```
import pandas as pd

d=pd.read_csv("CarPrice_Assignment.csv")
d
```

```
     car_ID  symboling                   CarName fueltype
aspiration  \
0         1          3        alfa-romero giulia      gas        std

1         2          3       alfa-romero stelvio      gas        std

2         3          1  alfa-romero Quadrifoglio      gas        std

3         4          2               audi 100 ls      gas        std

4         5          2                audi 100ls      gas        std

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

200     201         -1           volvo 145e (sw)      gas        std

201     202         -1               volvo 144ea      gas      turbo

202     203         -1               volvo 244dl      gas        std

203     204         -1                 volvo 246   diesel      turbo

204     205         -1               volvo 264gl      gas      turbo


    doornumber      carbody drivewheel enginelocation  wheelbase  ...
\
0          two  convertible        rwd          front       88.6  ...

1          two  convertible        rwd          front       88.6  ...

2          two    hatchback        rwd          front       94.5  ...

3         four        sedan        fwd          front       99.8  ...

4         four        sedan        4wd          front       99.4  ...

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

200       four        sedan        rwd          front      109.1  ...

201       four        sedan        rwd          front      109.1  ...

202       four        sedan        rwd          front      109.1  ...

203       four        sedan        rwd          front      109.1  ...
```

```
204       four        sedan         rwd          front      109.1  ...


     enginesize  fuelsystem  boreratio  stroke compressionratio
horsepower  \
0           130        mpfi       3.47    2.68              9.0
111
1           130        mpfi       3.47    2.68              9.0
111
2           152        mpfi       2.68    3.47              9.0
154
3           109        mpfi       3.19    3.40             10.0
102
4           136        mpfi       3.19    3.40              8.0
115
..          ...         ...        ...     ...              ...
...
200         141        mpfi       3.78    3.15              9.5
114
201         141        mpfi       3.78    3.15              8.7
160
202         173        mpfi       3.58    2.87              8.8
134
203         145         idi       3.01    3.40             23.0
106
204         141        mpfi       3.78    3.15              9.5
114

     peakrpm citympg  highwaympg    price
0       5000      21          27  13495.0
1       5000      21          27  16500.0
2       5000      19          26  16500.0
3       5500      24          30  13950.0
4       5500      18          22  17450.0
..       ...     ...         ...      ...
200     5400      23          28  16845.0
201     5300      19          25  19045.0
202     5500      18          23  21485.0
203     4800      26          27  22470.0
204     5400      19          25  22625.0

[205 rows x 26 columns]

d.shape

(205, 26)

d.head()

   car_ID  symboling                   CarName fueltype aspiration
doornumber  \
```

```
0       1          3        alfa-romero giulia      gas        std
two
1       2          3       alfa-romero stelvio      gas        std
two
2       3          1  alfa-romero Quadrifoglio      gas        std
two
3       4          2               audi 100 ls      gas        std
four
4       5          2                audi 100ls      gas        std
four

       carbody drivewheel enginelocation  wheelbase  ...
enginesize  \
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


   fuelsystem  boreratio  stroke compressionratio horsepower  peakrpm
citympg  \
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    3.40             10.0        102     5500
24
4        mpfi       3.19    3.40              8.0        115     5500
18

   highwaympg    price
0          27  13495.0
1          27  16500.0
2          26  16500.0
3          30  13950.0
4          22  17450.0

[5 rows x 26 columns]

d.tail()

     car_ID  symboling          CarName fueltype aspiration doornumber
\
200     201         -1  volvo 145e (sw)      gas        std       four
```

```
201     202          -1      volvo 144ea      gas      turbo        four

202     203          -1      volvo 244dl      gas        std        four

203     204          -1        volvo 246   diesel      turbo        four

204     205          -1      volvo 264gl      gas      turbo        four


    carbody drivewheel enginelocation  wheelbase  ...  enginesize
fuelsystem  \
200   sedan        rwd          front      109.1  ...         141
mpfi
201   sedan        rwd          front      109.1  ...         141
mpfi
202   sedan        rwd          front      109.1  ...         173
mpfi
203   sedan        rwd          front      109.1  ...         145
idi
204   sedan        rwd          front      109.1  ...         141
mpfi

     boreratio  stroke compressionratio horsepower  peakrpm citympg  \
200       3.78    3.15              9.5        114     5400      23
201       3.78    3.15              8.7        160     5300      19
202       3.58    2.87              8.8        134     5500      18
203       3.01    3.40             23.0        106     4800      26
204       3.78    3.15              9.5        114     5400      19

     highwaympg    price
200          28  16845.0
201          25  19045.0
202          23  21485.0
203          27  22470.0
204          25  22625.0

[5 rows x 26 columns]

d.head(15)

    car_ID  symboling                   CarName fueltype aspiration  \
0        1          3        alfa-romero giulia      gas        std
1        2          3       alfa-romero stelvio      gas        std
2        3          1  alfa-romero Quadrifoglio      gas        std
3        4          2               audi 100 ls      gas        std
4        5          2                audi 100ls      gas        std
5        6          2                  audi fox      gas        std
6        7          1                audi 100ls      gas        std
7        8          1                 audi 5000      gas        std
8        9          1                 audi 4000      gas      turbo
```

```
9       10           0       audi 5000s (diesel)      gas      turbo
10      11           2                  bmw 320i      gas        std
11      12           0                  bmw 320i      gas        std
12      13           0                    bmw x1      gas        std
13      14           0                    bmw x3      gas        std
14      15           1                    bmw z4      gas        std

   doornumber      carbody drivewheel enginelocation
wheelbase  ...  \
0          two  convertible        rwd          front       88.6  ...

1          two  convertible        rwd          front       88.6  ...

2          two    hatchback        rwd          front       94.5  ...

3         four        sedan        fwd          front       99.8  ...

4         four        sedan        4wd          front       99.4  ...

5          two        sedan        fwd          front       99.8  ...

6         four        sedan        fwd          front      105.8  ...

7         four        wagon        fwd          front      105.8  ...

8         four        sedan        fwd          front      105.8  ...

