DESCRIPTION Mtcars, an automobile company in Chambersburg, United States, has recorded the production of its cars within a dataset. The company is coming up with a new model based on the feedback given by its customers. It has to explore the current dataset to derive further insights from it. Objective: Import the dataset, explore for dimensionality, and type and average value of the horsepower across all the cars. Also, identify a few of mostly correlated features, which would help in modification.

In [1]:
```
import numpy,pandas
```

In [2]:
```
#Import the dataset
df = pandas.read_csv(r'C:\Users\ctoqu\Desktop\mtcars.csv', delimiter = ',')
hp = numpy.array(df['hp'])
model = numpy.array(df['model'])
mpg = numpy.array(df['mpg'])
cyl = numpy.array(df['cyl'])
print(df)
```

| | 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 |
| 10 | Merc 280C | 17.8 | 6 | 167.6 | 123 | 3.92 | 3.440 | 18.90 | 1 | 0 | 4 | 4 |
| 11 | Merc 450SE | 16.4 | 8 | 275.8 | 180 | 3.07 | 4.070 | 17.40 | 0 | 0 | 3 | 3 |
| 12 | Merc 450SL | 17.3 | 8 | 275.8 | 180 | 3.07 | 3.730 | 17.60 | 0 | 0 | 3 | 3 |
| 13 | Merc 450SLC | 15.2 | 8 | 275.8 | 180 | 3.07 | 3.780 | 18.00 | 0 | 0 | 3 | 3 |
| 14 | Cadillac Fleetwood | 10.4 | 8 | 472.0 | 205 | 2.93 | 5.250 | 17.98 | 0 | 0 | 3 | 4 |
| 15 | Lincoln Continental | 10.4 | 8 | 460.0 | 215 | 3.00 | 5.424 | 17.82 | 0 | 0 | 3 | 4 |
| 16 | Chrysler Imperial | 14.7 | 8 | 440.0 | 230 | 3.23 | 5.345 | 17.42 | 0 | 0 | 3 | 4 |
| 17 | Fiat 128 | 32.4 | 4 | 78.7 | 66 | 4.08 | 2.200 | 19.47 | 1 | 1 | 4 | 1 |
| 18 | Honda Civic | 30.4 | 4 | 75.7 | 52 | 4.93 | 1.615 | 18.52 | 1 | 1 | 4 | 2 |
| 19 | Toyota Corolla | 33.9 | 4 | 71.1 | 65 | 4.22 | 1.835 | 19.90 | 1 | 1 | 4 | 1 |
| 20 | Toyota Corona | 21.5 | 4 | 120.1 | 97 | 3.70 | 2.465 | 20.01 | 1 | 0 | 3 | 1 |
| 21 | Dodge Challenger | 15.5 | 8 | 318.0 | 150 | 2.76 | 3.520 | 16.87 | 0 | 0 | 3 | 2 |
| 22 | AMC Javelin | 15.2 | 8 | 304.0 | 150 | 3.15 | 3.435 | 17.30 | 0 | 0 | 3 | 2 |
| 23 | Camaro Z28 | 13.3 | 8 | 350.0 | 245 | 3.73 | 3.840 | 15.41 | 0 | 0 | 3 | 4 |
| 24 | Pontiac Firebird | 19.2 | 8 | 400.0 | 175 | 3.08 | 3.845 | 17.05 | 0 | 0 | 3 | 2 |
| 25 | Fiat X1-9 | 27.3 | 4 | 79.0 | 66 | 4.08 | 1.935 | 18.90 | 1 | 1 | 4 | 1 |
| 26 | Porsche 914-2 | 26.0 | 4 | 120.3 | 91 | 4.43 | 2.140 | 16.70 | 0 | 1 | 5 | 2 |
| 27 | Lotus Europa | 30.4 | 4 | 95.1 | 113 | 3.77 | 1.513 | 16.90 | 1 | 1 | 5 | 2 |
| 28 | Ford Pantera L | 15.8 | 8 | 351.0 | 264 | 4.22 | 3.170 | 14.50 | 0 | 1 | 5 | 4 |
| 29 | Ferrari Dino | 19.7 | 6 | 145.0 | 175 | 3.62 | 2.770 | 15.50 | 0 | 1 | 5 | 6 |
| 30 | Maserati Bora | 15.0 | 8 | 301.0 | 335 | 3.54 | 3.570 | 14.60 | 0 | 1 | 5 | 8 |
| 31 | Volvo 142E | 21.4 | 4 | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1 | 1 | 4 | 2 |

```
22     3     2
23     3     4
24     3     2
25     4     1
26     5     2
27     5     2
28     5     4
29     5     6
30     5     8
31     4     2
```

