SC1101_u5613415_Tanapat_t

June 7, 2018

In [2]:
```
# Follow www.analyticsvidhya.com to do the pandas
import pandas as pd
import numpy as np
import matplotlib as plt
```

In [5]:
```
df = pd.read_csv("C:/Users/EGAT/Downloads/train.csv") #Reading the dataset in a datafram
```

In [7]:
```
#Quick Data Exploration
df.head(10)
```

Out[7]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area	Loan_Status
0	LP001002	Male	No	0.0	Graduate	No	5849	0.0	NaN	360.0	1.0	Urban	Y
1	LP001003	Male	Yes	1.0	Graduate	No	4583	1508.0	128.0	360.0	1.0	Rural	N
2	LP001005	Male	Yes	0.0	Graduate	Yes	3000	0.0	66.0	360.0	1.0	Urban	Y
3	LP001006	Male	Yes	0.0	Not Graduate	No	2583	2358.0	120.0	360.0			
4	LP001008	Male	No	0.0	Graduate	No	6000	0.0	141.0	360.0			
5	LP001011	Male	Yes	2.0	Graduate	Yes	5417	4196.0	267.0	360.0			
6	LP001013	Male	Yes	0.0	Not Graduate	No	2333	1516.0	95.0	360.0			
7	LP001014	Male	Yes	3.0	Graduate	No	3036	2504.0	158.0	360.0			
8	LP001018	Male	Yes	2.0	Graduate	No	4006	1526.0	168.0	360.0			
9	LP001020	Male	Yes	1.0	Graduate	No	12841	10968.0	349.0	360.0			

```
3             1.0         Urban           Y
4             1.0         Urban           Y
5             1.0         Urban           Y
6             1.0         Urban           Y
7             0.0     Semiurban           N
8             1.0         Urban           Y
9             1.0     Semiurban           N
```

In [8]:
```
# The non-numerical values (e.g. Property_Area, Credit_History etc.), we can look at fre
df['Property_Area'].value_counts()
```

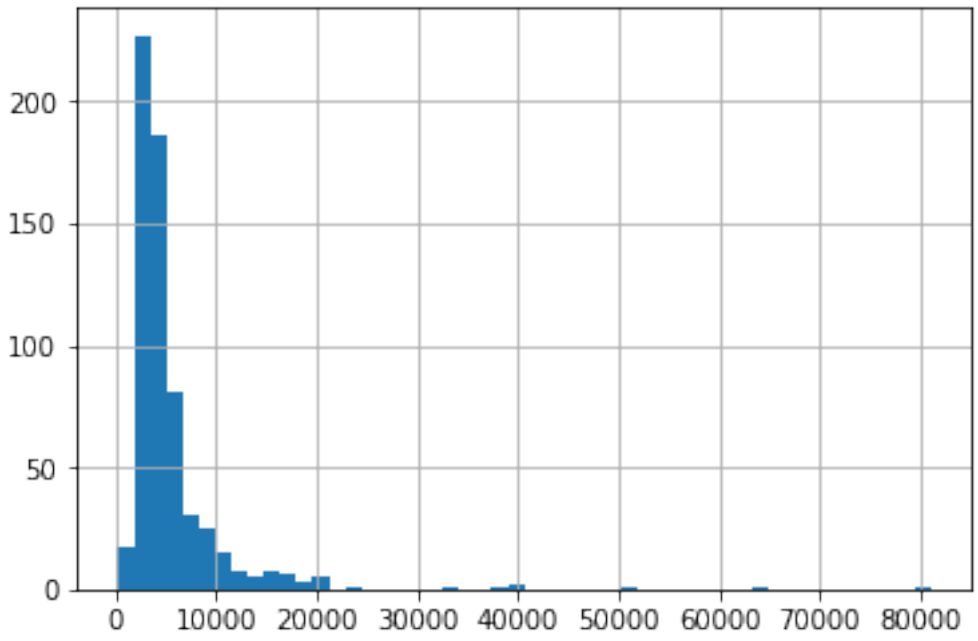
Out[8]:
```
Semiurban    236
Urban        205
Rural        183
Name: Property_Area, dtype: int64
```

In [9]:
```
df['ApplicantIncome'].hist(bins=50)
#Here we observe that there are few extreme values.
```

Out[9]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa06703bd30>
```

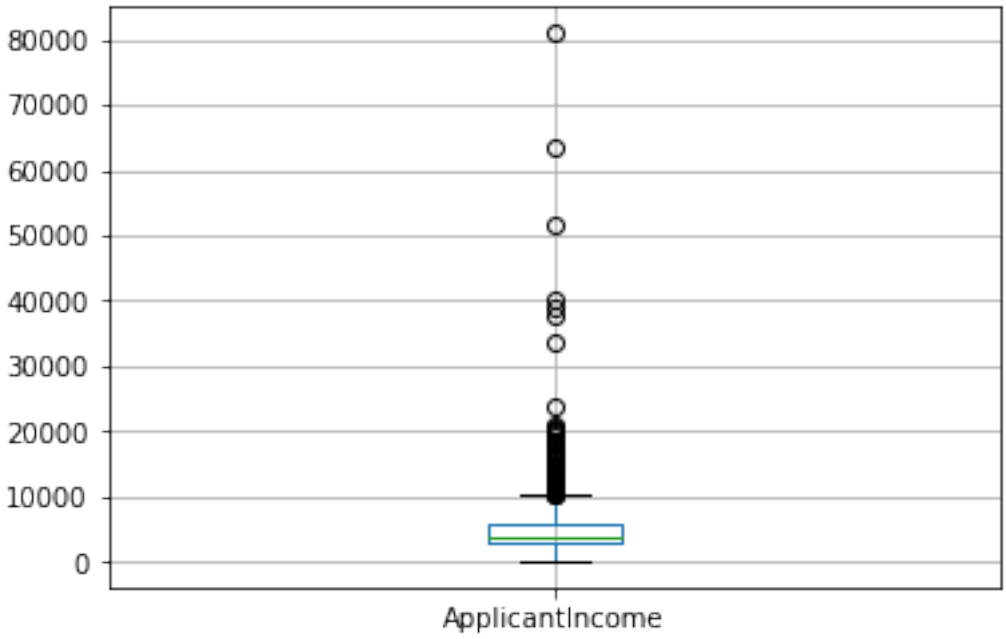
In [10]:
```
df['ApplicantIncome'].hist(bins=50)
 #Here we observe that there are few extreme values.
```

Out[10]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa06732b5f8>
```



In [11]:
```
df.boxplot(column='ApplicantIncome')
#we look at box plots to understand the distributions. Box plot for fare can be plotted
```

Out[11]: <matplotlib.axes._subplots.AxesSubplot at 0xa067461a90>



In [12]:
```
#We will look at the steps required to generate a similar insight using Python.
temp1 = df['Credit_History'].value_counts(ascending=True)
temp2 = df.pivot_table(values='Loan_Status',index=['Credit_History'],aggfunc=lambda x:
print ('Frequency Table for Credit History:')
print(temp1)

print('Probility of getting loan for each Credit History class:')
print(temp2)
```

```
Frequency Table for Credit History:
0.0     90
1.0    484
Name: Credit_History, dtype: int64
Probility of getting loan for each Credit History class:
               Loan_Status
Credit_History
0.0                0.077778
1.0                0.797521
```

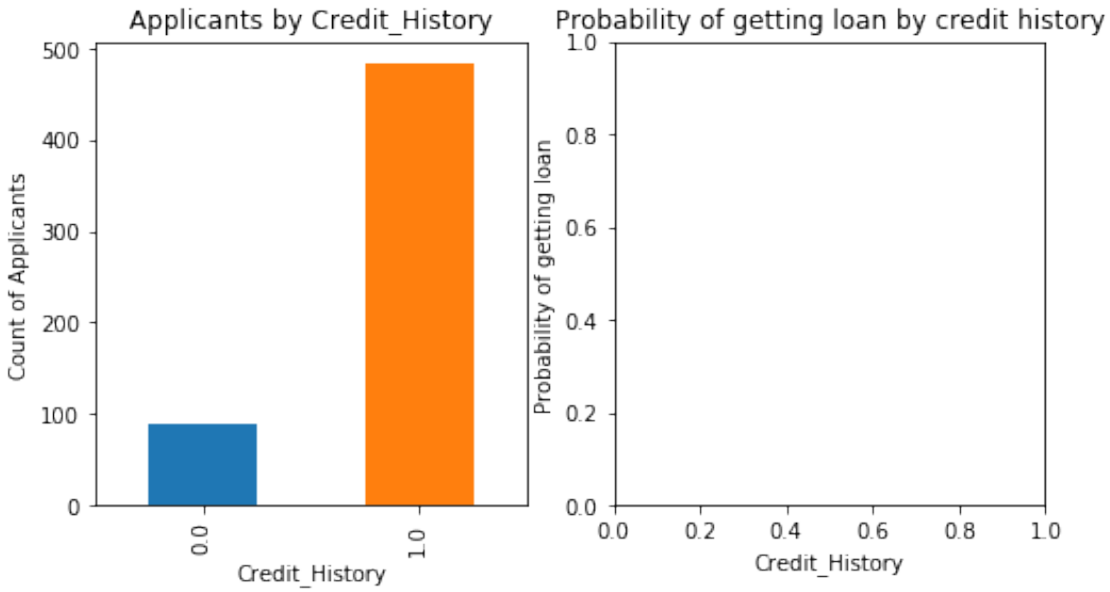
In [13]:
```
import matplotlib.pyplot as plt
fig = plt.figure(figsize=(8,4))
```