9          two    hatchback        4wd          front       99.5  ...

10         two        sedan        rwd          front      101.2  ...

11        four        sedan        rwd          front      101.2  ...

12         two        sedan        rwd          front      101.2  ...

13        four        sedan        rwd          front      101.2  ...

14        four        sedan        rwd          front      103.5  ...


    enginesize  fuelsystem  boreratio  stroke compressionratio
horsepower  \
0          130        mpfi       3.47    2.68              9.0
111
1          130        mpfi       3.47    2.68              9.0
111
2          152        mpfi       2.68    3.47              9.0
154
3          109        mpfi       3.19    3.40             10.0
102
4          136        mpfi       3.19    3.40              8.0
```

```
115
5          136         mpfi       3.19    3.40              8.5
110
6          136         mpfi       3.19    3.40              8.5
110
7          136         mpfi       3.19    3.40              8.5
110
8          131         mpfi       3.13    3.40              8.3
140
9          131         mpfi       3.13    3.40              7.0
160
10         108         mpfi       3.50    2.80              8.8
101
11         108         mpfi       3.50    2.80              8.8
101
12         164         mpfi       3.31    3.19              9.0
121
13         164         mpfi       3.31    3.19              9.0
121
14         164         mpfi       3.31    3.19              9.0
121

    peakrpm citympg  highwaympg      price
0      5000      21          27  13495.000
1      5000      21          27  16500.000
2      5000      19          26  16500.000
3      5500      24          30  13950.000
4      5500      18          22  17450.000
5      5500      19          25  15250.000
6      5500      19          25  17710.000
7      5500      19          25  18920.000
8      5500      17          20  23875.000
9      5500      16          22  17859.167
10     5800      23          29  16430.000
11     5800      23          29  16925.000
12     4250      21          28  20970.000
13     4250      21          28  21105.000
14     4250      20          25  24565.000

[15 rows x 26 columns]

d.tail(20)

     car_ID  symboling                   CarName fueltype
aspiration  \
185     186          2         volkswagen type 3      gas
std

186     187          2       volkswagen 411 (sw)      gas
std

187     188          2   volkswagen super beetle   diesel
turbo
```

```
188     189          2         volkswagen dasher      gas        std
189     190          3                vw dasher      gas        std
190     191          3                vw rabbit      gas        std
191     192          0         volkswagen rabbit      gas        std
192     193          0  volkswagen rabbit custom   diesel      turbo
193     194          0         volkswagen dasher      gas        std
194     195         -2           volvo 145e (sw)      gas        std
195     196         -1               volvo 144ea      gas        std
196     197         -2               volvo 244dl      gas        std
197     198         -1                 volvo 245      gas        std
198     199         -2               volvo 264gl      gas      turbo
199     200         -1              volvo diesel      gas      turbo
200     201         -1           volvo 145e (sw)      gas        std
201     202         -1               volvo 144ea      gas      turbo
202     203         -1               volvo 244dl      gas        std
203     204         -1                 volvo 246   diesel      turbo
204     205         -1               volvo 264gl      gas      turbo

    doornumber      carbody drivewheel enginelocation  wheelbase  ...
\
185       four        sedan        fwd          front       97.3  ...
186       four        sedan        fwd          front       97.3  ...
187       four        sedan        fwd          front       97.3  ...
188       four        sedan        fwd          front       97.3  ...
189        two  convertible        fwd          front       94.5  ...
190        two    hatchback        fwd          front       94.5  ...
191       four        sedan        fwd          front      100.4  ...
```

```
192        four        sedan         fwd           front       100.4  ...
193        four        wagon         fwd           front       100.4  ...
194        four        sedan         rwd           front       104.3  ...
195        four        wagon         rwd           front       104.3  ...
196        four        sedan         rwd           front       104.3  ...
197        four        wagon         rwd           front       104.3  ...
198        four        sedan         rwd           front       104.3  ...
199        four        wagon         rwd           front       104.3  ...
200        four        sedan         rwd           front       109.1  ...
201        four        sedan         rwd           front       109.1  ...
202        four        sedan         rwd           front       109.1  ...
203        four        sedan         rwd           front       109.1  ...
204        four        sedan         rwd           front       109.1  ...

     enginesize  fuelsystem  boreratio  stroke compressionratio
horsepower  \
185         109        mpfi       3.19    3.40              9.0
85
186         109        mpfi       3.19    3.40              9.0
85
187          97         idi       3.01    3.40             23.0
68
188         109        mpfi       3.19    3.40             10.0
100
189         109        mpfi       3.19    3.40              8.5
90
190         109        mpfi       3.19    3.40              8.5
90
191         136        mpfi       3.19    3.40              8.5
110
192          97         idi       3.01    3.40             23.0
68
193         109        mpfi       3.19    3.40              9.0
88
194         141        mpfi       3.78    3.15              9.5
114
195         141        mpfi       3.78    3.15              9.5
114
```

```
196         141        mpfi       3.78    3.15                9.5
114
197         141        mpfi       3.78    3.15                9.5
114
198         130        mpfi       3.62    3.15                7.5
162
199         130        mpfi       3.62    3.15                7.5
162
200         141        mpfi       3.78    3.15                9.5
114
201         141        mpfi       3.78    3.15                8.7
160
202         173        mpfi       3.58    2.87                8.8
134
203         145         idi       3.01    3.40               23.0
106
204         141        mpfi       3.78    3.15                9.5
114

     peakrpm citympg  highwaympg    price
185     5250      27          34   8195.0
186     5250      27          34   8495.0
187     4500      37          42   9495.0
188     5500      26          32   9995.0
189     5500      24          29  11595.0
190     5500      24          29   9980.0
191     5500      19          24  13295.0
192     4500      33          38  13845.0
193     5500      25          31  12290.0
194     5400      23          28  12940.0
195     5400      23          28  13415.0
196     5400      24          28  15985.0
197     5400      24          28  16515.0
198     5100      17          22  18420.0
199     5100      17          22  18950.0
200     5400      23          28  16845.0
201     5300      19          25  19045.0
202     5500      18          23  21485.0
203     4800      26          27  22470.0
204     5400      19          25  22625.0

[20 rows x 26 columns]

d.isna()

     car_ID  symboling  CarName  fueltype  aspiration  doornumber
carbody  \
0     False      False    False     False       False       False
False
1     False      False    False     False       False       False
```

```
False
2     False       False    False     False       False       False
False
3     False       False    False     False       False       False
False
4     False       False    False     False       False       False
False
..      ...         ...      ...       ...         ...         ...