In [3]:
```
#explore for dimensionality
df.shape
```

Out[3]:
```
(32, 12)
```

In [4]:
```
type(df)
```

Out[4]:
```
pandas.core.frame.DataFrame
```

In [5]:
```
#type and average value of the horsepower??? iloc?
df.mean()
```

Out[5]:
```
mpg      20.090625
cyl       6.187500
disp    230.721875
hp      146.687500
drat      3.596563
wt        3.217250
qsec     17.848750
vs        0.437500
am        0.406250
gear      3.687500
carb      2.812500
dtype: float64
```

In [6]:
```
#type and average value of the horsepower using iloc
hponly = df.iloc[:,4]
print(hponly)
```

```
0     110
1     110
2      93
3     110
4     175
5     105
6     245
7      62
8      95
9     123
10    123
11    180
12    180
13    180
14    205
15    215
16    230
17     66
18     52
19     65
20     97
21    150
22    150
23    245
24    175
25     66
26     91
27    113
28    264
29    175
30    335
31    109
Name: hp, dtype: int64
```

In [7]:
```
df['hp'].mean()
```

Out[7]:
```
146.6875
```

Automobile Data Exploration II DESCRIPTION : Mtcars, the automobile company in the United States, has planned to rework on optimizing the horsepower of its cars as most of the customers' feedback was centred around horsepower. However, while developing an ML model with respect to horsepower, the efficiency of the model was compromised. Irregularity might be one of the causes. Objective: Check for missing values and outliers within the horsepower column and remove them.

In [8]:
```
df.describe()
```

Out[8]:

| | mpg | cyl | disp | hp | drat | wt | qsec | vs |
|---|---|---|---|---|---|---|---|---|
| **count** | 32.000000 | 32.000000 | 32.000000 | 32.000000 | 32.000000 | 32.000000 | 32.000000 | 32.000000 |
| **mean** | 20.090625 | 6.187500 | 230.721875 | 146.687500 | 3.596563 | 3.217250 | 17.848750 | 0.437500 |
| **std** | 6.026948 | 1.785922 | 123.938694 | 68.562868 | 0.534679 | 0.978457 | 1.786943 | 0.504016 |
| **min** | 10.400000 | 4.000000 | 71.100000 | 52.000000 | 2.760000 | 1.513000 | 14.500000 | 0.000000 |
| **25%** | 15.425000 | 4.000000 | 120.825000 | 96.500000 | 3.080000 | 2.581250 | 16.892500 | 0.000000 |
| **50%** | 19.200000 | 6.000000 | 196.300000 | 123.000000 | 3.695000 | 3.325000 | 17.710000 | 0.000000 |
| **75%** | 22.800000 | 8.000000 | 326.000000 | 180.000000 | 3.920000 | 3.610000 | 18.900000 | 1.000000 |
| **max** | 33.900000 | 8.000000 | 472.000000 | 335.000000 | 4.930000 | 5.424000 | 22.900000 | 1.000000 |

In [ ]:
```
Df =pd.DataFrame(data=np.c_[dataset['data'],dataset['target']], columns = dataset['feature_names'+'target'])
```