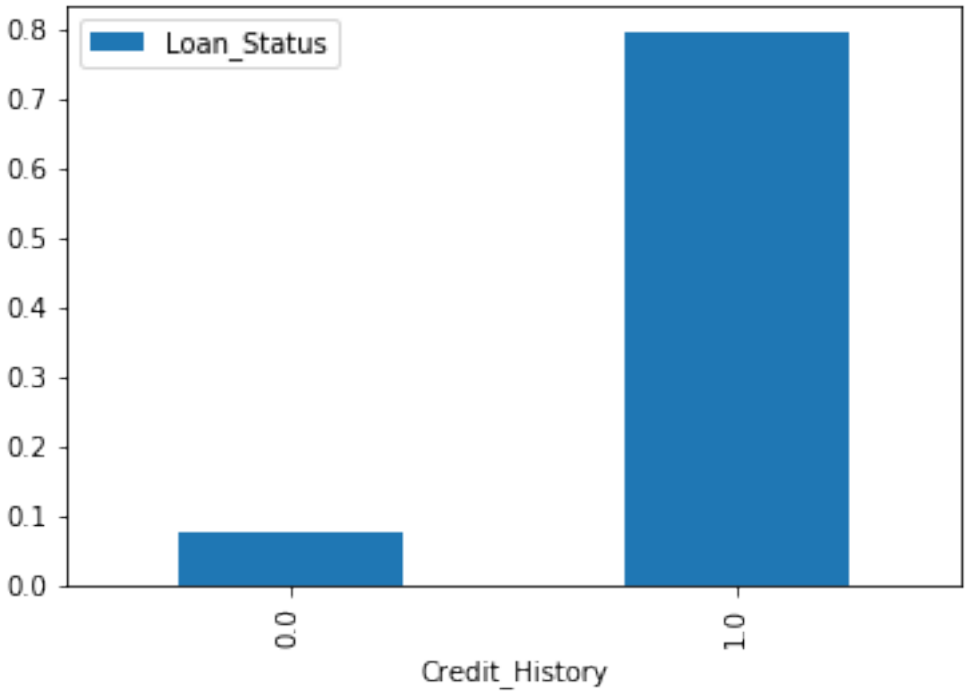
```
ax1 = fig.add_subplot(121)
ax1.set_xlabel('Credit_History')
ax1.set_ylabel('Count of Applicants')
ax1.set_title("Applicants by Credit_History")
temp1.plot(kind='bar')

ax2 = fig.add_subplot(122)
temp2.plot(kind = 'bar')
ax2.set_xlabel('Credit_History')
ax2.set_ylabel('Probability of getting loan')
ax2.set_title("Probability of getting loan by credit history")

#Now we can observe that we get a similar pivot_table like the MS Excel one.
#This can be plotted as a bar chart using the matplotlib library with following code:
```

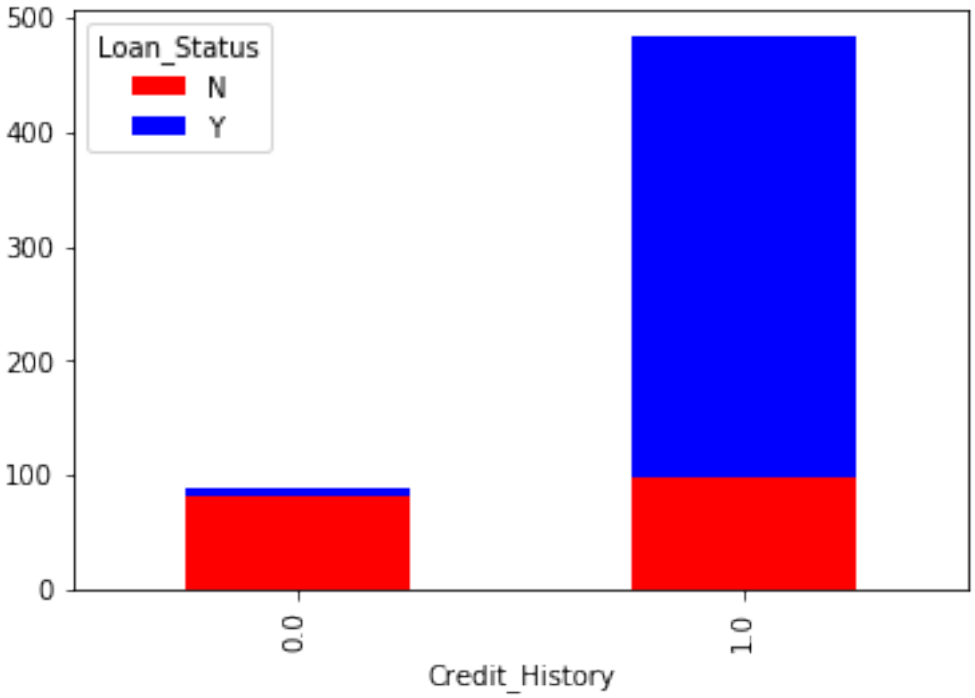
Out[13]: Text(0.5,1,'Probability of getting loan by credit history')





In [14]:
```
#This shows that the chances of getting a loan are eight-fold if the applicant has a va
#You can plot similar graphs by Married, Self-Employed, Property_Area, etc.
temp3 = pd.crosstab(df['Credit_History'], df['Loan_Status'])
temp3.plot(kind='bar', stacked=True, color=['red','blue'], grid=False)
```

Out[14]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa067557978>
```



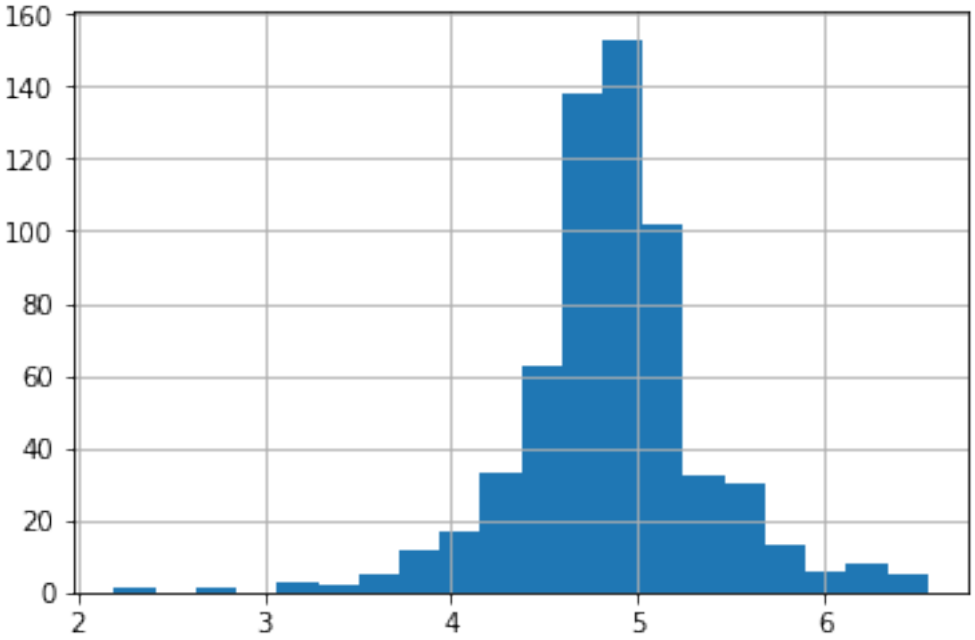
In [15]:
```
#Check missing values in the dataset
df.apply(lambda x: sum(x.isnull()),axis=0)
#This command should tell us the number of missing values in each column as isnull() re
```

Out[15]:
```
Loan_ID               0
Gender               13
Married               3
Dependents           15
Education             1
Self_Employed        32
ApplicantIncome       0
CoapplicantIncome     0
LoanAmount           23
Loan_Amount_Term     14
Credit_History       50
Property_Area         0
Loan_Status           0
dtype: int64
```

In [16]:
```
#The simplest being replacement by mean, which can be done by following code:
df['LoanAmount'].fillna(df['LoanAmount'].mean(), inplace=True)
```

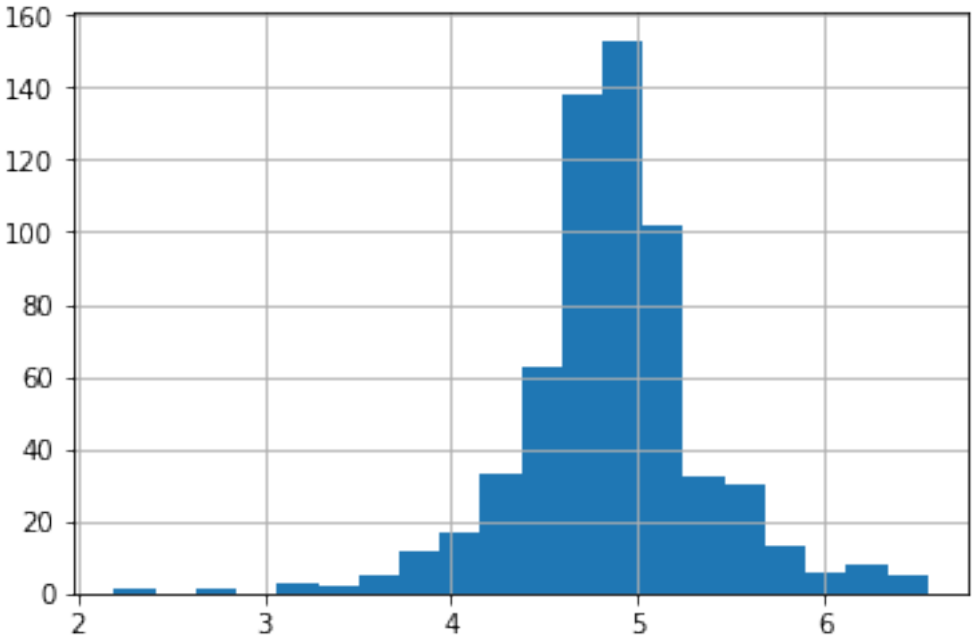
In [17]:
```
df['Self_Employed'].fillna('No',inplace=True)
#Since ~86% values are No, it is safe to impute the missing values as No as there is a
df['LoanAmount_log'] = np.log(df['LoanAmount'])
df['LoanAmount_log'].hist(bins=20)
```

Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0xa068b17128>



In [18]:
```
df['TotalIncome'] = df['ApplicantIncome'] + df['CoapplicantIncome']
df['TotalIncome_log'] = np.log(df['TotalIncome'])
df['LoanAmount_log'].hist(bins=20)
```

Out[18]: <matplotlib.axes._subplots.AxesSubplot at 0xa068e86588>



In [19]:
```
#Then i try to do pandas with others  new dataset to observe