...
200   False       False    False     False       False       False
False
201   False       False    False     False       False       False
False
202   False       False    False     False       False       False
False
203   False       False    False     False       False       False
False
204   False       False    False     False       False       False
False

     drivewheel  enginelocation  wheelbase  ...  enginesize
fuelsystem  \
0         False           False      False  ...       False
False
1         False           False      False  ...       False
False
2         False           False      False  ...       False
False
3         False           False      False  ...       False
False
4         False           False      False  ...       False
False
..          ...             ...        ...  ...         ...          ..
.
200       False           False      False  ...       False
False
201       False           False      False  ...       False
False
202       False           False      False  ...       False
False
203       False           False      False  ...       False
False
204       False           False      False  ...       False
False

     boreratio  stroke  compressionratio  horsepower  peakrpm  citympg
\
0        False   False             False       False    False    False

1        False   False             False       False    False    False
```

```
2        False   False             False       False    False    False

3        False   False             False       False    False    False

4        False   False             False       False    False    False

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

200      False   False             False       False    False    False

201      False   False             False       False    False    False

202      False   False             False       False    False    False

203      False   False             False       False    False    False

204      False   False             False       False    False    False


     highwaympg  price
0         False  False
1         False  False
2         False  False
3         False  False
4         False  False
..          ...    ...
200       False  False
201       False  False
202       False  False
203       False  False
204       False  False

[205 rows x 26 columns]
```

```
d.isna().sum()
```

```
car_ID              0
symboling           0
CarName             0
fueltype            0
aspiration          0
doornumber          0
carbody             0
drivewheel          0
enginelocation      0
wheelbase           0
carlength           0
carwidth            0
carheight           0
curbweight          0
```

```
enginetype          0
cylindernumber      0
enginesize          0
fuelsystem          0
boreratio           0
stroke              0
compressionratio    0
horsepower          0
peakrpm             0
citympg             0
highwaympg          0
price               0
dtype: int64
```

```
d.dtypes
```

```
car_ID                int64
symboling             int64
CarName              object
fueltype             object
aspiration           object
doornumber           object
carbody              object
drivewheel           object
enginelocation       object
wheelbase           float64
carlength           float64
carwidth            float64
carheight           float64
curbweight            int64
enginetype           object
cylindernumber       object
enginesize            int64
fuelsystem           object
boreratio           float64
stroke              float64
compressionratio    float64
horsepower            int64
peakrpm               int64
citympg               int64
highwaympg            int64
price               float64
dtype: object
```

```
(d==0).sum()
```

```
car_ID               0
symboling           67
CarName              0
fueltype             0
```

```
aspiration            0
doornumber            0
carbody               0
drivewheel            0
enginelocation        0
wheelbase             0
carlength             0
carwidth              0
carheight             0
curbweight            0
enginetype            0
cylindernumber        0
enginesize            0
fuelsystem            0
boreratio             0
stroke                0
compressionratio      0
horsepower            0
peakrpm               0
citympg               0
highwaympg            0
price                 0
dtype: int64
```

```
d.mean(numeric_only=True)
```

```
car_ID                103.000000
symboling               0.834146
wheelbase              98.756585
carlength             174.049268
carwidth               65.907805
carheight              53.724878
curbweight           2555.565854
enginesize            126.907317
boreratio               3.329756
stroke                  3.255415
compressionratio       10.142537
horsepower            104.117073
peakrpm              5125.121951
citympg                25.219512
highwaympg             30.751220
price               13276.710571
dtype: float64
```

```
d.mean(numeric_only=True).sum()
```

```
21757.393887804876
```

```
import numpy as np
```

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

```
x=d[["car_ID","symboling","CarName","fueltype","aspiration","doornumber","carbody","drivewheel","enginelocation","wheelbase","carlength","carwidth","carheight","curbweight","enginetype","cylindernumber","enginesize","fuelsystem","boreratio","stroke","compressionratio","horsepower","peakrpm","citympg","highwaympg"]]

y=d[["price"]]

x
```

```
     car_ID  symboling                   CarName fueltype
aspiration  \
0         1          3        alfa-romero giulia      gas        std

1         2          3       alfa-romero stelvio      gas        std

2         3          1  alfa-romero Quadrifoglio      gas        std

3         4          2               audi 100 ls      gas        std

4         5          2                audi 100ls      gas        std

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

200     201         -1           volvo 145e (sw)      gas        std

201     202         -1               volvo 144ea      gas      turbo

202     203         -1               volvo 244dl      gas        std

203     204         -1                 volvo 246   diesel      turbo

204     205         -1               volvo 264gl      gas      turbo


    doornumber      carbody drivewheel enginelocation  wheelbase  ...
\
0          two  convertible        rwd          front       88.6  ...

1          two  convertible        rwd          front       88.6  ...

2          two    hatchback        rwd          front       94.5  ...

3         four        sedan        fwd          front       99.8  ...

4         four        sedan        4wd          front       99.4  ...

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

200       four        sedan        rwd          front      109.1  ...

201       four        sedan        rwd          front      109.1  ...
```

```
202       four         sedan         rwd           front       109.1  ...

203       four         sedan         rwd           front       109.1  ...

204       four         sedan         rwd           front       109.1  ...


     cylindernumber  enginesize  fuelsystem  boreratio stroke  \
0              four         130        mpfi       3.47   2.68
1              four         130        mpfi       3.47   2.68
2               six         152        mpfi       2.68   3.47
3              four         109        mpfi       3.19   3.40
4              five         136        mpfi       3.19   3.40
..              ...         ...         ...        ...    ...