In [9]:
```
df['hp'].isna().any()
```

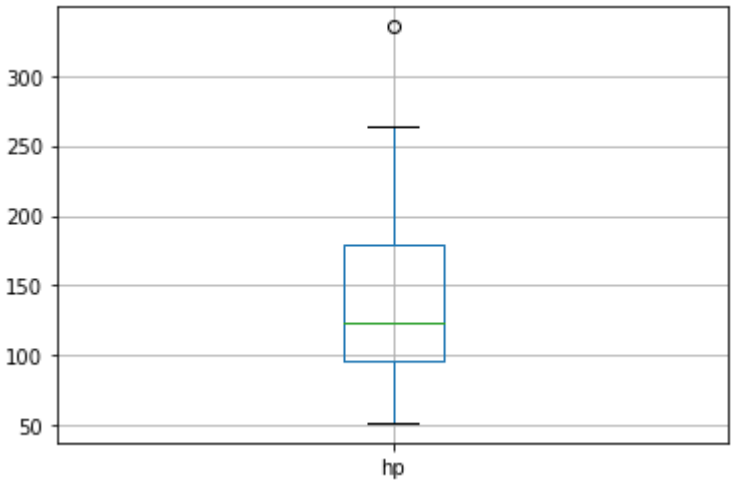
Out[9]:
```
False
```

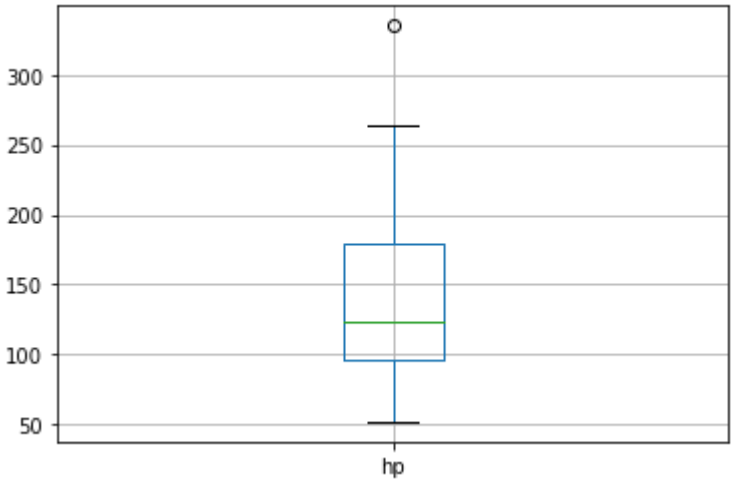
Automobile Data Exploration III Check for missing values and outliers within the horsepower column and remove them

