DS_HW2

September 30, 2019

[93]:
```
import pandas as pd
import matplotlib.pyplot as plt
plt.style.use('seaborn')
import seaborn as sns
import numpy as np
```

1 This data is about detailed information of cars from 1985 Ward's Automotive Yearbook, and the features included ranging from manufature,aspiration to price.

2 And it contains 206 entries and each entry has 26 features.

[85]:
```
car=pd.read_csv('./Automobile_data.csv')
print("The shape of dataset :{}".format(car.shape))
print(car.head())
print(car.info())
```

```
The shape of dataset :(205, 26)
   symboling normalized-losses         make fuel-type aspiration num-of-doors  \
0          3                 ?  alfa-romero       gas        std          two
1          3                 ?  alfa-romero       gas        std          two
2          1                 ?  alfa-romero       gas        std          two
3          2               164         audi       gas        std         four
4          2               164         audi       gas        std         four

    body-style drive-wheels engine-location  wheel-base  …  engine-size  \
0  convertible          rwd           front        88.6  …          130
1  convertible          rwd           front        88.6  …          130
2    hatchback          rwd           front        94.5  …          152
3        sedan          fwd           front        99.8  …          109
4        sedan          4wd           front        99.4  …          136

   fuel-system  bore  stroke compression-ratio horsepower  peak-rpm city-mpg  \
0         mpfi  3.47    2.68               9.0        111      5000       21
```

```
1         mpfi  3.47    2.68              9.0        111      5000       21
2         mpfi  2.68    3.47              9.0        154      5000       19
3         mpfi  3.19     3.4             10.0        102      5500       24
4         mpfi  3.19     3.4              8.0        115      5500       18

  highway-mpg  price
0          27  13495
1          27  16500
2          26  16500
3          30  13950
4          22  17450

[5 rows x 26 columns]
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 205 entries, 0 to 204
Data columns (total 26 columns):
symboling            205 non-null int64
normalized-losses    205 non-null object
make                 205 non-null object
fuel-type            205 non-null object
aspiration           205 non-null object
num-of-doors         205 non-null object
body-style           205 non-null object
drive-wheels         205 non-null object
engine-location      205 non-null object
wheel-base           205 non-null float64
length               205 non-null float64
width                205 non-null float64
height               205 non-null float64
curb-weight          205 non-null int64
engine-type          205 non-null object
num-of-cylinders     205 non-null object
engine-size          205 non-null int64
fuel-system          205 non-null object
bore                 205 non-null object
stroke               205 non-null object
compression-ratio    205 non-null float64
horsepower           205 non-null object
peak-rpm             205 non-null object
city-mpg             205 non-null int64
highway-mpg          205 non-null int64
price                205 non-null object
dtypes: float64(5), int64(5), object(16)
memory usage: 41.8+ KB
None
```

3 Though this data set dosen't have any missing data, but there are still a few unknow data which represented by '?'

(Following are some preprocessing with the missing data. Without doing so, a lot of plots in this homework cannot be properly drawn)

[89]:
```
clean_by_mean=['price','horsepower','bore','stroke','peak-rpm']
for name in clean_by_mean[0:2]:
    a=car[car[name]!='?']
    b=(a[name].astype(int)).mean()
    car[name]=car[name].replace('?',b).astype(int)
    print(name,':',car[car[name]!='?'].shape)

for name in clean_by_mean[2:]:
    a=car[car[name]!='?']
    b=(a[name].astype(float)).mean()
    car[name]=car[name].replace('?',b).astype(float)
    print(name,':',car[car[name]!='?'].shape)
a=car['num-of-doors'].map({'two':2,'four':4,'?':4})
car['num-of-doors']=a
```