200            four         141        mpfi       3.78   3.15
201            four         141        mpfi       3.78   3.15
202             six         173        mpfi       3.58   2.87
203             six         145         idi       3.01   3.40
204            four         141        mpfi       3.78   3.15

    compressionratio  horsepower peakrpm  citympg  highwaympg
0                9.0         111    5000       21          27
1                9.0         111    5000       21          27
2                9.0         154    5000       19          26
3               10.0         102    5500       24          30
4                8.0         115    5500       18          22
..               ...         ...     ...      ...         ...
200              9.5         114    5400       23          28
201              8.7         160    5300       19          25
202              8.8         134    5500       18          23
203             23.0         106    4800       26          27
204              9.5         114    5400       19          25

[205 rows x 25 columns]

y

       price
0    13495.0
1    16500.0
2    16500.0
3    13950.0
4    17450.0
..       ...
200  16845.0
201  19045.0
202  21485.0
203  22470.0
204  22625.0
```

```
[205 rows x 1 columns]
```

```
x_train,x_test,y_train,y_test=train_test_split(x,y,random_state=0,test
_size=0.25)
```

```
x_train
```

```
     car_ID  symboling                   CarName fueltype
aspiration  \
163     164          1   toyota corolla liftback      gas        std

61       62          1          mazda glc custom      gas        std

75       76          1            mercury cougar      gas      turbo

106     107          1            nissan clipper      gas        std

63       64          0          mazda glc deluxe   diesel        std

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

67       68         -1  buick electra 225 custom   diesel      turbo

192     193          0  volkswagen rabbit custom   diesel      turbo

117     118          0             peugeot 604sl      gas      turbo

47       48          0                 jaguar xj      gas        std

172     173          2           toyota cressida      gas        std


    doornumber      carbody drivewheel enginelocation  wheelbase  ...
\
163        two        sedan        rwd          front       94.5  ...

61         two    hatchback        fwd          front       98.8  ...

75         two    hatchback        rwd          front      102.7  ...

106        two    hatchback        rwd          front       99.2  ...

63        four        sedan        fwd          front       98.8  ...

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

67        four        sedan        rwd          front      110.0  ...

192       four        sedan        fwd          front      100.4  ...

117       four        sedan        rwd          front      108.0  ...
```

```
47         four         sedan         rwd           front       113.0  ...
172         two   convertible         rwd           front        98.4  ...


     cylindernumber  enginesize  fuelsystem  boreratio stroke  \
163            four          98        2bbl       3.19   3.03
61             four         122        2bbl       3.39   3.39
75             four         140        mpfi       3.78   3.12
106             six         181        mpfi       3.43   3.27
63             four         122         idi       3.39   3.39
..              ...         ...         ...        ...    ...
67             five         183         idi       3.58   3.64
192            four          97         idi       3.01   3.40
117            four         134        mpfi       3.61   3.21
47              six         258        mpfi       3.63   4.17
172            four         146        mpfi       3.62   3.50

    compressionratio  horsepower  peakrpm  citympg  highwaympg
163              9.0          70     4800       29          34
61               8.6          84     4800       26          32
75               8.0         175     5000       19          24
106              9.0         160     5200       19          25
63              22.7          64     4650       36          42
..               ...         ...      ...      ...         ...
67              21.5         123     4350       22          25
192             23.0          68     4500       33          38
117              7.0         142     5600       18          24
47               8.1         176     4750       15          19
172              9.3         116     4800       24          30

[153 rows x 25 columns]

y_train

       price
163   8058.0
61   10595.0
75   16503.0
106  18399.0
63   10795.0
..       ...
67   25552.0
192  13845.0
117  18150.0
47   32250.0
172  17669.0

[153 rows x 1 columns]
```

```
x_test

     car_ID  symboling                          CarName fueltype
aspiration  \
52       53          1                mazda rx2 coupe      gas
std
181     182         -1                 toyouta tercel      gas
std
5         6          2                      audi fox      gas
std
18       19          2               chevrolet impala      gas
std
188     189          2              volkswagen dasher      gas
std
170     171          2                 toyota tercel      gas
std
76       77          2              mitsubishi mirage      gas
std
154     155          0      toyota corolla 1600 (sw)      gas
std
104     105          3                  nissan teana      gas
std
33       34          1              honda accord cvcc      gas
std
12       13          0                        bmw x1      gas
std
129     130          1                porsche cayenne      gas
std
55       56          3                     mazda 626      gas
std
66       67          0                 mazda rx-7 gs   diesel
std
45       46          0           isuzu D-Max V-Cross      gas
std
169     170          2                toyota starlet      gas
std
130     131          0                  renault 12tl      gas
std
7         8          1                     audi 5000      gas
std
37       38          0                  honda accord      gas
std
152     153          1            toyota corolla 1200      gas
std
80       81          3          mitsubishi mirage g4      gas
turbo
111     112          0                   peugeot 504      gas
std
131     132          2                  renault 5 gtl      gas
std
```

```
171     172           2                    toyota corolla      gas
std
179     180           3                     toyota corona      gas
std
138     139           2                            subaru      gas
std
156     157           0                    toyota mark ii      gas
std
113     114           0                       peugeot 504      gas
std
161     162           0                    toyota corolla      gas
std
89       90           1                      Nissan versa      gas
std
183     184           2     volkswagen 1131 deluxe sedan      gas
std
193     194           0                volkswagen dasher      gas
std
125     126           3                     porsche macan      gas
std
173     174          -1                    toyota corolla      gas
std
92       93           1                      nissan latio      gas
std
16       17           0                           bmw x5      gas
std
189     190           3                         vw dasher      gas
std
136     137           3                       saab 99gle      gas
turbo
22       23           1               dodge challenger se      gas
std
74       75           1  buick regal sport coupe (turbo)      gas
std
44       45           1                      isuzu D-Max       gas
std
4         5           2                        audi 100ls      gas
std
71       72          -1          buick opel isuzu deluxe      gas
std
134     135           3                         saab 99le      gas
std
145     146           0                        subaru r2       gas
turbo
122     123           1         plymouth fury gran sedan      gas
std
26       27           1                   dodge colt (sw)      gas
std
83       84           3                     mitsubishi g4      gas
```

```
turbo
149     150           0                        subaru dl      gas
turbo
186     187           2               volkswagen 411 (sw)      gas
std
8         9           1                        audi 4000      gas
turbo
90        91          1                      nissan gt-r   diesel
std

    doornumber       carbody drivewheel enginelocation  wheelbase  ...
