	1.000000	0.893646	0.932824	-0.543684	-0.370164	-0.609409
horsepower	-0.771437	0.838939	0.893646	1.000000	0.860574	-0.684259	-0.411651	-0.453669
weight	-0.831741	0.896017	0.932824	0.860574	1.000000	-0.417457	-0.306564	-0.581024
acceleration	0.420289	-0.505419	-0.543684	-0.684259	-0.417457	1.000000	0.288137	0.205873
model year	0.579267	-0.348746	-0.370164	-0.411651	-0.306564	0.288137	1.000000	0.180662
origin	0.563450	-0.562543	-0.609409	-0.453669	-0.581024	0.205873	0.180662	1.000000

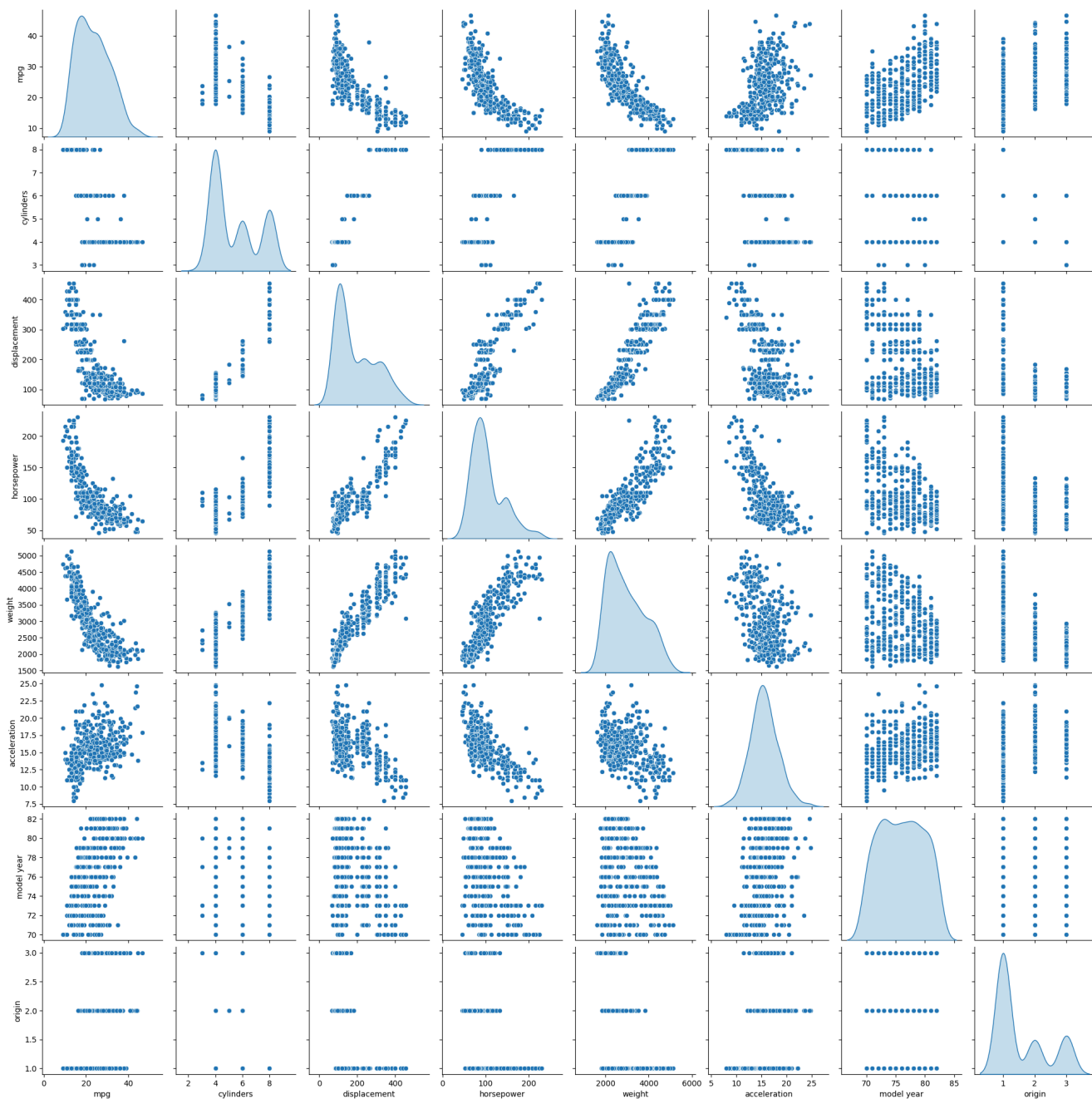
Next steps:

[Generate code with corr_table](#)[View recommended plots](#)[New interactive sheet](#)

```
sns.heatmap(dataset.corr(),annot=True,linecolor='black',linewidths=1)#Heatmap is a way to show some sc  
fig=plt.gcf()  
fig.set_size_inches(8,8)
```

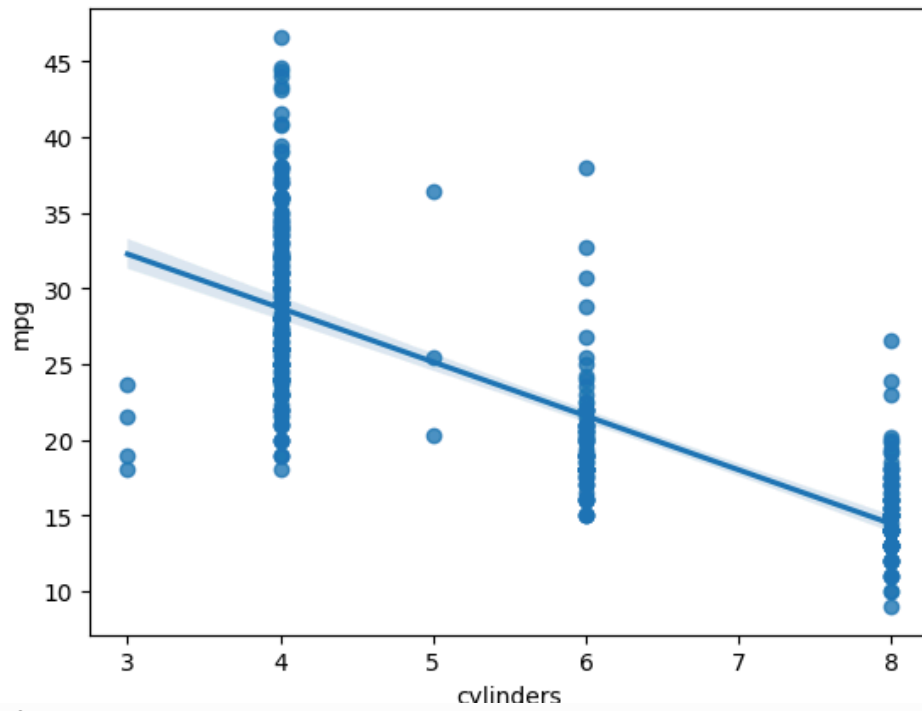


```
sns.pairplot(dataset,diag_kind='kde') #pairplot represents pairwise relation across the entire dataframe.  
plt.show()
```



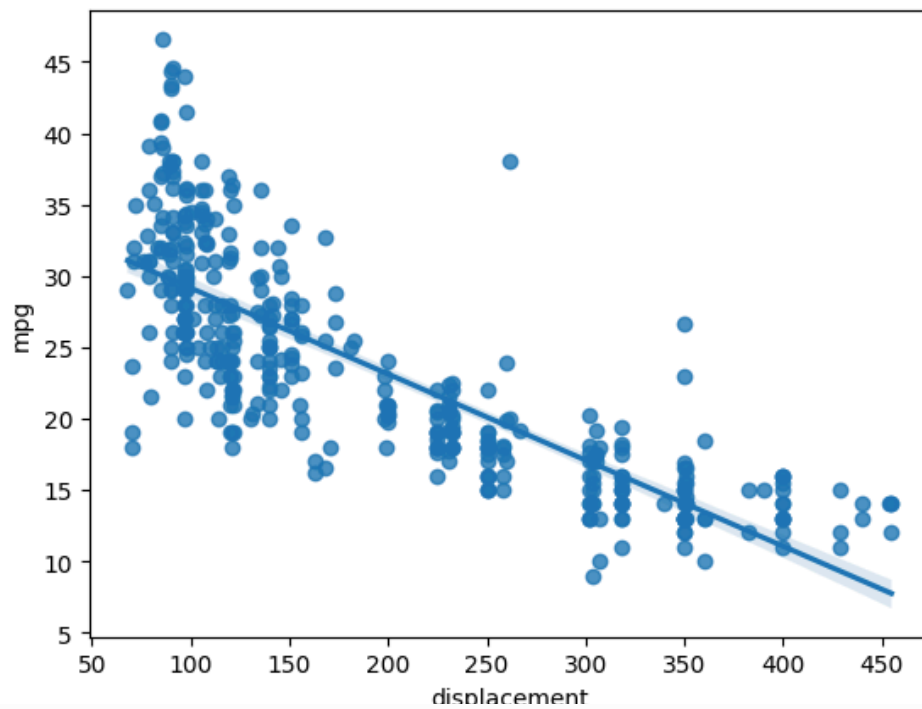
```
sns.regplot(x="cylinders", y="mpg", data=dataset)
```