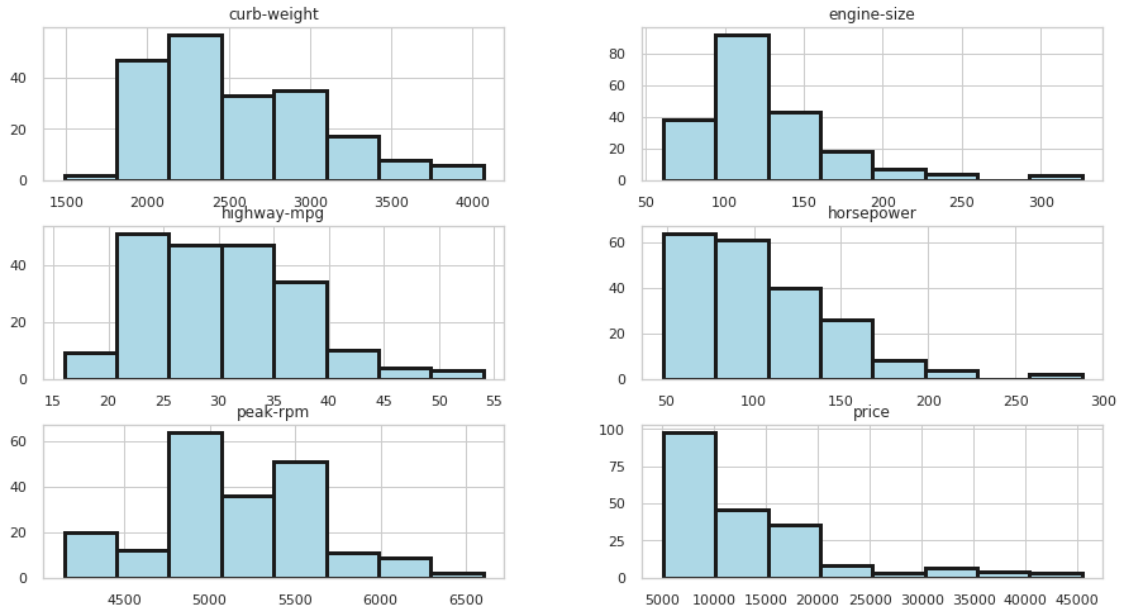
```
price : (205, 26)
horsepower : (205, 26)
bore : (205, 26)
stroke : (205, 26)
peak-rpm : (205, 26)
```

---

4 Then we want to understand the range of important features:

- Curb weight : Is the total weight of the vehicle without the weight of the passenger.
- Engine Size: It is the amount of air that can be sucked in by the engine.
- Highway-mpg: It is the kilometer or miles that a car can travel with one liter of fuel on the highway
- Horse Power: It is the measure of the power of the engine
- Peak rpm: RPM (Reolutions per minute) is the measure of the speed of roation of Engine per minute
- Price: In US today the median price of the vehicle is around 35000.This is a old data so it shows very low median car price.

[90]:
```
plt=car[['engine-size','peak-rpm','curb-weight','horsepower','price','highway-mpg']].
↪hist(figsize=(15,8),bins=8,color='lightblue',linewidth='3',edgecolor='k')
```



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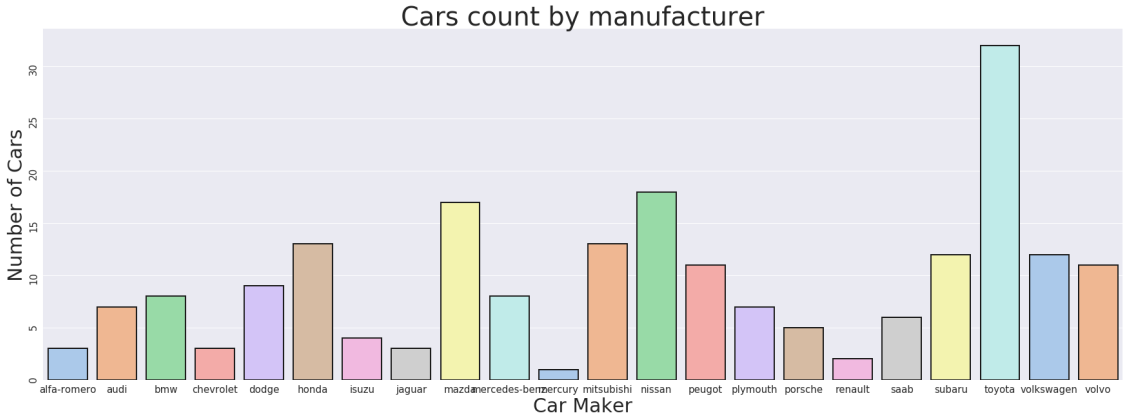
5 Which company sells most cars?