\
52          two    hatchback        fwd           front       93.1  ...

181        four        wagon        rwd           front      104.5  ...

5           two        sedan        fwd           front       99.8  ...

18          two    hatchback        fwd           front       88.4  ...

188        four        sedan        fwd           front       97.3  ...

170         two      hardtop        rwd           front       98.4  ...

76          two    hatchback        fwd           front       93.7  ...

154        four        wagon        4wd           front       95.7  ...

104         two    hatchback        rwd           front       91.3  ...

33          two    hatchback        fwd           front       93.7  ...

12          two        sedan        rwd           front      101.2  ...

129         two    hatchback        rwd           front       98.4  ...

55          two    hatchback        rwd           front       95.3  ...

66         four        sedan        rwd           front      104.9  ...

45         four        sedan        fwd           front       94.5  ...

169         two    hatchback        rwd           front       98.4  ...

130        four        wagon        fwd           front       96.1  ...

7          four        wagon        fwd           front      105.8  ...

37          two    hatchback        fwd           front       96.5  ...

152        four    hatchback        fwd           front       95.7  ...
```

```
80          two    hatchback        fwd          front        96.3  ...
111        four        sedan        rwd          front       107.9  ...
131         two    hatchback        fwd          front        96.1  ...
171         two    hatchback        rwd          front        98.4  ...
179         two    hatchback        rwd          front       102.9  ...
138         two    hatchback        fwd          front        93.7  ...
156        four        sedan        fwd          front        95.7  ...
113        four        wagon        rwd          front       114.2  ...
161        four    hatchback        fwd          front        95.7  ...
89          two        sedan        fwd          front        94.5  ...
183         two        sedan        fwd          front        97.3  ...
193        four        wagon        fwd          front       100.4  ...
125         two    hatchback        rwd          front        94.5  ...
173        four        sedan        fwd          front       102.4  ...
92         four        sedan        fwd          front        94.5  ...
16          two        sedan        rwd          front       103.5  ...
189         two  convertible        fwd          front        94.5  ...
136         two    hatchback        fwd          front        99.1  ...
22          two    hatchback        fwd          front        93.7  ...
74          two      hardtop        rwd          front       112.0  ...
44          two        sedan        fwd          front        94.5  ...
4          four        sedan        4wd          front        99.4  ...
71         four        sedan        rwd          front       115.6  ...
134         two    hatchback        fwd          front        99.1  ...
145        four        sedan        4wd          front        97.0  ...
122        four        sedan        fwd          front        93.7  ...
```

```
26         four        sedan          fwd          front        93.7  ...

83          two    hatchback          fwd          front        95.9  ...

149        four        wagon          4wd          front        96.9  ...

186        four        sedan          fwd          front        97.3  ...

8          four        sedan          fwd          front       105.8  ...

90          two        sedan          fwd          front        94.5  ...


     cylindernumber  enginesize  fuelsystem  boreratio stroke  \
52             four          91        2bbl       3.03  3.150
181             six         161        mpfi       3.27  3.350
5              five         136        mpfi       3.19  3.400
18            three          61        2bbl       2.91  3.030
188            four         109        mpfi       3.19  3.400
170            four         146        mpfi       3.62  3.500
76             four          92        2bbl       2.97  3.230
154            four          92        2bbl       3.05  3.030
104             six         181        mpfi       3.43  3.270
33             four          92        1bbl       2.91  3.410
12              six         164        mpfi       3.31  3.190
129           eight         203        mpfi       3.94  3.110
55              two          70        4bbl       3.33  3.255
66             four         134         idi       3.43  3.640
45             four          90        2bbl       3.03  3.110
169            four         146        mpfi       3.62  3.500
130            four         132        mpfi       3.46  3.900
7              five         136        mpfi       3.19  3.400
37             four         110        1bbl       3.15  3.580
152            four          92        2bbl       3.05  3.030
80             four         110        spdi       3.17  3.460
111            four         120        mpfi       3.46  2.190
131            four         132        mpfi       3.46  3.900
171            four         146        mpfi       3.62  3.500
179             six         171        mpfi       3.27  3.350
138            four          97        2bbl       3.62  2.360
156            four          98        2bbl       3.19  3.030
113            four         120        mpfi       3.46  2.190
161            four          98        2bbl       3.19  3.030
89             four          97        2bbl       3.15  3.290
183            four         109        mpfi       3.19  3.400
193            four         109        mpfi       3.19  3.400
125            four         151        mpfi       3.94  3.110
173            four         122        mpfi       3.31  3.540
92             four          97        2bbl       3.15  3.290
```

16	six	209	mpfi	3.62	3.390
189	four	109	mpfi	3.19	3.400
136	four	121	mpfi	3.54	3.070
22	four	90	2bbl	2.97	3.230
74	eight	304	mpfi	3.80	3.350
44	four	90	2bbl	3.03	3.110
4	five	136	mpfi	3.19	3.400