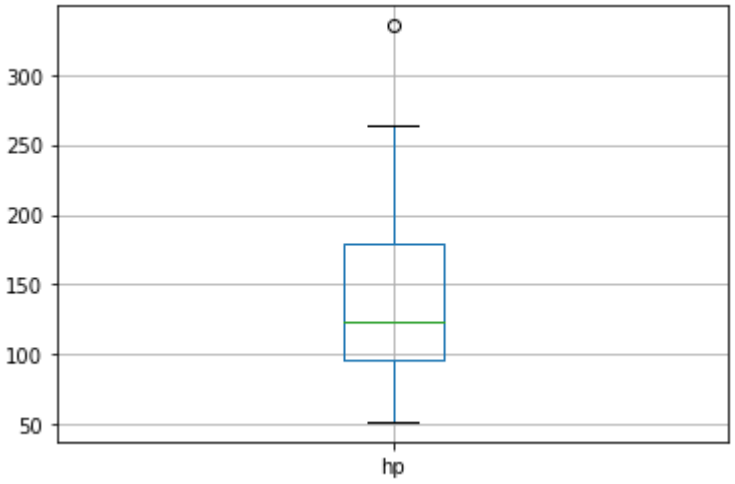
In [13]:
```
df.isnull().any()
```

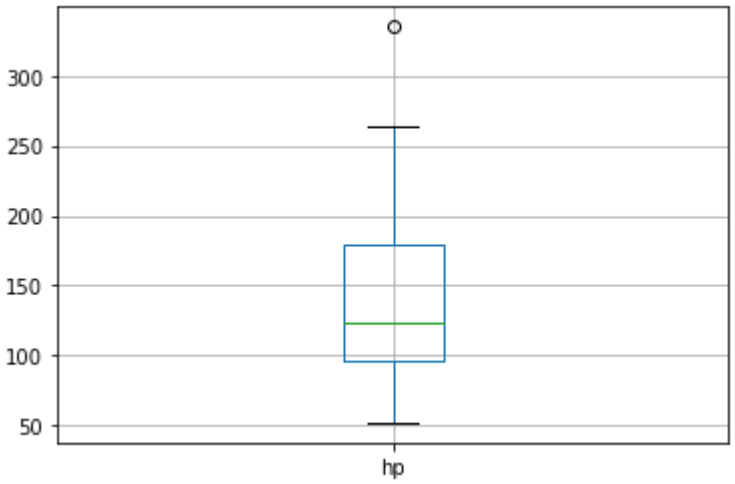
Out[13]:
```
model    False
mpg      False
cyl      False
disp     False
hp       False
drat     False
wt       False
qsec     False
vs       False
am       False
gear     False
carb     False
dtype: bool
```

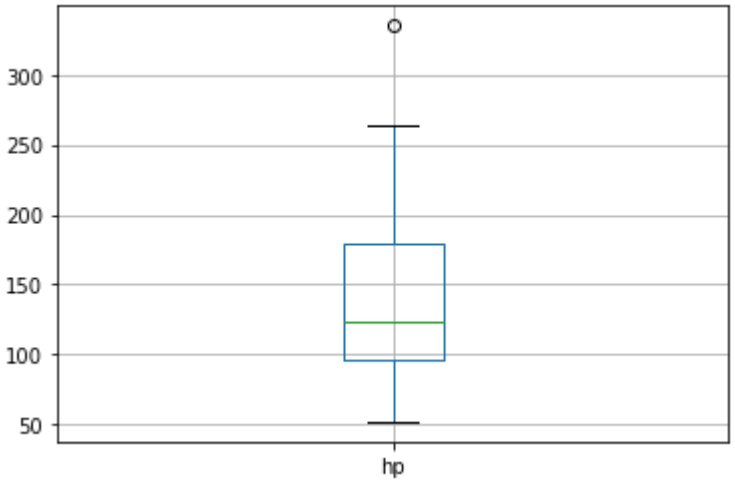
In [17]:
```
%matplotlib inline
import matplotlib.pyplot as plt

for column in df:
        plt.figure()
        df.boxplot(['hp'])
```