[94]:
```
plt.figure(figsize=(30, 10))
ax=sns.countplot(car['make'],palette='pastel',edgecolor='k',linewidth=2)
plt.xticks(rotation='horizontal')
plt.xlabel('Car Maker',fontsize=30)
plt.ylabel('Number of Cars',fontsize=30)
plt.title('Cars count by manufacturer',fontsize=40)
ax.tick_params(labelsize=15,)
plt.yticks(rotation='vertical')
plt.show()
```



We can see that Toyota is the most prolicfic company.

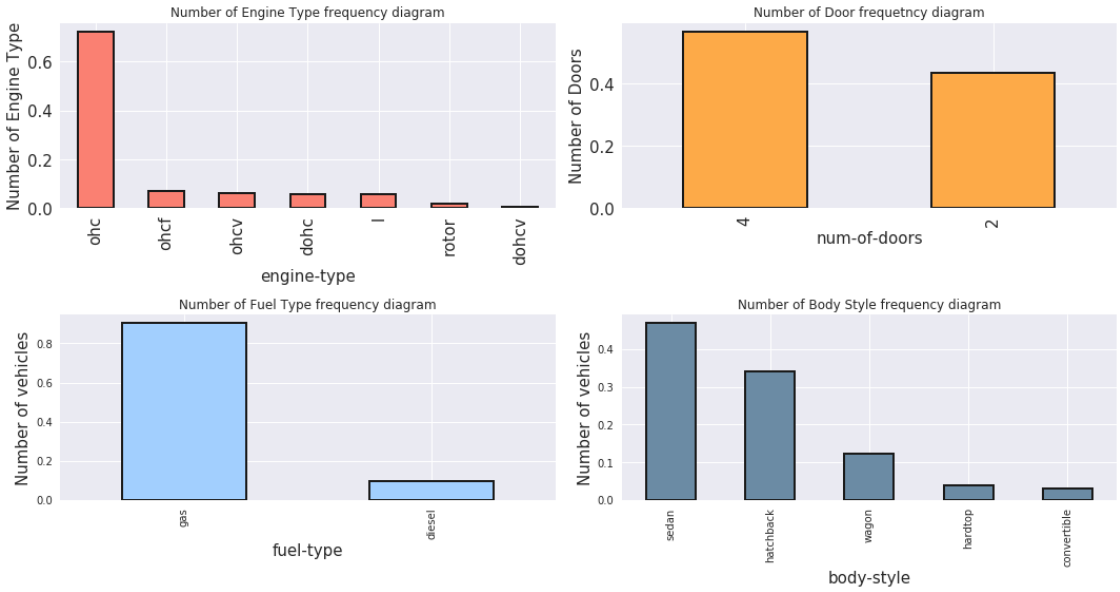
Next, I want to about the what proportion they account for the following features: * engine-type, * number-of-door, * fuel-type * body-style