71	eight	234	mpfi	3.46	3.100
134	four	121	mpfi	2.54	2.070
145	four	108	mpfi	3.62	2.640
122	four	98	2bbl	2.97	3.230
26	four	90	2bbl	2.97	3.230
83	four	156	spdi	3.59	3.860
149	four	108	mpfi	3.62	2.640
186	four	109	mpfi	3.19	3.400
8	five	131	mpfi	3.13	3.400
90	four	103	idi	2.99	3.470

	compressionratio	horsepower	peakrpm	citympg	highwaympg
52	9.0	68	5000	31	38
181	9.2	156	5200	19	24
5	8.5	110	5500	19	25
18	9.5	48	5100	47	53
188	10.0	100	5500	26	32
170	9.3	116	4800	24	30
76	9.4	68	5500	37	41
154	9.0	62	4800	27	32
104	9.0	160	5200	19	25
33	9.2	76	6000	30	34
12	9.0	121	4250	21	28
129	10.0	288	5750	17	28
55	9.4	101	6000	17	23
66	22.0	72	4200	31	39
45	9.6	70	5400	38	43
169	9.3	116	4800	24	30
130	8.7	90	5100	23	31
7	8.5	110	5500	19	25
37	9.0	86	5800	27	33
152	9.0	62	4800	31	38
80	7.5	116	5500	23	30
111	8.4	95	5000	19	24
131	8.7	90	5100	23	31
171	9.3	116	4800	24	30
179	9.3	161	5200	19	24
138	9.0	69	4900	31	36
156	9.0	70	4800	30	37
113	8.4	95	5000	19	24
161	9.0	70	4800	28	34
89	9.4	69	5200	31	37

183	9.0	85	5250	27	34
193	9.0	88	5500	25	31
125	9.5	143	5500	19	27
173	8.7	92	4200	29	34
92	9.4	69	5200	31	37
16	8.0	182	5400	16	22
189	8.5	90	5500	24	29
136	9.0	160	5500	19	26
22	9.4	68	5500	31	38
74	8.0	184	4500	14	16
44	9.6	70	5400	38	43
4	8.0	115	5500	18	22
71	8.3	155	4750	16	18
134	9.3	110	5250	21	28
145	7.7	111	4800	24	29
122	9.4	68	5500	31	38
26	9.4	68	5500	31	38
83	7.0	145	5000	19	24
149	7.7	111	4800	23	23
186	9.0	85	5250	27	34
8	8.3	140	5500	17	20
90	21.9	55	4800	45	50

[52 rows x 25 columns]

y_test

	price
52	6795.0
181	15750.0
5	15250.0
18	5151.0
188	9995.0
170	11199.0
76	5389.0
154	7898.0
104	17199.0
33	6529.0
12	20970.0
129	31400.5
55	10945.0
66	18344.0
45	8916.5
169	9989.0
130	9295.0
7	18920.0
37	7895.0
152	6488.0
80	9959.0
111	15580.0

```
131   9895.0
171  11549.0
179  15998.0
138   5118.0
156   6938.0
113  16695.0
161   8358.0
89    5499.0
183   7975.0
193  12290.0
125  22018.0
173   8948.0
92    6849.0
16   41315.0
189  11595.0
136  18150.0
22    6377.0
74   45400.0
44    8916.5
4    17450.0
71   34184.0
134  15040.0
145  11259.0
122   7609.0
26    7609.0
83   14869.0
149  11694.0
186   8495.0
8    23875.0
90    7099.0
```

```
x_train.shape
```

```
(153, 25)
```

```
y_train.shape
```

```
(153, 1)
```

```
x_test.shape
```

```
(52, 25)
```

```
y_test.shape
```

```
(52, 1)
```

```
subset1=d[["car_ID",
"CarName","fueltype","drivewheel","wheelbase","carlength","curbweight"
,"stroke","horsepower","highwaympg"]]
```

```
subset1
```

```
     car_ID                   CarName fueltype drivewheel
wheelbase  \
0         1        alfa-romero giulia      gas        rwd        88.6

1         2       alfa-romero stelvio      gas        rwd        88.6

2         3  alfa-romero Quadrifoglio      gas        rwd        94.5

3         4               audi 100 ls      gas        fwd        99.8

4         5                audi 100ls      gas        4wd        99.4

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

200     201           volvo 145e (sw)      gas        rwd       109.1

201     202               volvo 144ea      gas        rwd       109.1

202     203               volvo 244dl      gas        rwd       109.1

203     204                 volvo 246   diesel        rwd       109.1

204     205               volvo 264gl      gas        rwd       109.1


     carlength  curbweight  stroke  horsepower  highwaympg
0        168.8        2548    2.68         111          27
1        168.8        2548    2.68         111          27
2        171.2        2823    3.47         154          26
3        176.6        2337    3.40         102          30
4        176.6        2824    3.40         115          22
..         ...         ...     ...         ...         ...
200      188.8        2952    3.15         114          28
201      188.8        3049    3.15         160          25
202      188.8        3012    2.87         134          23
203      188.8        3217    3.40         106          27
204      188.8        3062    3.15         114          25

[205 rows x 10 columns]
```

```
subset2=d.iloc[0:100,0:26]
```

```
subset2
```

```
    car_ID  symboling                   CarName fueltype aspiration  \
0        1          3        alfa-romero giulia      gas        std
1        2          3       alfa-romero stelvio      gas        std
2        3          1  alfa-romero Quadrifoglio      gas        std
3        4          2               audi 100 ls      gas        std
```

```
4        5          2                audi 100ls      gas         std
..     ...        ...                       ...      ...         ...
94      95          1              nissan leaf      gas         std
95      96          1              nissan juke      gas         std
96      97          1             nissan latio      gas         std
97      98          1              nissan note      gas         std
98      99          2            nissan clipper      gas         std

   doornumber      carbody drivewheel enginelocation
wheelbase  ...  \
0         two  convertible        rwd          front       88.6  ...

1         two  convertible        rwd          front       88.6  ...

2         two    hatchback        rwd          front       94.5  ...

3        four        sedan        fwd          front       99.8  ...

4        four        sedan        4wd          front       99.4  ...

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

94        two        sedan        fwd          front       94.5  ...

95        two    hatchback        fwd          front       94.5  ...

96       four        sedan        fwd          front       94.5  ...

97       four        wagon        fwd          front       94.5  ...

98        two      hardtop        fwd          front       95.1  ...


    cylindernumber  enginesize  fuelsystem  boreratio stroke
compressionratio  \
0             four         130        mpfi       3.47   2.68
9.0
1             four         130        mpfi       3.47   2.68
9.0
2              six         152        mpfi       2.68   3.47
9.0
3             four         109        mpfi       3.19   3.40
10.0
4             five         136        mpfi       3.19   3.40
8.0
..             ...         ...         ...        ...    ...
...