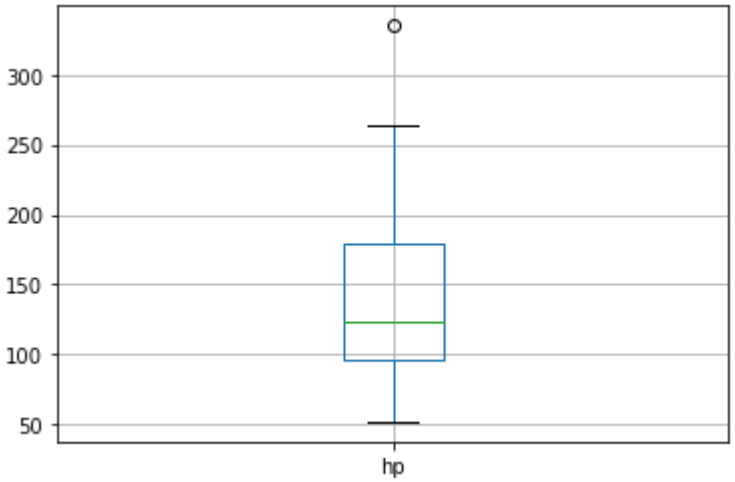

300
250
200
150
100
50
hp

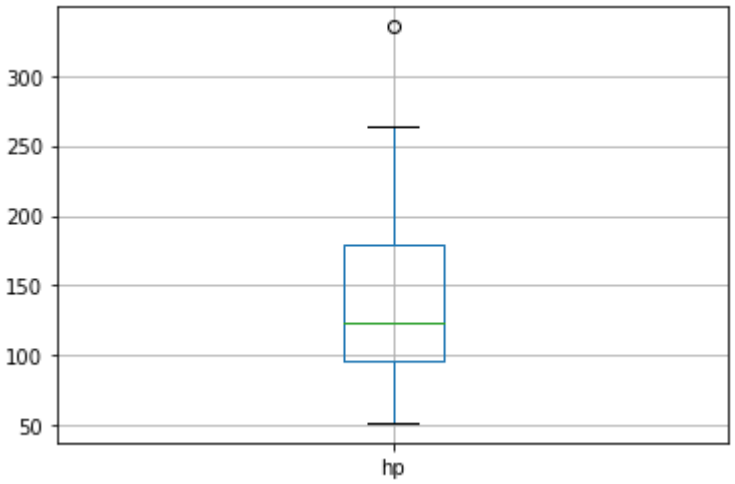

300
250
200
150
100
50
hp

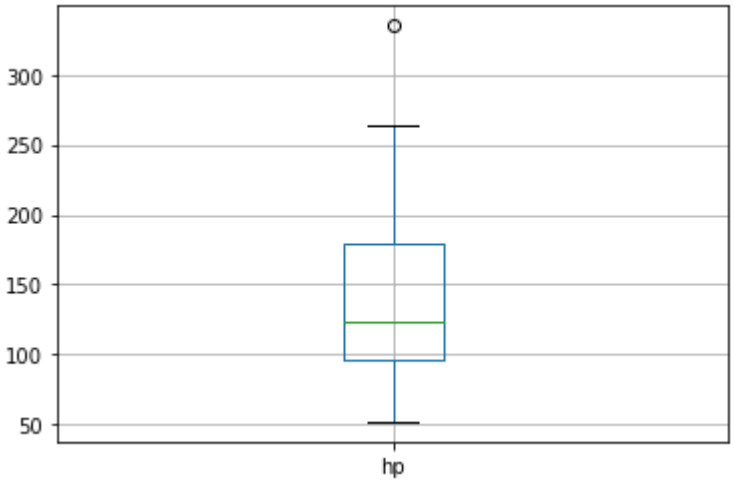

300
250
200
150
100
50
hp

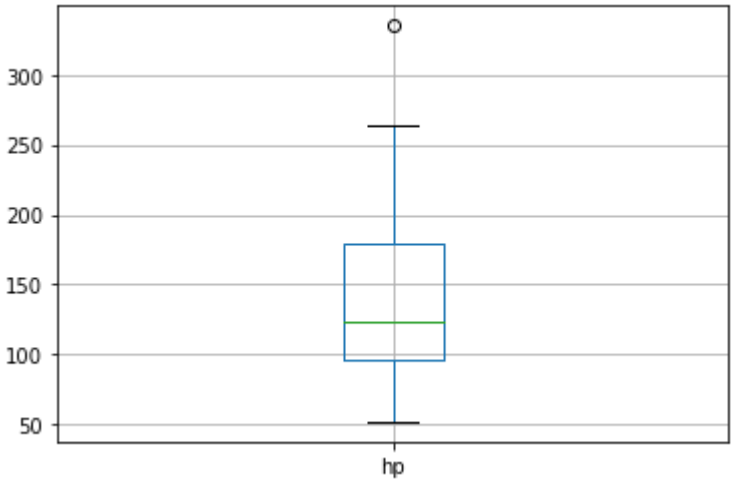

300
250
200
150
100
50
hp

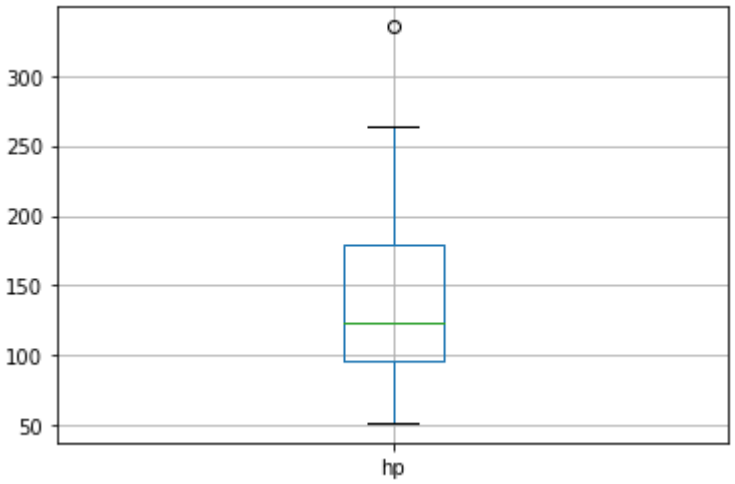

300
250
200
150
100
50
hp