[95]:
```
plt.subplot(221)
ax1=car['engine-type'].value_counts(normalize=True).
 ↪plot(figsize=(15,8),kind='bar',color='salmon',edgecolor='k',linewidth=2)
plt.title("Number of Engine Type frequency diagram")
plt.ylabel('Number of Engine Type',fontsize=15)
ax1.tick_params(labelsize=15)
plt.xlabel('engine-type',fontsize=15);


plt.subplot(222)
ax2=car['num-of-doors'].value_counts(normalize=True).
 ↪plot(figsize=(15,8),kind='bar',color='#fdaa48',edgecolor='k',linewidth=2)
plt.title("Number of Door frequetncy diagram")
plt.ylabel('Number of Doors',fontsize=15)
ax2.tick_params(labelsize=15)
plt.xlabel('num-of-doors',fontsize=15);

plt.subplot(223)
ax3=car['fuel-type'].value_counts(normalize= True).
 ↪plot(figsize=(15,8),kind='bar',color='#a2cffe',edgecolor='k',linewidth=2)
plt.title("Number of Fuel Type frequency diagram")
plt.ylabel('Number of vehicles',fontsize=15)
plt.xlabel('fuel-type',fontsize=15)
ax2.tick_params(labelsize=15)

plt.subplot(224)
ax4=car['body-style'].value_counts(normalize=True).
 ↪plot(figsize=(15,8),kind='bar',color='#6b8ba4',edgecolor='k',linewidth=2)
plt.title("Number of Body Style frequency diagram")
plt.ylabel('Number of vehicles',fontsize=15)
plt.xlabel('body-style',fontsize=15);
plt.tight_layout()
plt.show()
```



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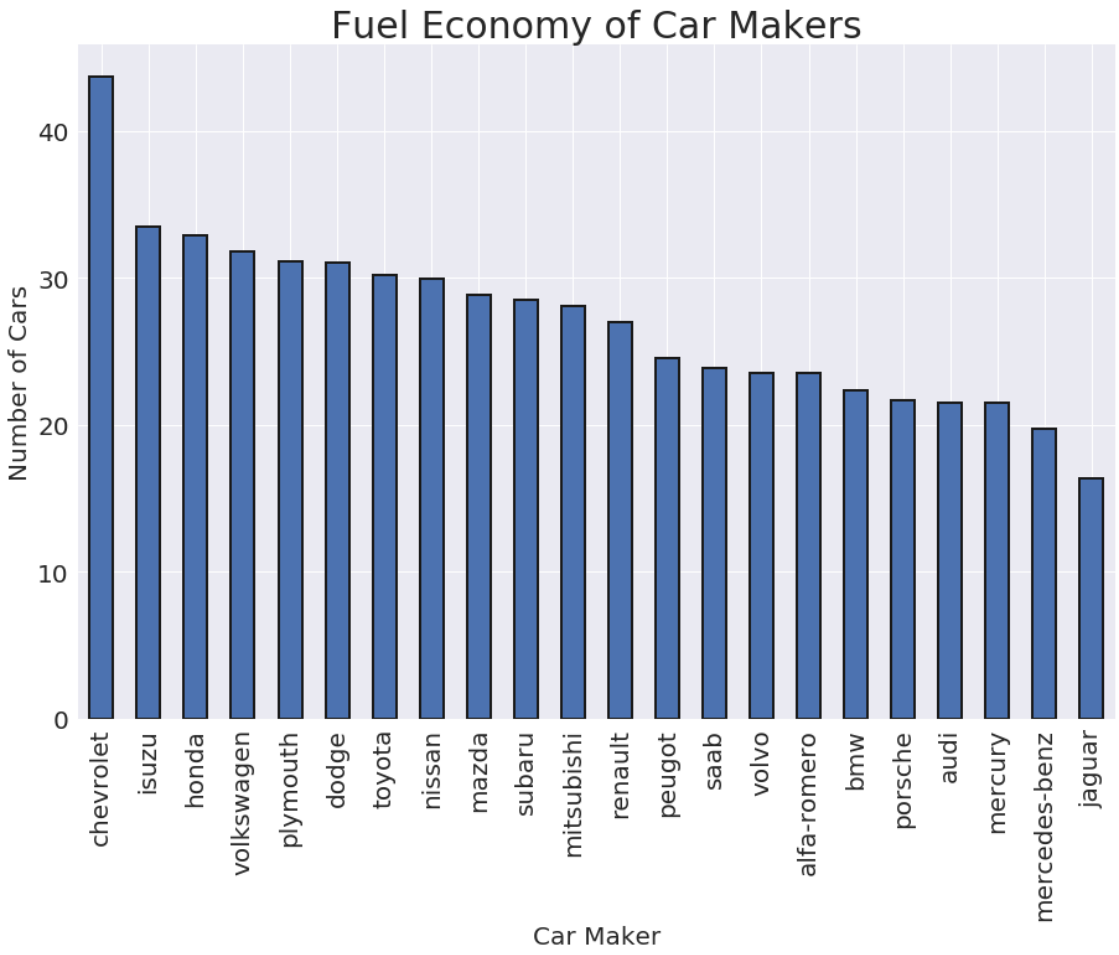
6 Following we want to see the fuel economy of different car makers

