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#1
import pandas as pd
df1=pd.read_csv("https://archive.ics.uci.edu/ml/machine-learning-databases/autos/imports-85.data")
df1

∃		3	?	alfa-romero	gas	std	two	convertible	rwd	front	88.60	•••	130	mpfi	3.47	2.68	9.00	111	5000	21	27	13495
	0	3	?	alfa-romero	gas	std	two	convertible	rwd	front	88.6		130	mpfi	3.47	2.68	9.0	111	5000	21	27	16500
	1	1	?	alfa-romero	gas	std	two	hatchback	rwd	front	94.5		152	mpfi	2.68	3.47	9.0	154	5000	19	26	16500
	2	2	164	audi	gas	std	four	sedan	fwd	front	99.8		109	mpfi	3.19	3.40	10.0	102	5500	24	30	13950
	3	2	164	audi	gas	std	four	sedan	4wd	front	99.4		136	mpfi	3.19	3.40	8.0	115	5500	18	22	17450
	4	2	?	audi	gas	std	two	sedan	fwd	front	99.8		136	mpfi	3.19	3.40	8.5	110	5500	19	25	15250
	199	-1	95	volvo	gas	std	four	sedan	rwd	front	109.1		141	mpfi	3.78	3.15	9.5	114	5400	23	28	16845
	200	-1	95	volvo	gas	turbo	four	sedan	rwd	front	109.1		141	mpfi	3.78	3.15	8.7	160	5300	19	25	19045
	201	-1	95	volvo	gas	std	four	sedan	rwd	front	109.1		173	mpfi	3.58	2.87	8.8	134	5500	18	23	21485
	202	-1	95	volvo	diesel	turbo	four	sedan	rwd	front	109.1		145	idi	3.01	3.40	23.0	106	4800	26	27	22470
	203	-1	95	volvo	gas	turbo	four	sedan	rwd	front	109.1		141	mpfi	3.78	3.15	9.5	114	5400	19	25	22625
_																						

204 rows × 26 columns

	symboling	normalized-losses	make	fuel-type	aspiration
0	3	122.0	alfa-romero	gas	std
1	3	122.0	alfa-romero	gas	std
2	1	122.0	alfa-romero	gas	std
3	2	164.0	audi	gas	std
4	2	164.0	audi	gas	std
• •	• • •	• • •		• • •	
200	-1	95.0	volvo	gas	std
201	-1	95.0	volvo	gas	turbo
202	-1	95.0	volvo	gas	std
203	-1	95.0	volvo	diesel	turbo
204	-1	95.0	volvo	gas	turbo

	num-of-doors	body-style	drive-wheels	engine-location	wheel-base		\
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		
	engine-size	fuel-svstem	bore stroke	e compression-rat:	io horsepowe	r \	