import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
%matplotlib inline
```

In [20]:
```
df = pd.read_csv("https://raw.githubusercontent.com/prasertcbs/tutorial/master/mpg.csv"
df.head()
# to observe the data with 5  rows by default
```

Out[20]:

	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy	fl	class
0	audi	a4	1.8	1999	4	auto(l5)	f	18	29	p	compact
1	audi	a4	1.8	1999	4	manual(m5)	f	21	29	p	compact
2	audi	a4	2.0	2008	4	manual(m6)	f	20	31	p	compact
3	audi	a4	2.0	2008	4	auto(av)	f	21	30	p	compact
4	audi	a4	2.8	1999	6	auto(l5)	f	16	26	p	compact

In [21]:
```
df['cty_kml'] = df['cty'] * .425143707 #to create new column  just type nametable["name
df.head()
```

Out[21]:

	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy	fl	class	\
0	audi	a4	1.8	1999	4	auto(l5)	f	18	29	p	compact	
1	audi	a4	1.8	1999	4	manual(m5)	f	21	29	p	compact	
2	audi	a4	2.0	2008	4	manual(m6)	f	20	31	p	compact	
3	audi	a4	2.0	2008	4	auto(av)	f	21	30	p	compact	
4	audi	a4	2.8	1999	6	auto(l5)	f	16	26	p	compact	

	cty_kml
0	7.652587
1	8.928018
2	8.502874
3	8.928018
4	6.802299

In [22]:
```
df['hwy_kml'] = df.hwy * 4.25143707
df.head()
```

Out[22]:

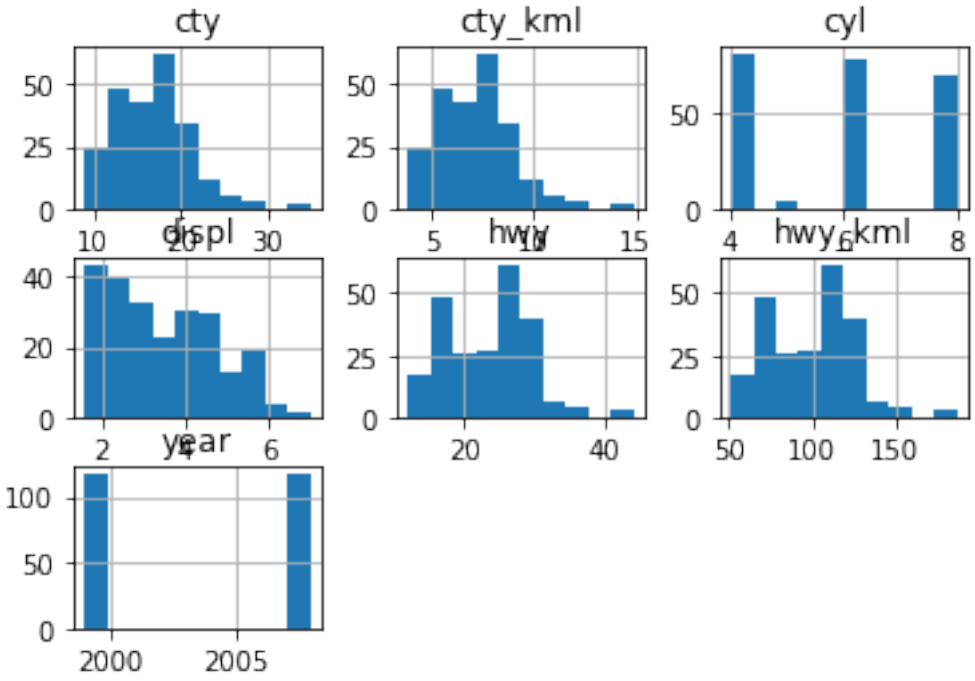
	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy	fl	class	\
0	audi	a4	1.8	1999	4	auto(l5)	f	18	29	p	compact	
1	audi	a4	1.8	1999	4	manual(m5)	f	21	29	p	compact	
2	audi	a4	2.0	2008	4	manual(m6)	f	20	31	p	compact	
3	audi	a4	2.0	2008	4	auto(av)	f	21	30	p	compact	
4	audi	a4	2.8	1999	6	auto(l5)	f	16	26	p	compact	

	cty_kml	hwy_kml

```
0  7.652587  123.291675
1  8.928018  123.291675
2  8.502874  131.794549
3  8.928018  127.543112
4  6.802299  110.537364
```

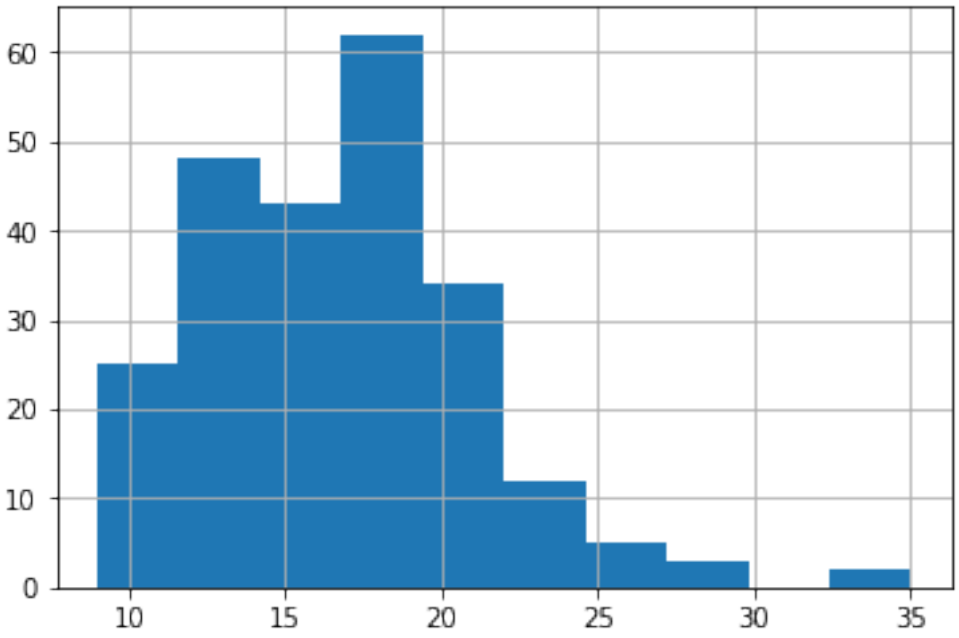
In [24]:
```
df.hist() #program will collect column to create histogram when data is numerical or in
```

Out[24]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000000A06772B320>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A068C80E80>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A068D93E80>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000000A068DCEE80>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A068E0AE80>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A068E0AEB8>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000000A069884940>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A0698C1E10>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000000A069903390>]],
      dtype=object)
```