94            four          97        2bbl       3.15   3.29
9.4
95            four          97        2bbl       3.15   3.29
```

```
9.4
96            four          97        2bbl       3.15   3.29
9.4
97            four          97        2bbl       3.15   3.29
9.4
98            four          97        2bbl       3.15   3.29
9.4

    horsepower peakrpm  citympg  highwaympg
0          111    5000       21          27
1          111    5000       21          27
2          154    5000       19          26
3          102    5500       24          30
4          115    5500       18          22
..         ...     ...      ...         ...
94          69    5200       31          37
95          69    5200       31          37
96          69    5200       31          37
97          69    5200       31          37
98          69    5200       31          37

[99 rows x 25 columns]
```

```
subset3=d[["car_ID", "CarName","fueltype","drivewheel","wheelbase"]]

subset3
```

```
     car_ID                   CarName fueltype drivewheel  wheelbase
0         1       alfa-romero giulia      gas        rwd       88.6
1         2      alfa-romero stelvio      gas        rwd       88.6
2         3  alfa-romero Quadrifoglio      gas        rwd       94.5
3         4               audi 100 ls      gas        fwd       99.8
4         5                audi 100ls      gas        4wd       99.4
..      ...                       ...      ...        ...        ...
200     201          volvo 145e (sw)      gas        rwd      109.1
201     202              volvo 144ea      gas        rwd      109.1
202     203              volvo 244dl      gas        rwd      109.1
203     204                volvo 246   diesel        rwd      109.1
204     205              volvo 264gl      gas        rwd      109.1

[205 rows x 5 columns]
```

```
subset4=d[d["fueltype"]=="gas"]

subset4
```

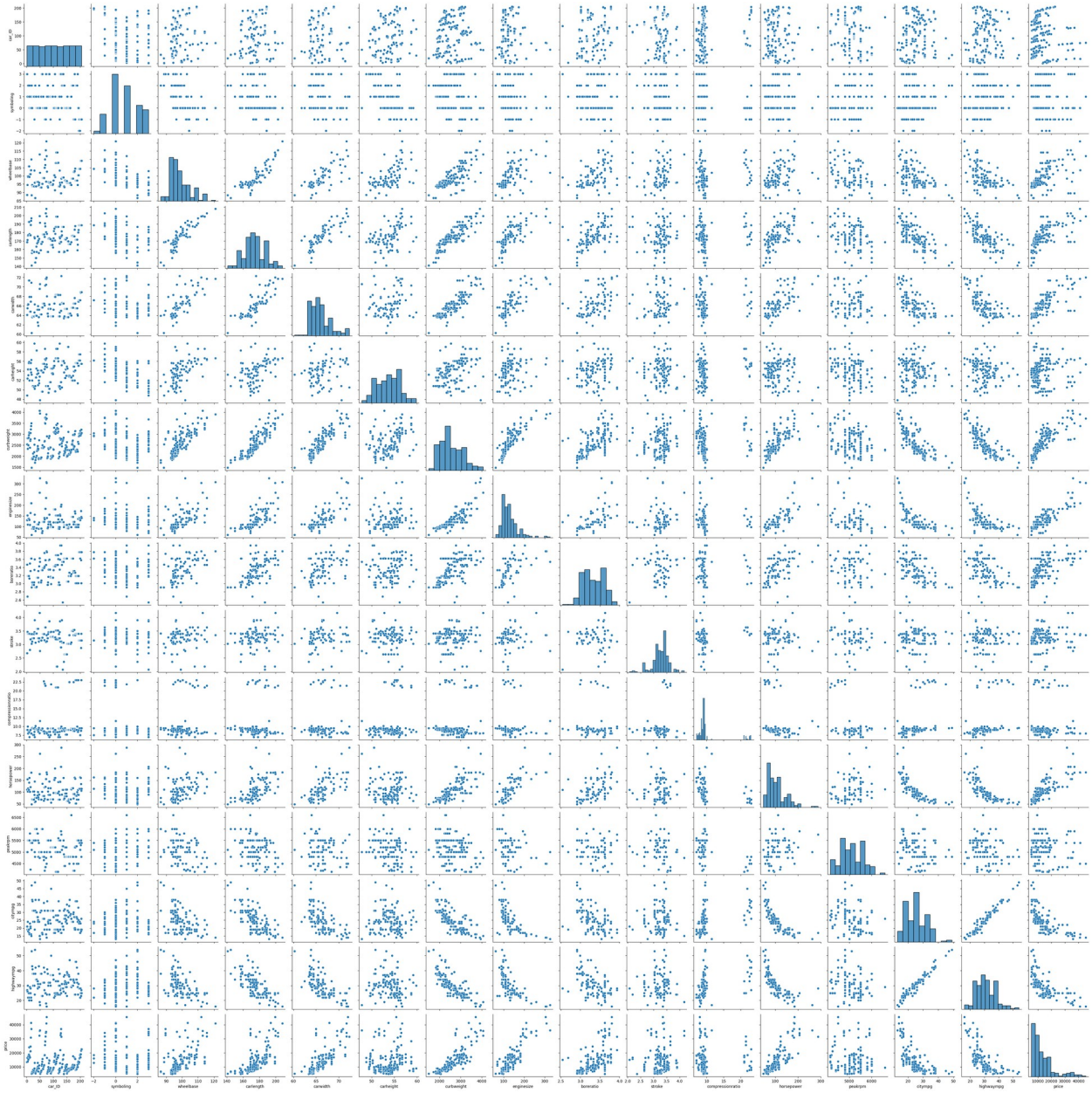
```
     car_ID  symboling                   CarName fueltype
aspiration  \
0         1          3       alfa-romero giulia      gas        std

1         2          3      alfa-romero stelvio      gas        std
```

```
2          3           1  alfa-romero Quadrifoglio      gas        std
3          4           2               audi 100 ls      gas        std
4          5           2                audi 100ls      gas        std
..       ...         ...                       ...      ...        ...
199      200          -1              volvo diesel      gas      turbo
200      201          -1           volvo 145e (sw)      gas        std
201      202          -1               volvo 144ea      gas      turbo
202      203          -1               volvo 244dl      gas        std
204      205          -1               volvo 264gl      gas      turbo

    doornumber      carbody drivewheel enginelocation  wheelbase  ...
\
0          two  convertible        rwd          front       88.6  ...