↔ <Axes: xlabel='cylinders', ylabel='mpg'>



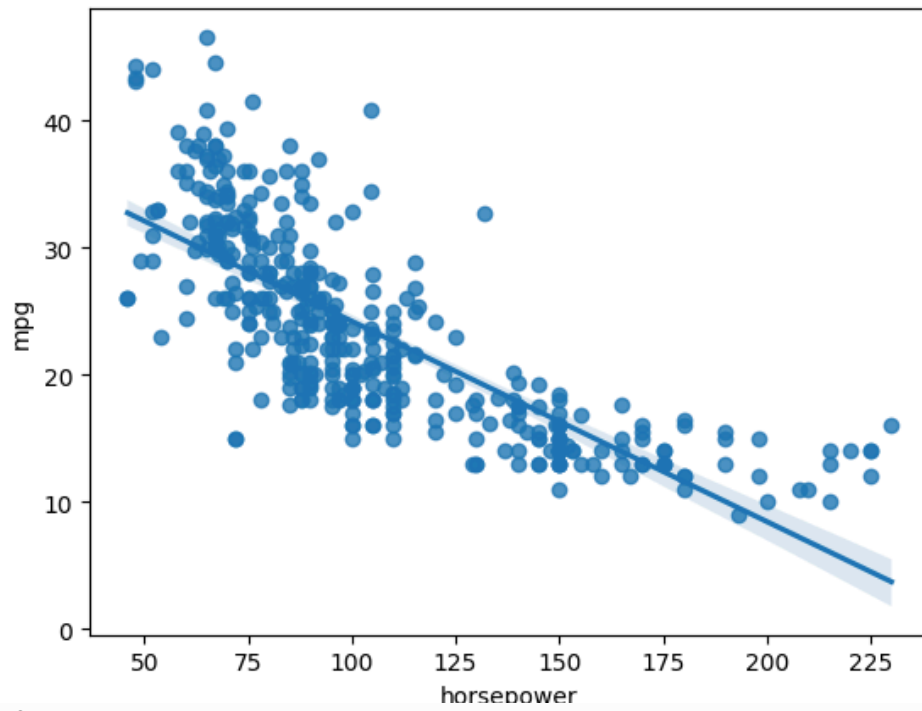
```
sns.regplot(x="displacement", y="mpg", data=dataset)
```

↔ <Axes: xlabel='displacement', ylabel='mpg'>



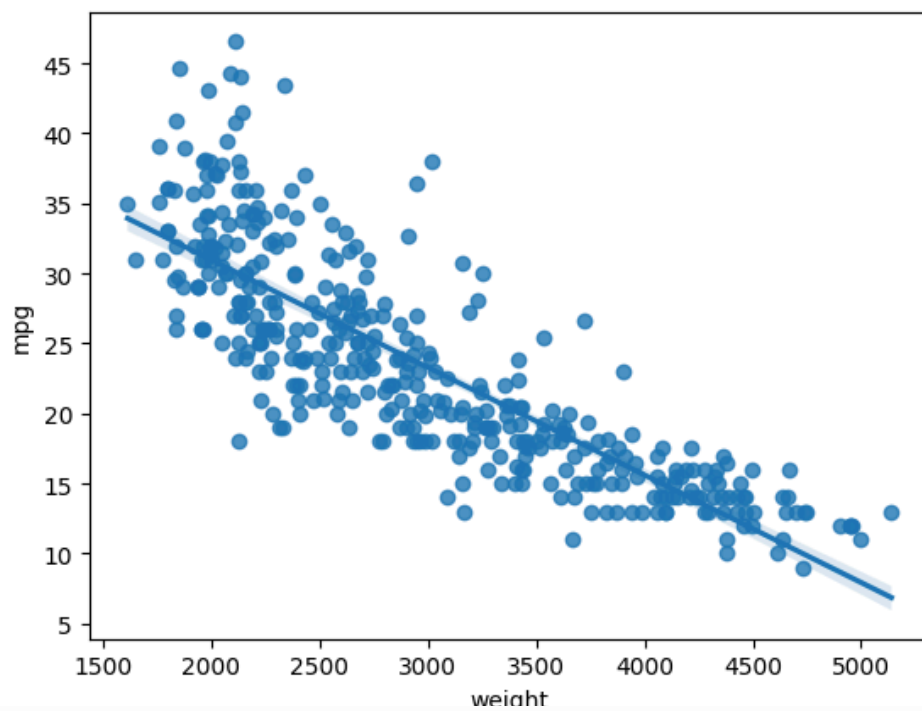
```
sns.regplot(x="horsepower", y="mpg", data=dataset)
```