[96]:
```
fig = plt.figure(figsize=(15, 10))
mileage=car.groupby(['make']).mean()
mileage['avg-mpg']=((mileage['city-mpg']+mileage['highway-mpg'])/2)
ax=mileage['avg-mpg'].sort_values(ascending=False).plot.
 ↪bar(edgecolor='k',linewidth=2)
plt.xticks(rotation='vertical')
plt.xlabel('Car Maker',fontsize=20)
plt.ylabel('Number of Cars',fontsize=20)
plt.title('Fuel Economy of Car Makers',fontsize=30)
ax.tick_params(labelsize=20)
#plt.yticks(rotation='vertical')
plt.show()
plt.show()
```



And we can find out that chevrolet's cars are the most efficient on the fuel economy

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7 Then I want to know the relation between the number of cylinder and the horsepower

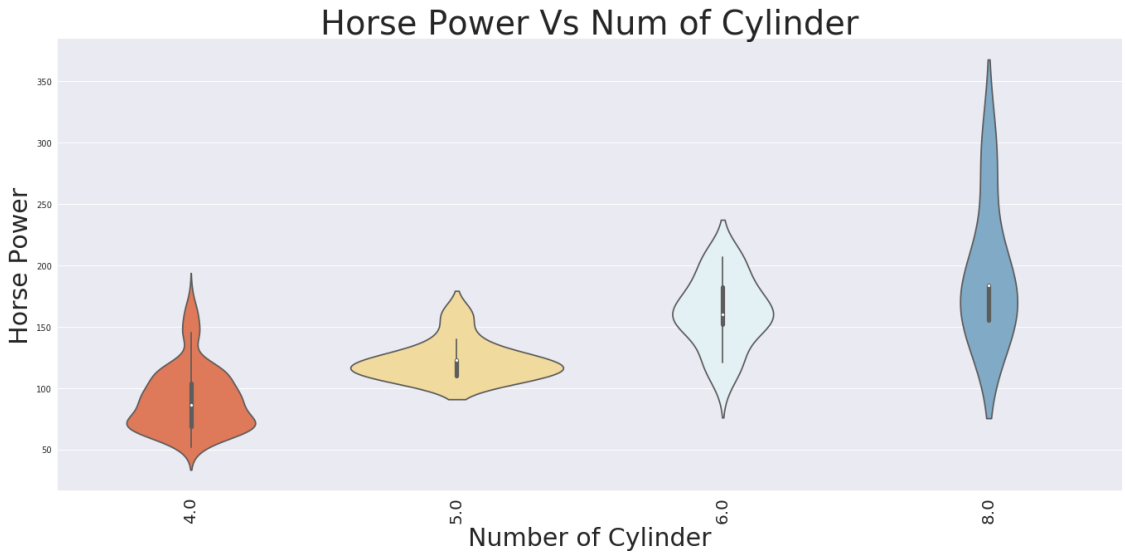
[98]:
```
## Cleaning the missing data for horse power and number of cylinder
a=car['num-of-cylinders'].map({'four':4,'five':5,'six':6,'eight':8,'?':4})
car['num-of-cylinders']=a
print('num-of-cylinders :',car[car['num-of-cylinders']!='?'].shape)


plt.rcParams['figure.figsize']=(23,10)
print(car["num-of-cylinders"])
```

```
ax=sns.violinplot(data=car, x="num-of-cylinders", y="horsepower",palette=sns.
 ↪color_palette("RdYlBu", 4))
ax.set_xlabel('Number of Cylinder',fontsize=30)
ax.set_ylabel('Horse Power',fontsize=30)
plt.title('Horse Power Vs Num of Cylinder',fontsize=40)
ax.tick_params(axis='x',labelsize=20,rotation=90)
```

```
/home/brian/.local/lib/python3.6/site-packages/pandas/core/ops/__init__.py:1115:
FutureWarning: elementwise comparison failed; returning scalar instead, but in
the future will perform elementwise comparison
  result = method(y)
```