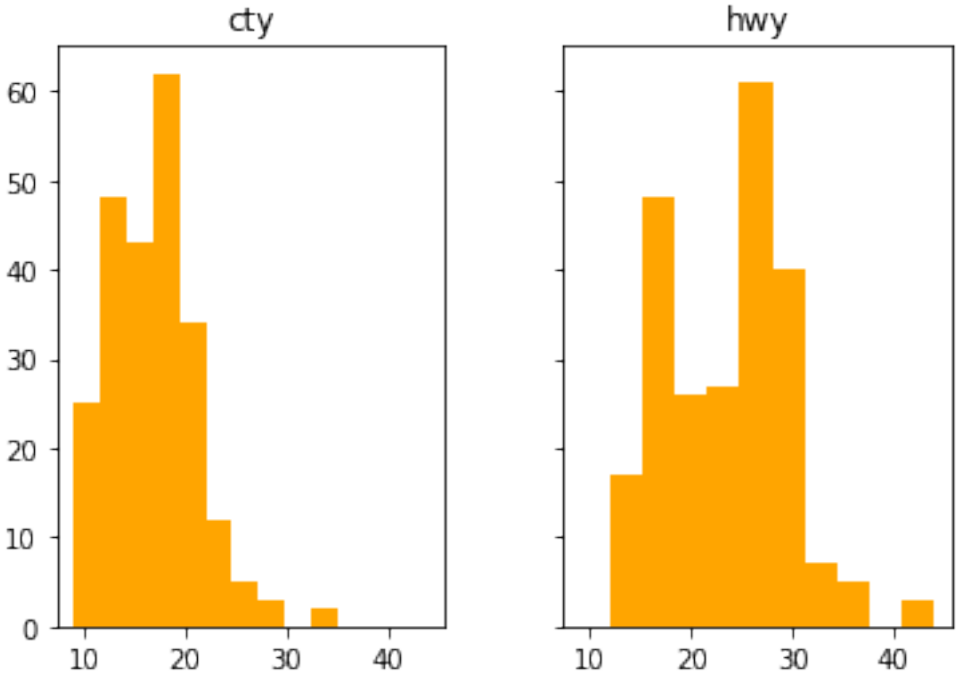
In [23]:
```
df.cty.hist() # to see in each column just code df.name_column.hist()
```

Out[23]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa067794d30>
```



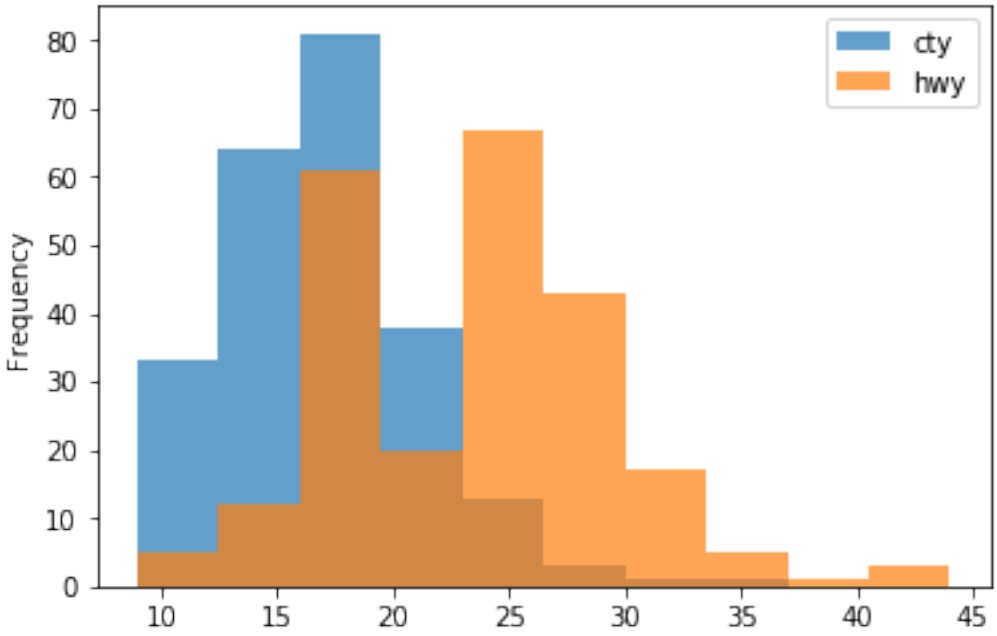

```
In [25]: df[["cty","hwy"]].hist(grid = False, color = "orange",sharex = True , sharey = True) #u
```

```
Out[25]: array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000000A069A64C88>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x000000A069AAEB38>]],
               dtype=object)
```



In [26]:
```
df[["cty","hwy"]].plot.hist(alpha = .7)
```

Out[26]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa069b0b668>
```

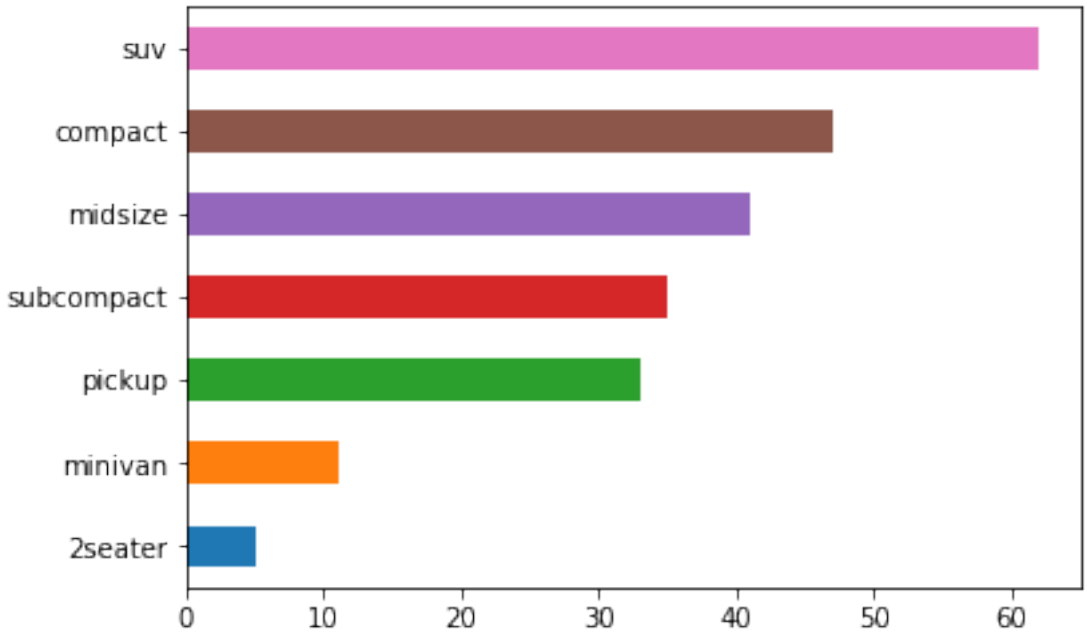


In [27]:
```
# if you want to see some column whose column name is class call  then we just code lik
df["class"].value_counts()
```

Out[27]:
```
suv           62
compact       47
midsize       41
subcompact    35
pickup        33
minivan       11
2seater        5
Name: class, dtype: int64
```

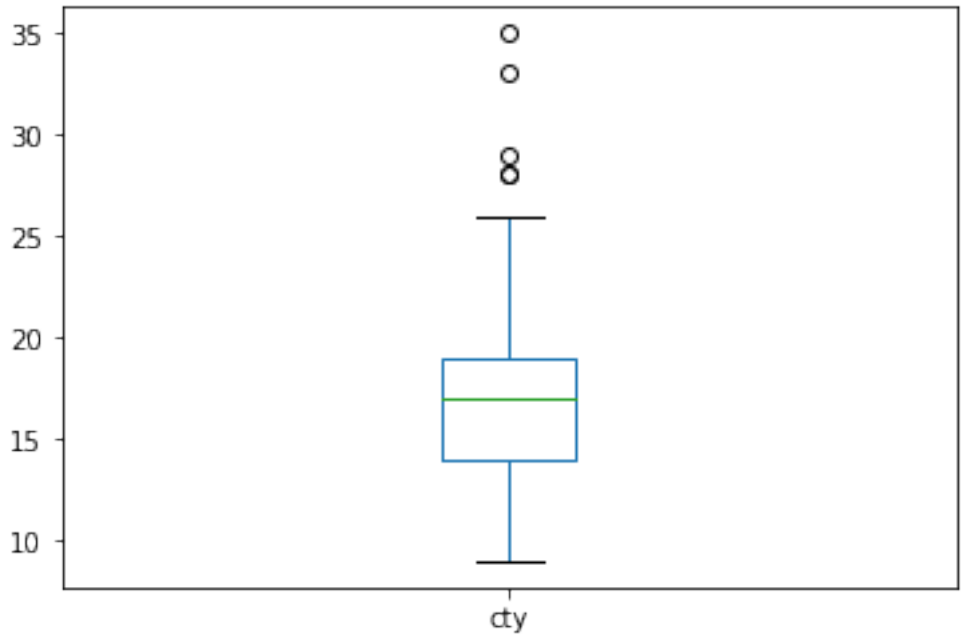
In [28]:
```
df["class"].value_counts().sort_values().plot.barh()
```