↗ <Axes: xlabel='horsepower', ylabel='mpg'>



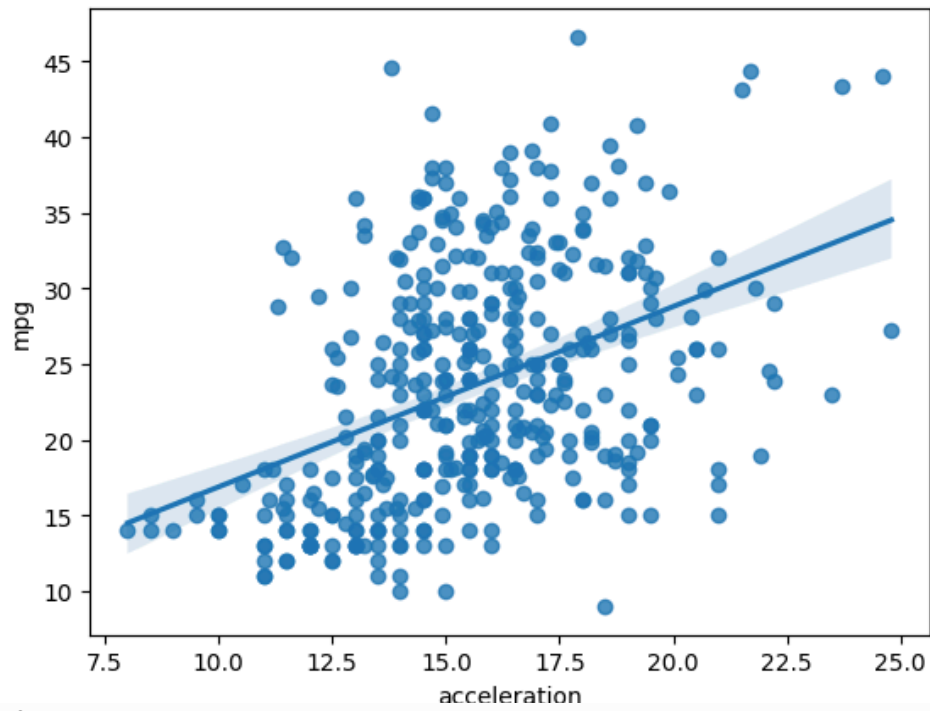
```
sns.regplot(x="weight", y="mpg", data=dataset)
```