1          two  convertible        rwd          front       88.6  ...
2          two    hatchback        rwd          front       94.5  ...
3         four        sedan        fwd          front       99.8  ...
4         four        sedan        4wd          front       99.4  ...
..         ...          ...        ...            ...        ...  ...
199       four        wagon        rwd          front      104.3  ...
200       four        sedan        rwd          front      109.1  ...
201       four        sedan        rwd          front      109.1  ...
202       four        sedan        rwd          front      109.1  ...
204       four        sedan        rwd          front      109.1  ...

     enginesize  fuelsystem  boreratio  stroke compressionratio
horsepower  \
0           130        mpfi       3.47    2.68              9.0
111
1           130        mpfi       3.47    2.68              9.0
111
```

```
2            152         mpfi       2.68    3.47                9.0
154
3            109         mpfi       3.19    3.40               10.0
102
4            136         mpfi       3.19    3.40                8.0
115
..           ...          ...        ...     ...                ...
...
199          130         mpfi       3.62    3.15                7.5
162
200          141         mpfi       3.78    3.15                9.5
114
201          141         mpfi       3.78    3.15                8.7
160
202          173         mpfi       3.58    2.87                8.8
134
204          141         mpfi       3.78    3.15                9.5
114

     peakrpm citympg  highwaympg    price
0       5000      21          27  13495.0
1       5000      21          27  16500.0
2       5000      19          26  16500.0
3       5500      24          30  13950.0
4       5500      18          22  17450.0
..       ...     ...         ...      ...
199     5100      17          22  18950.0
200     5400      23          28  16845.0
201     5300      19          25  19045.0
202     5500      18          23  21485.0
204     5400      19          25  22625.0

[185 rows x 26 columns]
```

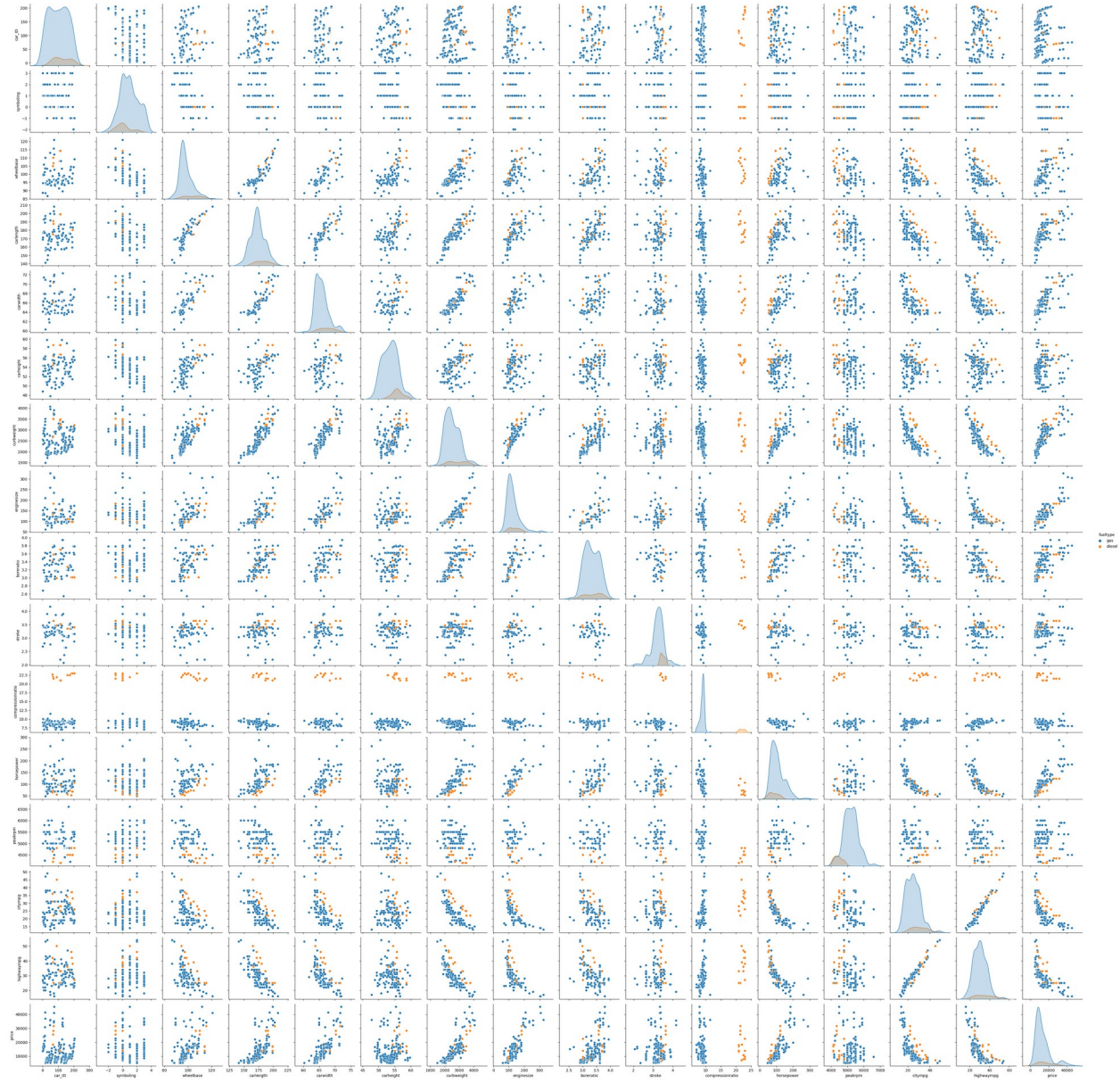
```
import matplotlib.pyplot as plot

import seaborn as sb

sb.pairplot(d)
```

```
<seaborn.axisgrid.PairGrid at 0x7f762eae3760>
```



```
sb.pairplot(d,hue="fueltype")
```

```
<seaborn.axisgrid.PairGrid at 0x7f7622d4e2e0>
```


car_ID
symboling
wheelbase
carlength
carwidth
carheight
curbweight
enginesize
boreratio
stroke
compressionratio
horsepower
peakrpm
citympg
highwaympg
price
fueltype
gas
diesel