Out[28]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa069bd9278>
```



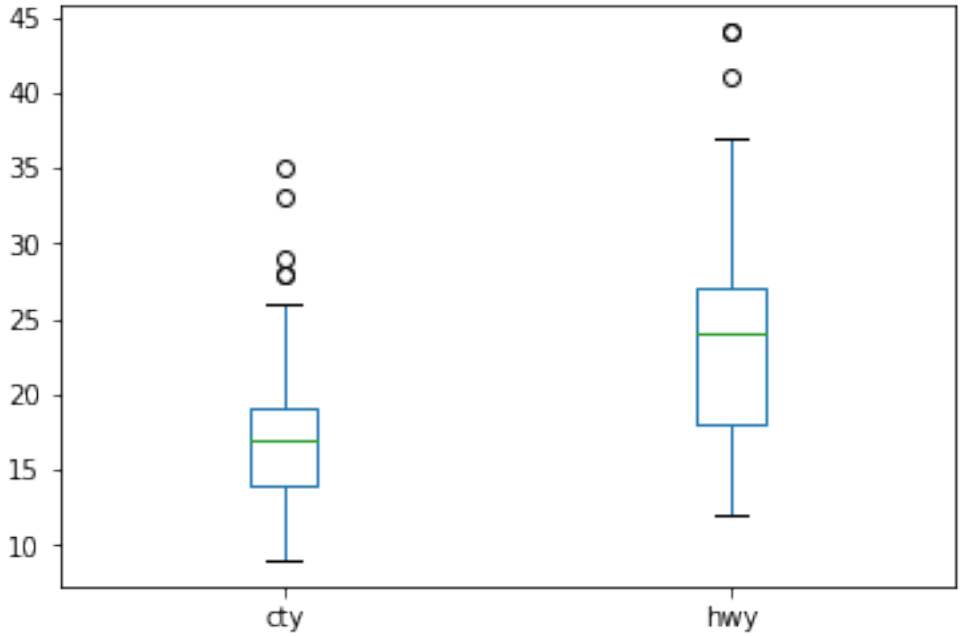
In [29]:
```
#Next is to create boxplot
df.cty.plot.box()
```

Out[29]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa069a535f8>
```



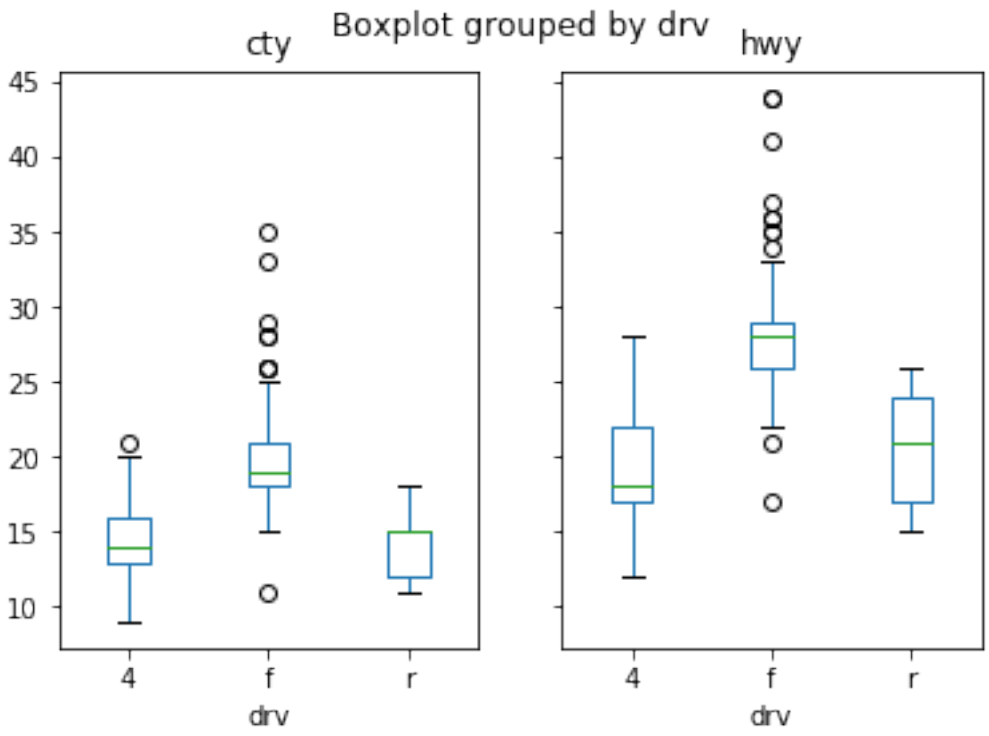
```
In [30]: #Another way to create boxplot
         df[['cty','hwy']].plot.box()
```

```
Out[30]: <matplotlib.axes._subplots.AxesSubplot at 0xa06773ac88>
```




```
In [31]: df.boxplot(column=['cty','hwy'], by = 'drv', grid = False)
```

```
Out[31]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x000000A069C74A58>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x000000A069D7F6A0>],
               dtype=object)
```



In [32]:
```
#To use aggregate function
df.agg(['mean']) #to see only mean
```

Out[32]:

	displ	year	cyl	cty	hwy	cty_kml	hwy_kml
mean	3.471795	2003.5	5.888889	16.858974	23.440171	7.167487	99.654412

In [33]:
```
df.agg(['min', 'max' , 'mean'])
```

Out[33]:

	manufacturer	model	displ	year	cyl	trans	\
max	volkswagen	toyota tacoma 4wd	7.000000	2008.0	8.000000	manual(m6)	
mean	NaN	NaN	3.471795	2003.5	5.888889	NaN	
min	audi	4runner 4wd	1.600000	1999.0	4.000000	auto(av)	

	drv	cty	hwy	fl	class	cty_kml	hwy_kml
max	r	35.000000	44.000000	r	suv	14.880030	187.063231
mean	NaN	16.858974	23.440171	NaN	NaN	7.167487	99.654412
min	4	9.000000	12.000000	c	2seater	3.826293	51.017245

In [34]:
```
#This is to group only mean in each year
df.groupby('year').mean()
```

Out[34]:

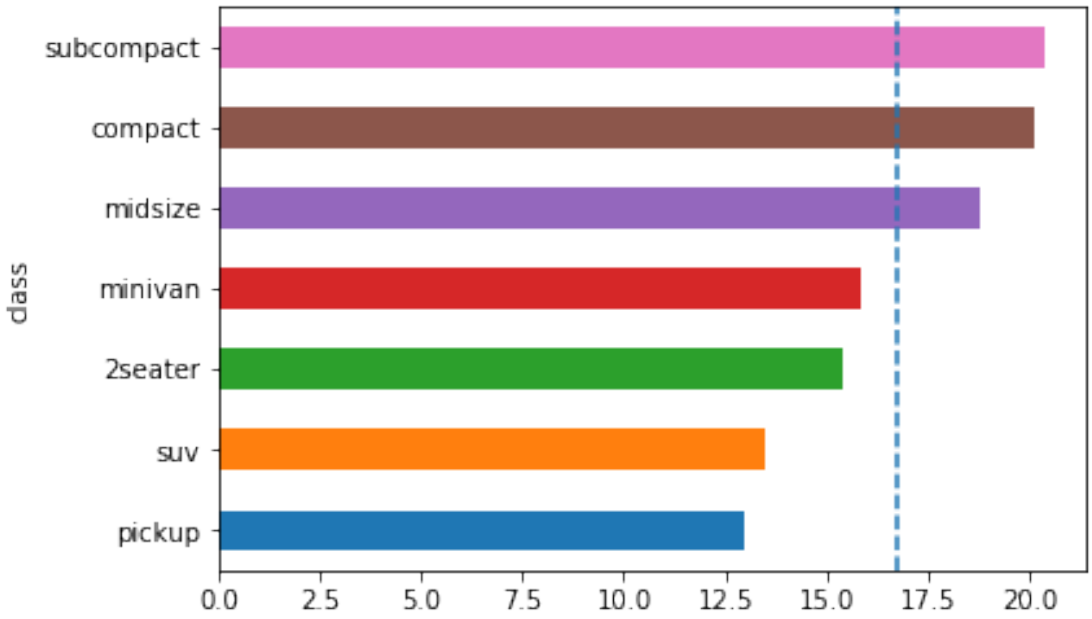
year	displ	cyl	cty	hwy	cty_kml	hwy_kml
1999	3.281197	5.692308	17.017094	23.427350	7.234710	99.599906
2008	3.662393	6.085470	16.700855	23.452991	7.100263	99.708917