↗ <Axes: xlabel='weight', ylabel='mpg'>



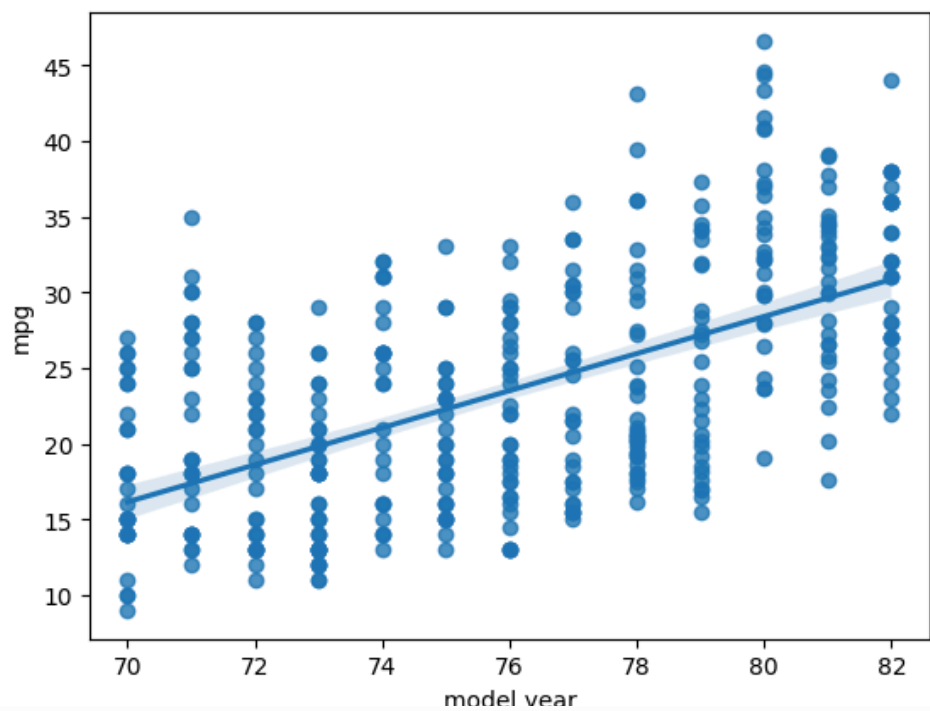
```
sns.regplot(x="acceleration", y="mpg", data=dataset)
```

↗ <Axes: xlabel='acceleration', ylabel='mpg'>




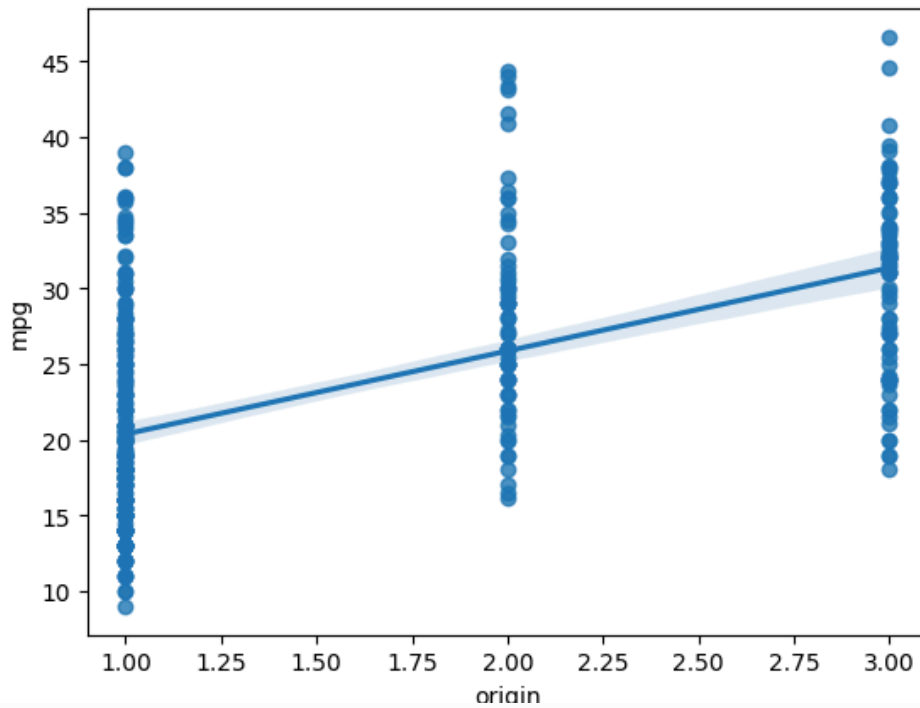
```
sns.regplot(x="model year", y="mpg", data=dataset)
```