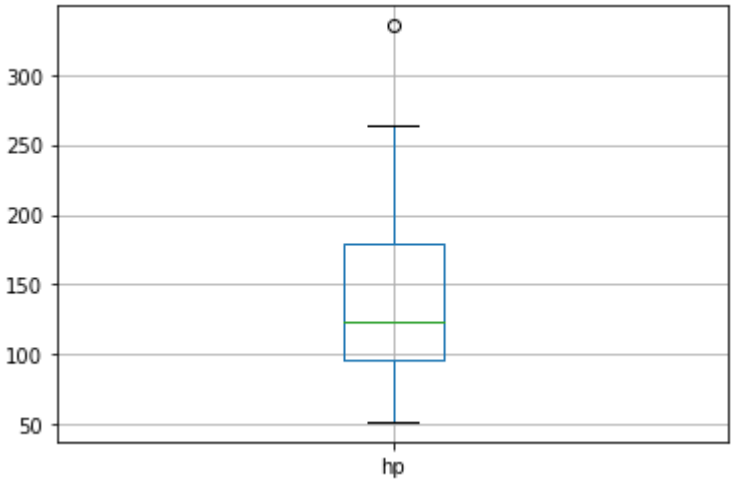

300
250
200
150
100
50
hp

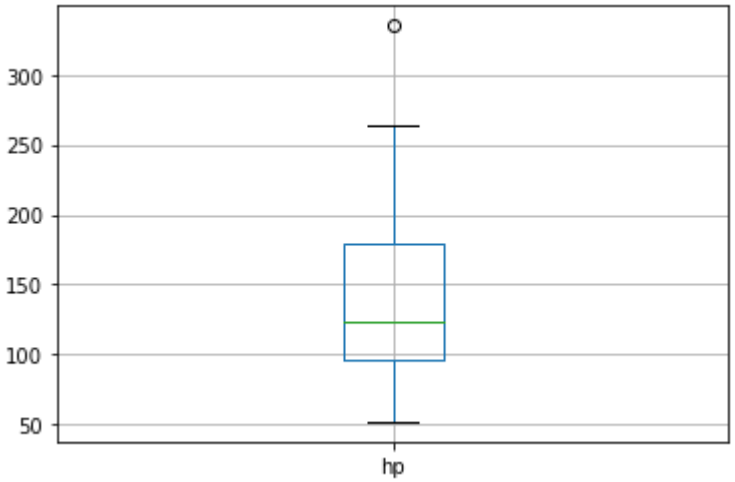

300
250
200
150
100
50
hp


300
250
200
150
100
50
hp


300
250
200
150
100
50
hp


300
250
200
150
100
50
hp


300
250
200
150
100
50
hp


300
250
200
150
100
50
hp

In [21]:
```
#Removing outliers
filter=df['hp'].values<250
df_outlier_rem=df[filter]
df_outlier_rem
```