In [35]:
```
#avg only class
avg = df.groupby('class').cty.mean().mean()
avg
```

Out[35]:
```
16.710481075007728
```

In [36]:
```
df.groupby('class').cty.mean().sort_values().plot(kind = 'barh')
plt.axvline(x=avg, linestyle = '--')
```

Out[36]:
```
<matplotlib.lines.Line2D at 0xa069e87940>
```



In [37]:
```
# How to handle duplicate values
df.drop_duplicates()
```

Out[37]:

	manufacturer	model	displ	year	cyl	trans	drv	cty	\
0	audi	a4	1.8	1999	4	auto(l5)	f	18	
1	audi	a4	1.8	1999	4	manual(m5)	f	21	
2	audi	a4	2.0	2008	4	manual(m6)	f	20	
3	audi	a4	2.0	2008	4	auto(av)	f	21	
4	audi	a4	2.8	1999	6	auto(l5)	f	16	
5	audi	a4	2.8	1999	6	manual(m5)	f	18	
6	audi	a4	3.1	2008	6	auto(av)	f	18	
7	audi	a4 quattro	1.8	1999	4	manual(m5)	4	18	
8	audi	a4 quattro	1.8	1999	4	auto(l5)	4	16	
9	audi	a4 quattro	2.0	2008	4	manual(m6)	4	20	
10	audi	a4 quattro	2.0	2008	4	auto(s6)	4	19	
11	audi	a4 quattro	2.8	1999	6	auto(l5)	4	15	

12	audi	a4 quattro	2.8	1999	6	manual(m5)	4	17
13	audi	a4 quattro	3.1	2008	6	auto(s6)	4	17
14	audi	a4 quattro	3.1	2008	6	manual(m6)	4	15
15	audi	a6 quattro	2.8	1999	6	auto(l5)	4	15
16	audi	a6 quattro	3.1	2008	6	auto(s6)	4	17
17	audi	a6 quattro	4.2	2008	8	auto(s6)	4	16
18	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14
19	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	11
21	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(l4)	r	13
22	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(l4)	r	12
23	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16
24	chevrolet	corvette	5.7	1999	8	auto(l4)	r	15
25	chevrolet	corvette	6.2	2008	8	manual(m6)	r	16
26	chevrolet	corvette	6.2	2008	8	auto(s6)	r	15
27	chevrolet	corvette	7.0	2008	8	manual(m6)	r	15
28	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	14
29	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	11
30	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(l4)	4	11
..	...	...	...	...	...	...	..	...
204	toyota	toyota tacoma 4wd	3.4	1999	6	auto(l4)	4	15
205	toyota	toyota tacoma 4wd	4.0	2008	6	manual(m6)	4	15
206	toyota	toyota tacoma 4wd	4.0	2008	6	auto(l5)	4	16
207	volkswagen	gti	2.0	1999	4	manual(m5)	f	21
208	volkswagen	gti	2.0	1999	4	auto(l4)	f	19
209	volkswagen	gti	2.0	2008	4	manual(m6)	f	21
210	volkswagen	gti	2.0	2008	4	auto(s6)	f	22
211	volkswagen	gti	2.8	1999	6	manual(m5)	f	17
212	volkswagen	jetta	1.9	1999	4	manual(m5)	f	33
213	volkswagen	jetta	2.0	1999	4	manual(m5)	f	21
214	volkswagen	jetta	2.0	1999	4	auto(l4)	f	19
215	volkswagen	jetta	2.0	2008	4	auto(s6)	f	22
216	volkswagen	jetta	2.0	2008	4	manual(m6)	f	21
217	volkswagen	jetta	2.5	2008	5	auto(s6)	f	21
218	volkswagen	jetta	2.5	2008	5	manual(m5)	f	21
219	volkswagen	jetta	2.8	1999	6	auto(l4)	f	16
220	volkswagen	jetta	2.8	1999	6	manual(m5)	f	17
221	volkswagen	new beetle	1.9	1999	4	manual(m5)	f	35
222	volkswagen	new beetle	1.9	1999	4	auto(l4)	f	29
223	volkswagen	new beetle	2.0	1999	4	manual(m5)	f	21
224	volkswagen	new beetle	2.0	1999	4	auto(l4)	f	19
225	volkswagen	new beetle	2.5	2008	5	manual(m5)	f	20
226	volkswagen	new beetle	2.5	2008	5	auto(s6)	f	20
227	volkswagen	passat	1.8	1999	4	manual(m5)	f	21
228	volkswagen	passat	1.8	1999	4	auto(l5)	f	18
229	volkswagen	passat	2.0	2008	4	auto(s6)	f	19
230	volkswagen	passat	2.0	2008	4	manual(m6)	f	21
231	volkswagen	passat	2.8	1999	6	auto(l5)	f	16
232	volkswagen	passat	2.8	1999	6	manual(m5)	f	18

```
233   volkswagen              passat    3.6  2008    6    auto(s6)   f   17
```

	hwy	fl	class	cty_kml	hwy_kml
0	29	p	compact	7.652587	123.291675
1	29	p	compact	8.928018	123.291675
2	31	p	compact	8.502874	131.794549
3	30	p	compact	8.928018	127.543112
4	26	p	compact	6.802299	110.537364
5	26	p	compact	7.652587	110.537364
6	27	p	compact	7.652587	114.788801
7	26	p	compact	7.652587	110.537364
8	25	p	compact	6.802299	106.285927
9	28	p	compact	8.502874	119.040238
10	27	p	compact	8.077730	114.788801
11	25	p	compact	6.377156	106.285927
12	25	p	compact	7.227443	106.285927
13	25	p	compact	7.227443	106.285927
14	25	p	compact	6.377156	106.285927
15	24	p	midsize	6.377156	102.034490
16	25	p	midsize	7.227443	106.285927
17	23	p	midsize	6.802299	97.783053
18	20	r	suv	5.952012	85.028741
19	15	e	suv	4.676581	63.771556
21	17	r	suv	5.526868	72.274430
22	17	r	suv	5.101724	72.274430
23	26	p	2seater	6.802299	110.537364
24	23	p	2seater	6.377156	97.783053
25	26	p	2seater	6.802299	110.537364
26	25	p	2seater	6.377156	106.285927
27	24	p	2seater	6.377156	102.034490
28	19	r	suv	5.952012	80.777304
29	14	e	suv	4.676581	59.520119
30	15	r	suv	4.676581	63.771556
..	...	..	...	...	...
204	19	r	pickup	6.377156	80.777304
205	18	r	pickup	6.377156	76.525867
206	20	r	pickup	6.802299	85.028741
207	29	r	compact	8.928018	123.291675
208	26	r	compact	8.077730	110.537364
209	29	p	compact	8.928018	123.291675
210	29	p	compact	9.353162	123.291675
211	24	r	compact	7.227443	102.034490
212	44	d	compact	14.029742	187.063231
213	29	r	compact	8.928018	123.291675
214	26	r	compact	8.077730	110.537364
215	29	p	compact	9.353162	123.291675
216	29	p	compact	8.928018	123.291675
217	29	r	compact	8.928018	123.291675

```
218   29  r     compact   8.928018  123.291675
219   23  r     compact   6.802299   97.783053
220   24  r     compact   7.227443  102.034490
221   44  d  subcompact  14.880030  187.063231
222   41  d  subcompact  12.329168  174.308920
223   29  r  subcompact   8.928018  123.291675
224   26  r  subcompact   8.077730  110.537364
225   28  r  subcompact   8.502874  119.040238
226   29  r  subcompact   8.502874  123.291675
227   29  p     midsize   8.928018  123.291675
228   29  p     midsize   7.652587  123.291675
229   28  p     midsize   8.077730  119.040238
230   29  p     midsize   8.928018  123.291675
231   26  p     midsize   6.802299  110.537364
232   26  p     midsize   7.652587  110.537364
233   26  p     midsize   7.227443  110.537364

[225 rows x 13 columns]
```

In [38]:
```
df.drop_duplicates(subset = 'manufacturer') #to remove duplicate in each colum just use
```