↗ <Axes: xlabel='model year', ylabel='mpg'>




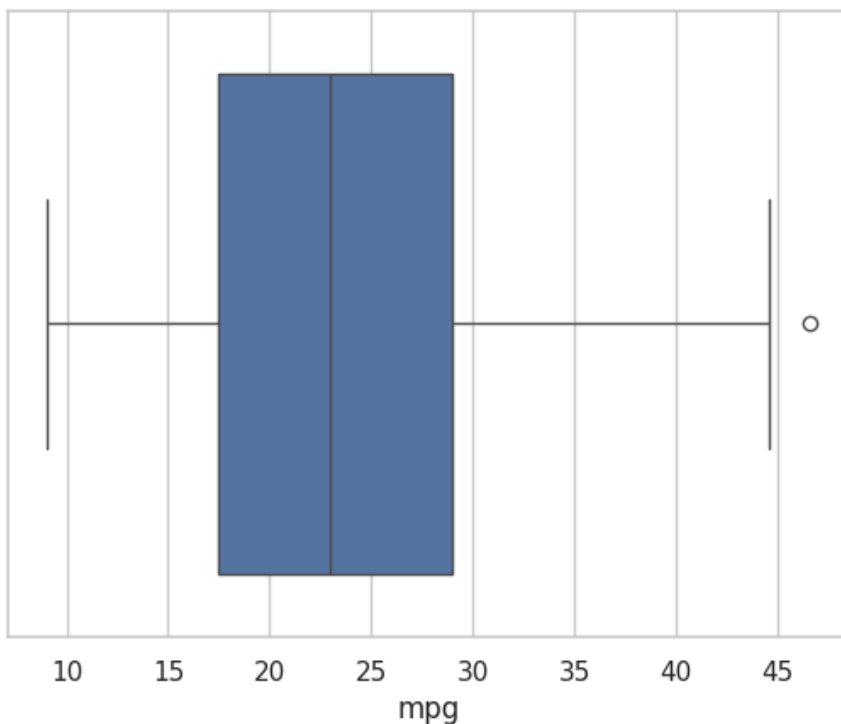
```
sns.regplot(x="origin", y="mpg", data=dataset)
```


 <Axes: xlabel='origin', ylabel='mpg'>




```
sns.set(style="whitegrid")
sns.boxplot(x=dataset["mpg"])
```

 /usr/local/lib/python3.10/dist-packages/seaborn/categorical.py:640: FutureWarning: SeriesGroupBy.group positions = grouped.grouper.result_index.to_numpy(dtype=float)
<Axes: xlabel='mpg'>



```
from scipy import stats
```

```
pearson_coef, p_value = stats.pearsonr(dataset['cylinders'], dataset['mpg'])
print("The Pearson Correlation Coefficient is", pearson_coef, " with a P-value of P =", p_value)
```

 The Pearson Correlation Coefficient is -0.7753962854205542 with a P-value of P = 4.503992246178154e-8

```
pearson_coef, p_value = stats.pearsonr(dataset['displacement'], dataset['mpg'])
print("The Pearson Correlation Coefficient is", pearson_coef, " with a P-value of P =", p_value)
```

⇒ The Pearson Correlation Coefficient is -0.8042028248058978 with a P-value of P = 1.6558889101929443e-

```
pearson_coef, p_value = stats.pearsonr(dataset['horsepower'], dataset['mpg'])
print("The Pearson Correlation Coefficient is", pearson_coef, " with a P-value of P =", p_value)
```

⇒ The Pearson Correlation Coefficient is -0.7714371350025526 with a P-value of P = 9.255477533167874e-8

```
pearson_coef, p_value = stats.pearsonr(dataset['weight'], dataset['mpg'])
print("The Pearson Correlation Coefficient is", pearson_coef, " with a P-value of P =", p_value)
```

⇒ The Pearson Correlation Coefficient is -0.831740933244335 with a P-value of P = 2.9727995640496354e-1

```
pearson_coef, p_value = stats.pearsonr(dataset['acceleration'], dataset['mpg'])
print("The Pearson Correlation Coefficient is", pearson_coef, " with a P-value of P =", p_value)
```

⇒ The Pearson Correlation Coefficient is 0.4202889121016507 with a P-value of P = 1.823091535078707e-18

```
test=smf.ols('mpg~cylinders+displacement+horsepower+weight+acceleration+origin',dataset).fit()
test.summary()
```