Out[21]:

| | 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 |
| **10** | Merc 280C | 17.8 | 6 | 167.6 | 123 | 3.92 | 3.440 | 18.90 | 1 | 0 | 4 | 4 |
| **11** | Merc 450SE | 16.4 | 8 | 275.8 | 180 | 3.07 | 4.070 | 17.40 | 0 | 0 | 3 | 3 |
| **12** | Merc 450SL | 17.3 | 8 | 275.8 | 180 | 3.07 | 3.730 | 17.60 | 0 | 0 | 3 | 3 |
| **13** | Merc 450SLC | 15.2 | 8 | 275.8 | 180 | 3.07 | 3.780 | 18.00 | 0 | 0 | 3 | 3 |
| **14** | Cadillac Fleetwood | 10.4 | 8 | 472.0 | 205 | 2.93 | 5.250 | 17.98 | 0 | 0 | 3 | 4 |
| **15** | Lincoln Continental | 10.4 | 8 | 460.0 | 215 | 3.00 | 5.424 | 17.82 | 0 | 0 | 3 | 4 |
| **16** | Chrysler Imperial | 14.7 | 8 | 440.0 | 230 | 3.23 | 5.345 | 17.42 | 0 | 0 | 3 | 4 |
| **17** | Fiat 128 | 32.4 | 4 | 78.7 | 66 | 4.08 | 2.200 | 19.47 | 1 | 1 | 4 | 1 |
| **18** | Honda Civic | 30.4 | 4 | 75.7 | 52 | 4.93 | 1.615 | 18.52 | 1 | 1 | 4 | 2 |
| **19** | Toyota Corolla | 33.9 | 4 | 71.1 | 65 | 4.22 | 1.835 | 19.90 | 1 | 1 | 4 | 1 |
| **20** | Toyota Corona | 21.5 | 4 | 120.1 | 97 | 3.70 | 2.465 | 20.01 | 1 | 0 | 3 | 1 |
| **21** | Dodge Challenger | 15.5 | 8 | 318.0 | 150 | 2.76 | 3.520 | 16.87 | 0 | 0 | 3 | 2 |
| **22** | AMC Javelin | 15.2 | 8 | 304.0 | 150 | 3.15 | 3.435 | 17.30 | 0 | 0 | 3 | 2 |
| **23** | Camaro Z28 | 13.3 | 8 | 350.0 | 245 | 3.73 | 3.840 | 15.41 | 0 | 0 | 3 | 4 |
| **24** | Pontiac Firebird | 19.2 | 8 | 400.0 | 175 | 3.08 | 3.845 | 17.05 | 0 | 0 | 3 | 2 |
| **25** | Fiat X1-9 | 27.3 | 4 | 79.0 | 66 | 4.08 | 1.935 | 18.90 | 1 | 1 | 4 | 1 |
| **26** | Porsche 914-2 | 26.0 | 4 | 120.3 | 91 | 4.43 | 2.140 | 16.70 | 0 | 1 | 5 | 2 |
| **27** | Lotus Europa | 30.4 | 4 | 95.1 | 113 | 3.77 | 1.513 | 16.90 | 1 | 1 | 5 | 2 |
| **29** | Ferrari Dino | 19.7 | 6 | 145.0 | 175 | 3.62 | 2.770 | 15.50 | 0 | 1 | 5 | 6 |
| **31** | Volvo 142E | 21.4 | 4 | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1 | 1 | 4 | 2 |

In [ ]:
```
```