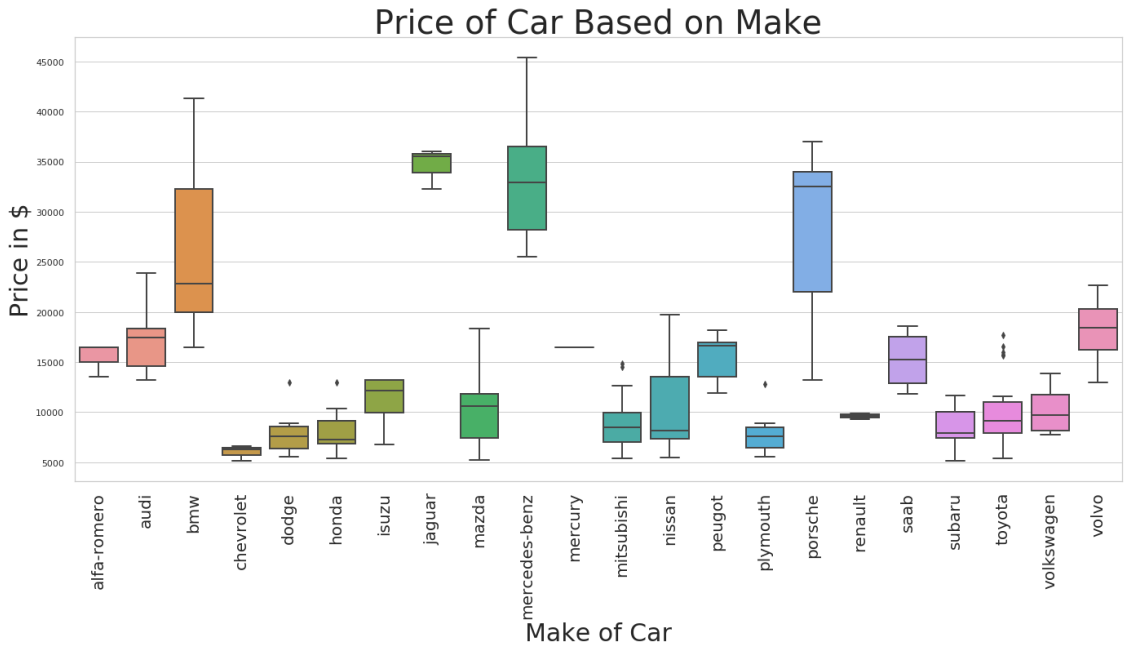
```
num-of-cylinders : (205, 26)
0      4.0
1      4.0
2      6.0
3      4.0
4      5.0
      ...
200    4.0
201    4.0
202    6.0
203    6.0
204    4.0
Name: num-of-cylinders, Length: 205, dtype: float64
```



And we can find out that the number of cylinders do have direct impact on the horsepower.However,the difference between 5 cylinders cars and 4 cylinders cara is not significant. From 6 cylinders and so on can really tell that huge difference.

8 At last, I want to know that how much the brand of the car will affect its selling price.

[69]:
```
plt.rcParams['figure.figsize']=(23,10)
ax = sns.boxplot(x="make", y="price", data=car,width=0.8,linewidth=2)
ax.set_xlabel('Make of Car',fontsize=30)
ax.set_ylabel('Price in $',fontsize=30)
plt.title('Price of Car Based on Make',fontsize=40)
ax.tick_params(axis='x',labelsize=20,rotation=90)
```



And We can still find out that brands do have huge impact on the price of the cars. Among them, BMW,Benz,Jaguar,Porsche are the most expensive cars.