⇒

OLS Regression Results							
Dep. Variable:	mpg	R-squared:	0.717				
Model:	OLS	Adj. R-squared:	0.713				
Method:	Least Squares	F-statistic:	165.5				
Date:	Fri, 04 Oct 2024	Prob (F-statistic):	4.84e-104				
Time:	16:49:07	Log-Likelihood:	-1131.1				
No. Observations:	398	AIC:	2276.				
Df Residuals:	391	BIC:	2304.				
Df Model:	6						
Covariance Type: nonrobust							
	coef	std err	t	P> t	[0.025	0.975]	
Intercept	42.7111	2.693	15.861	0.000	37.417	48.005	
cylinders	-0.5256	0.404	-1.302	0.194	-1.320	0.268	
displacement	0.0106	0.009	1.133	0.258	-0.008	0.029	
horsepower	-0.0529	0.016	-3.277	0.001	-0.085	-0.021	
weight	-0.0051	0.001	-6.441	0.000	-0.007	-0.004	
acceleration	0.0043	0.120	0.036	0.972	-0.232	0.241	
origin	1.4269	0.345	4.136	0.000	0.749	2.105	
Omnibus:	32.659	Durbin-Watson:	0.886				
Prob(Omnibus):	0.000	Jarque-Bera (JB):	43.338				
Skew:	0.624	Prob(JB):	3.88e-10				
Kurtosis:	4.028	Cond. No.	3.99e+04				

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

[2] The condition number is large, 3.99e+04. This might indicate that there are

```
X=dataset[['cylinders','displacement','horsepower','weight','model year','origin']].values
X
```

```
⇒ array([[8.000e+00, 3.070e+02, 1.300e+02, 3.504e+03, 7.000e+01, 1.000e+00],
         [8.000e+00, 3.500e+02, 1.650e+02, 3.693e+03, 7.000e+01, 1.000e+00],
         [8.000e+00, 3.180e+02, 1.500e+02, 3.436e+03, 7.000e+01, 1.000e+00],
         ...,
         [4.000e+00, 1.350e+02, 8.400e+01, 2.295e+03, 8.200e+01, 1.000e+00],
         [4.000e+00, 1.200e+02, 7.900e+01, 2.625e+03, 8.200e+01, 1.000e+00],
         [4.000e+00, 1.190e+02, 8.200e+01, 2.720e+03, 8.200e+01, 1.000e+00]])
```

```
y=dataset.iloc[:,0:1].values
```

```
y
```

```
⇒
```

```
[28. ],  
[31. ]])
```

```
from sklearn.model_selection import train_test_split
```

```
X_train,X_test,y_train,y_test=train_test_split(X ,y,test_size=0.1,random_state=0)
```

```
from sklearn.tree import DecisionTreeRegressor  
dt=DecisionTreeRegressor(random_state=0,criterion="squared_error")  
dt.fit(X_train,y_train)
```



DecisionTreeRegressor ⓘ ?
DecisionTreeRegressor(random_state=0)

```
import pickle  
pickle.dump(dt,open('decision_model.pkl','wb'))
```

```
y_pred=dt.predict(x_test)  
y_pred
```



```
array([15. , 26.5, 14. , 19. , 18. , 31. , 31.8, 22. , 15. , 24.2, 36. ,  
       31.8, 18. , 26. , 15.5, 29. , 27. , 26. , 16. , 44. , 16. , 23. ,  
       25. , 19. , 34.2, 24.2, 29.8, 36. , 34.5, 15. , 19.2, 23.7, 18. ,  
       32. , 19.1, 23. , 19.4, 16. , 29. , 12. ])
```

```
ax1 = sns.distplot(dataset['mpg'], hist=False, color="r", label="Actual Value")  
sns.distplot(y_pred, hist=False, color="b", label="Fitted Values" , ax=ax1)
```

```
plt.title('Actual vs Fitted Values for mpg')  
plt.xlabel('mpg')  
plt.ylabel('Proportion of Cars')  
plt.legend()  
plt.show()  
plt.close()
```



<ipython-input-43-ec6d5054b950>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see