Out[38]:

```
    manufacturer                model  displ  year  cyl       trans drv  cty  \
0           audi                   a4    1.8  1999    4    auto(l5)   f   18
18     chevrolet  c1500 suburban 2wd    5.3  2008    8    auto(l4)   r   14
37         dodge         caravan 2wd    2.4  1999    4    auto(l3)   f   18
74          ford      expedition 2wd    4.6  1999    8    auto(l4)   r   11
99         honda               civic    1.6  1999    4  manual(m5)   f   28
108      hyundai              sonata    2.4  1999    4    auto(l4)   f   18
122         jeep  grand cherokee 4wd    3.0  2008    6    auto(l5)   4   17
130   land rover         range rover    4.0  1999    8    auto(l4)   4   11
134      lincoln       navigator 2wd    5.4  1999    8    auto(l4)   r   11
137      mercury     mountaineer 4wd    4.0  1999    6    auto(l5)   4   14
141       nissan              altima    2.4  1999    4  manual(m5)   f   21
154      pontiac          grand prix    3.1  1999    6    auto(l4)   f   18
159       subaru        forester awd    2.5  1999    4  manual(m5)   4   18
173       toyota         4runner 4wd    2.7  1999    4  manual(m5)   4   15
207   volkswagen                 gti    2.0  1999    4  manual(m5)   f   21

     hwy fl       class    cty_kml     hwy_kml
0     29  p     compact   7.652587  123.291675
18    20  r         suv   5.952012   85.028741
37    24  r     minivan   7.652587  102.034490
74    17  r         suv   4.676581   72.274430
99    33  r  subcompact  11.904024  140.297423
108   26  r     midsize   7.652587  110.537364
122   22  d         suv   7.227443   93.531616
130   15  p         suv   4.676581   63.771556
134   17  r         suv   4.676581   72.274430
```

```
137   17  r         suv   5.952012   72.274430
141   29  r     compact   8.928018  123.291675
154   26  r     midsize   7.652587  110.537364
159   25  r         suv   7.652587  106.285927
173   20  r         suv   6.377156   85.028741
207   29  r     compact   8.928018  123.291675
```

In [39]:
```
# to create cross tab
pd.crosstab(df.drv,df['class']) #due rto class is key word in python .we must use blank
# it seems that compact cars that use 4 wheel  drv have 12 model.
```

Out[39]:
```
class  2seater  compact  midsize  minivan  pickup  subcompact  suv
drv
4            0       12        3        0      33           4   51
f            0       35       38       11       0          22    0
r            5        0        0        0       0           9   11
```

In [40]:
```
pd.crosstab(df.drv,df['class'], margins = True) #if you want to know total just add mar
```

Out[40]:
```
class  2seater  compact  midsize  minivan  pickup  subcompact  suv  All
drv
4            0       12        3        0      33           4   51  103
f            0       35       38       11       0          22    0  106
r            5        0        0        0       0           9   11   25
All          5       47       41       11      33          35   62  234
```

In [41]:
```
pd.crosstab(df.drv,df['class'], margins = True, normalize = 'all') #we try to use norma
```

Out[41]:
```
class   2seater   compact   midsize   minivan    pickup  subcompact       suv  \
drv
4      0.000000  0.051282  0.012821  0.000000  0.141026    0.017094  0.217949
f      0.000000  0.149573  0.162393  0.047009  0.000000    0.094017  0.000000
r      0.021368  0.000000  0.000000  0.000000  0.000000    0.038462  0.047009
All    0.021368  0.200855  0.175214  0.047009  0.141026    0.149573  0.264957

class       All
drv
4      0.440171
f      0.452991
r      0.106838
All    1.000000
```

In [42]:
```
(pd.crosstab(df.drv,df['class'], margins = True, normalize = 'all')*100).round(1) #we c
```

Out[42]:
```
class  2seater  compact  midsize  minivan  pickup  subcompact   suv    All
drv
4          0.0      5.1      1.3      0.0    14.1         1.7  21.8   44.0
f          0.0     15.0     16.2      4.7     0.0         9.4   0.0   45.3
r          2.1      0.0      0.0      0.0     0.0         3.8   4.7   10.7
All        2.1     20.1     17.5      4.7    14.1        15.0  26.5  100.0
```

In [88]:
```
#Newt we will do traing and test datase by using this datatype
url = "https://raw.githubusercontent.com/prasertcbs/tutorial/master/mtcars.csv"
df2 = pd.read_csv(url,nrows = 10)
df2
```

Out[88]:

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
5	Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
6	Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
7	Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
8	Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
9	Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4

In [89]:
```
#Next step i will show you how to do training and test data set
#normally training data wille be 70% and 30 % will be test set
df2.shape
```

Out[89]: (10, 12)

In [90]:
```
np.iinfo(np.int32).max
```

Out[90]: 2147483647

In [93]:
```
np.random.randint(np.iinfo(np.int32).min,np.iinfo(np.int32).max)
#now you will get the random number that every time you run ,it will random new number
```

Out[93]: 865473121

In [110]:
```
np.random.randint(np.iinfo(np.int32).min,np.iinfo(np.int32).max,5)
 #this will random 5 number that every time you run
```

Out[110]: array([752588946, 1750824090, 843263716, 1343895736, 1714292689])

In [111]:
```
df2['uid'] =np.random.randint(np.iinfo(np.int32).min,np.iinfo(np.int32).max,df2.shape[
df2
#now we wis ill create column that  is usi
```

Out[111]:

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb	uid
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4	2096065320
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4	-106090991
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1	-847626544
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1	-1643140384
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2	400715154
5	Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1	-1432445439
6	Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4	-400941851
7	Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2	-107469547
8	Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2	846756041
9	Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4	-366665134

In [115]:
```
df2.sort_values(['uid'], inplace =True)
df2
```

Out[115]:

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb	uid
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1	-1643140384
5	Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1	-1432445439
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1	-847626544
6	Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4	-400941851
9	Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4	-366665134
7	Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2	-107469547
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4	-106090991
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2	400715154
8	Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2	846756041
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4	2096065320

```
9     4  -366665134
7     2  -107469547
1     4  -106090991
4     2   400715154
8     2   846756041
0     4  2096065320
```

In [117]:
```
train_ratio = 0.7
df_train = df2[:int(df2.shape[0] * train_ratio)]
df_train
#
```

Out[117]:

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb	uid
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1	-1643140384
5	Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1	-1432445439
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1	-847626544
6	Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4	-400941851
9	Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4	-366665134
7	Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2	-107469547
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4	-106090991

In [118]:
```
df_train.shape# it means that the fist 7 row will be training set that is 70%
```

Out[118]:
```
(7, 13)
```

In [120]:
```
df_test = df2[int(df2.shape[0] * train_ratio):]
df_test
```

Out[120]:

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb	uid
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.44	17.02	0	0	3	2	400715154
8	Merc 230	22.8	4	140.8	95	3.92	3.15	22.90	1	0	4	2	846756041
0	Mazda RX4	21.0	6	160.0	110	3.90	2.62	16.46	0	1	4	4	2096065320

In [121]:
```
df_test.shape# test set will be 30%
# this is the example how to split data in to 70% and 30%
```

Out[121]: (3, 13)

In [114]:
```
#This is to do cluster analysis by getting the dataset from the link below to show you
#'well e clustering companies using their stock market prices, and distinguishing diff
df = pd.read_csv("https://assets.datacamp.com/production/course_2072/datasets/company-
df.head()
```

Out[114]:

	Unnamed: 0	2010-01-04	2010-01-05	2010-01-06	2010-01-07	\
0	Apple	0.580000	-0.220005	-3.409998	-1.170000	
1	AIG	-0.640002	-0.650000	-0.210001	-0.420000	
2	Amazon	-2.350006	1.260009	-2.350006	-2.009995	
3	American express	0.109997	0.000000	0.260002	0.720002	
4	Boeing	0.459999	1.770000	1.549999	2.690003	

	2010-01-08	2010-01-11	2010-01-12	2010-01-13	2010-01-14	...	\
0	1.680011	-2.689994	-1.469994	2.779997	-0.680003	...	
1	0.710001	-0.200001	-1.130001	0.069999	-0.119999	...	
2	2.960006	-2.309997	-1.640007	1.209999	-1.790001	...	
3	0.190003	-0.270001	0.750000	0.300004	0.639999	...	
4	0.059997	-1.080002	0.360000	0.549999	0.530002	...	

	2013-10-16	2013-10-17	2013-10-18	2013-10-21	2013-10-22	2013-10-23	\
0	0.320008	4.519997	2.899987	9.590019	-6.540016	5.959976	
1	0.919998	0.709999	0.119999	-0.480000	0.010002	-0.279998	
2	2.109985	3.699982	9.570008	-3.450013	4.820008	-4.079986	
3	0.680001	2.290001	0.409996	-0.069999	0.100006	0.069999	
4	1.559997	2.480003	0.019997	-1.220001	0.480003	3.020004	

	2013-10-24	2013-10-25	2013-10-28	2013-10-29
0	6.910011	-5.359962	0.840019	-19.589981
1	-0.190003	-0.040001	-0.400002	0.660000
2	2.579986	4.790009	-1.760009	3.740021
3	0.130005	1.849999	0.040001	0.540001
4	-0.029999	1.940002	1.130005	0.309998

[5 rows x 964 columns]