<https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
ax1 = sns.distplot(dataset['mpg'], hist=False, color="r", label="Actual Value")
```

<ipython-input-43-ec6d5054b950>:2: UserWarning:

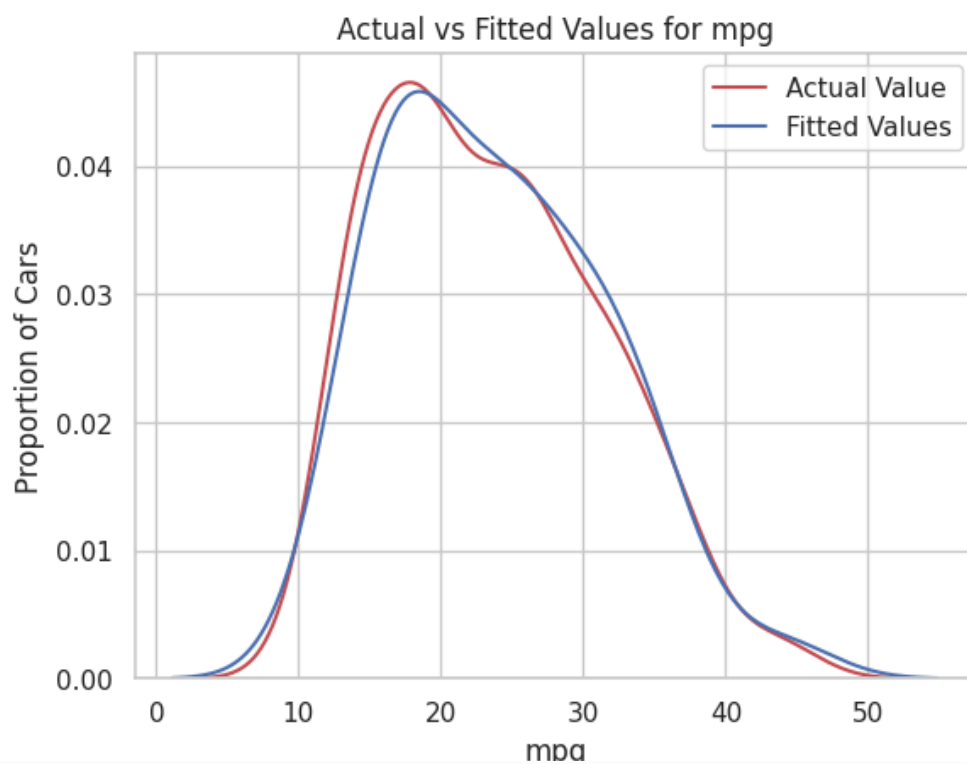
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

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```
sns.distplot(y_pred, hist=False, color="b", label="Fitted Values" , ax=ax1)
```



```
from sklearn.metrics import r2_score,mean_squared_error
```

```
r2_score(y_test,y_pred)
```



0.8244088578636598

```
mean_squared_error(y_test,y_pred)
```

```
np.sqrt(mean_squared_error(y_test,y_pred))
```



3.4837838624116744

```
from sklearn.linear_model import LinearRegression
```

```
mr=LinearRegression()
```

```
mr.fit(x_train,y_train)
```



▼ LinearRegression ⓘ ?

LinearRegression()

```
y_pred2=mr.predict(x_test)
y_pred2
```



```
array([[13.20818031],
       [24.27993342],
       [11.61339788],
       [20.96914745],
       [17.7247275 ],
       [29.44595217],
       [33.47372984],
       [23.18555594 ],
       [15.045202  ],
       [26.79998444],
       [32.32754229],
       [33.93400668],
       [21.48572281],
       [25.80404696],
       [16.32002867],
       [30.62069212],
       [28.3611479 ],
       [28.68598061],
       [17.66367225],
       [31.02921296],
       [15.54781059],
       [24.61489613],
       [26.90655487],
       [20.51716586],
       [29.66216351],
       [28.48379869],
       [31.00137585],
       [29.9752557 ],
       [29.90123742],
       [18.07465439],
       [20.36226872],
       [31.32907003],
       [20.95979818],
       [32.03796407],
       [23.8731354 ],
       [26.30724058],
       [21.37158555],
       [16.80870416],
       [32.14991802],
       [ 9.27600756]])
```

```
ax1 = sns.distplot(dataset['mpg'], hist=False, color="r", label="Actual Value")
sns.distplot(y_pred2, hist=False, color="b", label="Fitted Values" , ax=ax1)
```

```
plt.title('Actual vs Fitted Values for mpg')
plt.xlabel('mpg')
plt.ylabel('Proportion of Cars')
plt.legend()
plt.show()
plt.close()
```



<ipython-input-54-4c0275dbc6f8>:1: UserWarning:

``distplot`` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either ``displot`` (a figure-level function with similar flexibility) or ``kdeplot`` (an axes-level function for kernel density plots).

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```
ax1 = sns.distplot(dataset['mpg'], hist=False, color="r", label="Actual Value")
```

<ipython-input-54-4c0275dbc6f8>:2: UserWarning:

``distplot`` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either ``displot`` (a figure-level function with similar flexibility) or ``kdeplot`` (an axes-level function for kernel density plots).