In [53]:
```
#points of size 300x2, where each row gives the (x, y) co-ordinates of a point on a map
points = np.array([[ 0.06544649, -0.76866376],
       [-1.52901547, -0.42953079],
       [ 1.70993371,  0.69885253],
       [ 1.16779145,  1.01262638],
       [-1.80110088, -0.31861296],
       [-1.63567888, -0.02859535],
       [ 1.21990375,  0.74643463],
       [-0.26175155, -0.62492939],
       [-1.61925804, -0.47983949],
       [-1.84329582, -0.16694431],
```

```
[ 1.35999602,  0.94995827],
[ 0.42291856, -0.7349534 ],
[-1.68576139,  0.10686728],
[ 0.90629995,  1.09105162],
[-1.56478322, -0.84675394],
[-0.0257849 , -1.18672539],
[ 0.83027324,  1.14504612],
[ 1.22450432,  1.35066759],
[-0.15394596, -0.71704301],
[ 0.86358809,  1.06824613],
[-1.43386366, -0.2381297 ],
[ 0.03844769, -0.74635022],
[-1.58567922,  0.08499354],
[ 0.6359888 , -0.58477698],
[ 0.24417242, -0.53172465],
[-2.19680359,  0.49473677],
[ 1.0323503 , -0.55688   ],
[-0.28858067, -0.39972528],
[ 0.20597008, -0.80171536],
[-1.2107308 , -0.34924109],
[ 1.33423684,  0.7721489 ],
[ 1.19480152,  1.04788556],
[ 0.9917477 ,  0.89202008],
[-1.8356219 , -0.04839732],
[ 0.08415721, -0.71564326],
[-1.48970175, -0.19299604],
[ 0.38782418, -0.82060119],
[-0.01448044, -0.9779841 ],
[-2.0521341 , -0.02129125],
[ 0.10331194, -0.82162781],
[-0.44189315, -0.65710974],
[ 1.10390926,  1.02481182],
[-1.59227759, -0.17374038],
[-1.47344152, -0.02202853],
[-1.35514704,  0.22971067],
[ 0.0412337 , -1.23776622],
[ 0.4761517 , -1.13672124],
[ 1.04335676,  0.82345905],
[-0.07961882, -0.85677394],
[ 0.87065059,  1.08052841],
[ 1.40267313,  1.07525119],
[ 0.80111157,  1.28342825],
[-0.16527516, -1.23583804],
[-0.33779221, -0.59194323],
[ 0.80610749, -0.73752159],
[-1.43590032, -0.56384446],
[ 0.54868895, -0.95143829],
[ 0.46803131, -0.74973907],
```

```
[-1.5137129 , -0.83914323],
[ 0.9138436 ,  1.51126532],
[-1.97233903, -0.41155375],
[ 0.5213406 , -0.88654894],
[ 0.62759494, -1.18590477],
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```

In [54]:
```
# Import KMeans
from sklearn.cluster import KMeans

# Create a KMeans instance with 3 clusters: model
model = KMeans(n_clusters=3)

# Fit model to points
model.fit(points)

# Determine the cluster labels of new_points: labels
#After the model has been fit, you'll obtain the cluster labels for some new points usi

labels = model.predict(new_points)

# Print cluster labels of new_points
print(labels)

# performed k-Means clustering and predicted the labels of new points. But it is not ea
#A visualization would be far more useful. you'll inspect your clustering with a scatte



# Import pyplot
from matplotlib import pyplot as plt

# Assign the columns of new_points: xs and ys
xs = new_points[:,0]
ys = new_points[:,1]

# Make a scatter plot of xs and ys, using labels to define the colors
plt.scatter(xs, ys, c=labels, alpha=0.5)
```

```
        # Assign the cluster centers: centroids
        centroids = model.cluster_centers_

        # Assign the columns of centroids: centroids_x, centroids_y
        centroids_x = centroids[:,0]
        centroids_y = centroids[:,1]

        # Make a scatter plot of centroids_x and centroids_y
        plt.scatter(centroids_x, centroids_y, marker='D', s=50)
        plt.show()

        #The clustering looks better
```

```
[2 1 0 2 1 2 1 1 1 0 2 1 1 0 0 1 0 0 1 1 0 1 2 1 2 0 1 0 0 2 2 1 1 1 0 2 1
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```
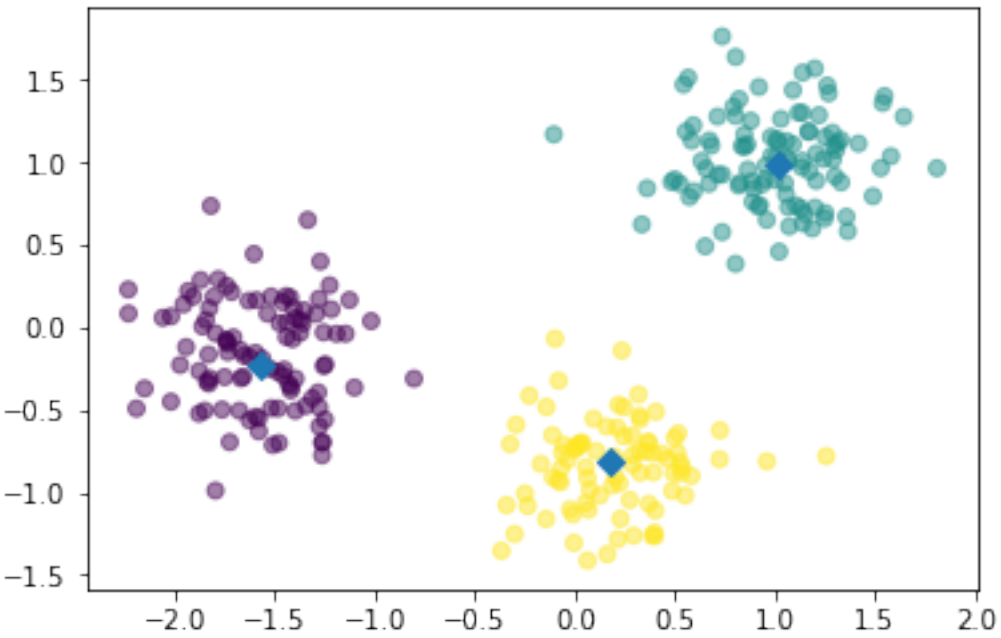
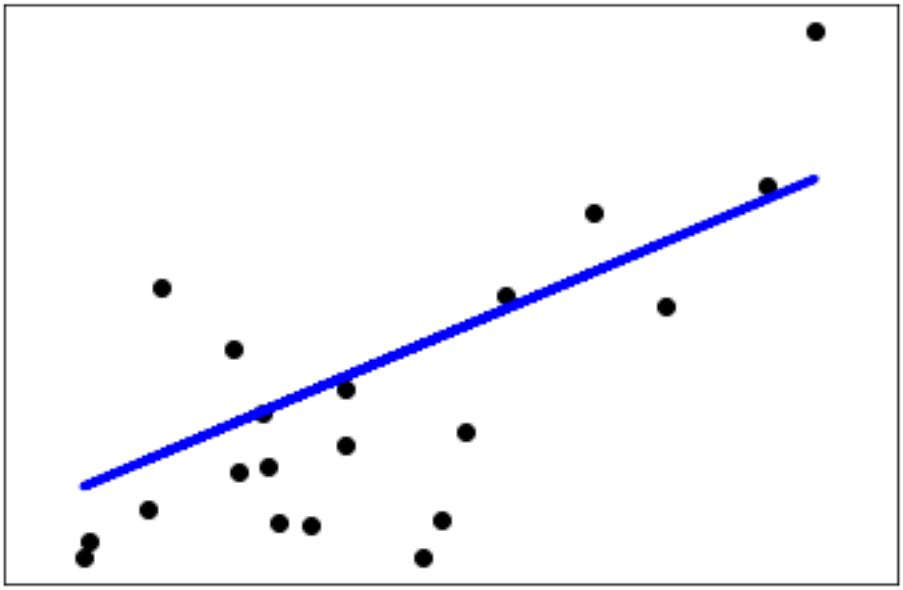




```
In [55]: import matplotlib.pyplot as plt
         import numpy as np
```

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

        # Load the diabetes dataset
        diabetes = datasets.load_diabetes()

In [56]: # Use only one feature
        diabetes_X = diabetes.data[:, np.newaxis, 2]

        # Split the data into training/testing sets
        diabetes_X_train = diabetes_X[:-20]
        diabetes_X_test = diabetes_X[-20:]

        # Split the targets into training/testing sets
        diabetes_y_train = diabetes.target[:-20]
        diabetes_y_test = diabetes.target[-20:]

        # Create linear regression object
        regr = linear_model.LinearRegression()

        # Train the model using the training sets
        regr.fit(diabetes_X_train, diabetes_y_train)

        # Make predictions using the testing set
        diabetes_y_pred = regr.predict(diabetes_X_test)

        # The coefficients
        print('Coefficients: \n', regr.coef_)
        # The mean squared error
        print("Mean squared error: %.2f"
              % mean_squared_error(diabetes_y_test, diabetes_y_pred))
        # Explained variance score: 1 is perfect prediction
        print('Variance score: %.2f' % r2_score(diabetes_y_test, diabetes_y_pred))

        # Plot outputs
        plt.scatter(diabetes_X_test, diabetes_y_test,  color='black')
        plt.plot(diabetes_X_test, diabetes_y_pred, color='blue', linewidth=3)

        plt.xticks(())
        plt.yticks(())

        plt.show()

        #The coefficients, the residual sum of squares and the variance score are also calculat

Coefficients:
 [938.23786125]
Mean squared error: 2548.07
```

```
Variance score: 0.47
```



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