						_	
	engine-size	fuel-system	bore	stroke	compression-ratio	horsepower	١
0	130	mpfi	3.47	2.68	9.0	111.0	
1	130	mpfi	3.47	2.68	9.0	111.0	
2	152	mpfi	2.68	3.47	9.0	154.0	
3	109	mpfi	3.19	3.40	10.0	102.0	
4	136	mpfi	3.19	3.40	8.0	115.0	
					• • •		
200	141	mpfi	3.78	3.15	9.5	114.0	
201	141	mpfi	3.78	3.15	8.7	160.0	
202	173	mpfi	3.58	2.87	8.8	134.0	

```
203
                  145
                               idi 3.01
                                            3.40
                                                               23.0
                                                                         106.0
     204
                  141
                              mpfi 3.78
                                            3.15
                                                                9.5
                                                                         114.0
          peak-rpm city-mpg
                             highway-mpg
                                            price
     0
            5000.0
                                          13495.0
                         21
                                      27
            5000.0
                                          16500.0
     1
                         21
                                      27
     2
            5000.0
                         19
                                      26
                                          16500.0
            5500.0
                                      30
                                          13950.0
     3
                         24
            5500.0
                                      22 17450.0
     4
                         18
     200
            5400.0
                         23
                                      28
                                          16845.0
                                          19045.0
     201
            5300.0
                         19
                                      25
     202
            5500.0
                         18
                                      23
                                          21485.0
     203
            4800.0
                         26
                                      27 22470.0
     204
            5400.0
                         19
                                      25 22625.0
     [205 rows x 26 columns]
import pandas as pd
print(df1.head())
        symboling normalized-losses
                                            make fuel-type aspiration num-of-doors \
                                    alfa-romero
                                                       gas
                                                                   std
                                                                                two
                3
     1
                3
                                    alfa-romero
                                                                   std
                                                                                two
     2
                1
                                     alfa-romero
                                                       gas
                                                                   std
     3
                2
                                164
                                            audi
                                                       gas
                                                                   std
                                                                               four
                2
                                164
     4
                                            audi
                                                        gas
                                                                   std
                                                                               four
         body-style drive-wheels engine-location wheel-base \dots engine-size \setminus
     0
        convertible
                                            front
                                                        88.6 ...
                                                                            130
                             rwd
     1
        convertible
                             rwd
                                            front
                                                         88.6
                                                                            130
          hatchback
                                            front
                                                         94.5 ...
                             rwd
                                                                            152
                                                         99.8 ...
                             fwd
                                            front
                                                                            109
     3
              sedan
     4
              sedan
                             4wd
                                            front
                                                         99.4
                                                                            136
        fuel-system bore stroke compression-ratio horsepower peak-rpm city-mpg \
               mpfi 3.47
     0
                             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
               mpfi 3.19
     3
                             3.40
                                               10.0
                                                            102
                                                                     5500
                                                                                24
     4
               mpfi 3.19
                             3.40
                                                8.0
                                                            115
                                                                     5500
                                                                                18
       highway-mpg price
                    13495
     a
                27
     1
                27
                    16500
                26 16500
     2
     3
                30 13950
     4
                22 17450
     [5 rows x 26 columns]
print(df1.head())
        symboling
                   normalized-losses
                                             make fuel-type aspiration
                                 NaN alfa-romero
                                                        gas
                                                                    std
                                 NaN
                                      alfa-romero
                3
                                                                    std
     1
                                                         gas
     2
                1
                                 NaN
                                      alfa-romero
                                                         gas
                                                                    std
                               164.0
     3
                                             audi
                                                        gas
                                                                    std
     4
                               164.0
                                             audi
                                                        gas
                                                                    std
       num-of-doors
                      body-style drive-wheels engine-location wheel-base ... \
     0
                two
                     convertible
                                          rwd
                                                        front
                                                                      88.6 ...
                     convertible
                                                         front
                                                                      88.6 ...
     1
                two
                                          rwd
                                                                      94.5 ...
                two
                       hatchback
                                          rwd
                                                         front
     3
               four
                           sedan
                                          fwd
                                                         front
                                                                      99.8
                                                         front
                                                                      99.4 ...
     4
               four
                           sedan
                                          4wd
        engine-size
                     fuel-system
                                 bore
                                        stroke compression-ratio horsepower \
     0
                            mpfi
                                  3.47
                                                             9.0
                130
                                          2.68
                                                                       111.0
                            mpfi
                                 3.47
                                                                       111.0
                130
                                          2.68
                                                             9.0
     1
     2
                152
                            mpfi
                                  2.68
                                          3.47
                                                             9.0
                                                                       154.0
                                                                       102.0
     3
                109
                            mpfi 3.19
                                          3.40
                                                             10.0
                136
                            mpfi 3.19
     4
                                          3.40
                                                             8.0
                                                                       115.0
        peak-rpm city-mpg
                           highway-mpg
     0
          5000.0
                       21
                                    27
                                        13495.0
     1
          5000.0
                       21
                                    27
                                       16500.0
          5000.0
                       19
                                    26 16500.0
```

#3

```
22 17450.0
          5500.0
     4
                       18
     [5 rows x 26 columns]
missing values = df1.isna()
print(missing_values)
          symboling normalized-losses
                                         make fuel-type aspiration num-of-doors \
              False
     0
                                   True False
                                                    False
                                                                 False
                                                                               False
     1
              False
                                   True
                                         False
                                                    False
                                                                 False
                                                                               False
     2
              False
                                   True
                                         False
                                                    False
                                                                 False
                                                                               False
                                  False
                                                    False
                                                                               False
     3
              False
                                         False
                                                                 False
     4
              False
                                  False
                                         False
                                                    False
                                                                 False
                                                                               False
                . . .
                                    . . .
                                                      . . .
                                                                  . . .
     200
              False
                                  False
                                         False
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                                                                 False
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     201
              False
                                  False
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     202
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     204
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              False
                                                    False
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                                                                               False
          body-style drive-wheels engine-location wheel-base \dots engine-size \setminus
                                                           False ...
     0
               False
                             False
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                                                            False ...
     1
               False
                              False
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     2
               False
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     3
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                                                            False ...
     200
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                              False
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     201
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     203
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                                               False
     204
                                                            False ...
               False
                              False
                                               False
                                                                              False
          fuel-system
                       bore
                              stroke compression-ratio
                                                           horsepower peak-rpm \
     0
                False
                       False
                                False
                                                   False
                                                                False
                                                                          False
     1
                False
                       False
                                False
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     2
                False
                       False
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     3
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     4
                False
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                                False
                                                   False
                                                                False
                                                                          False
     200
                False
                       False
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     201
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     203
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                False False
     204
                                False
                                                   False
                                                                False
                                                                          False
          city-mpg highway-mpg price
     0
             False
                          False
     1
             False
                          False
                                 False
     2
             False
                          False
                                 False
     3
             False
                          False
                                 False
     4
             False
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                                 False
               . . .
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                          False False
             False
     200
     201
             False
                          False
                                  False
     202
             False
                          False False
     203
             False
                          False False
     204
             False
                          False False
     [205 rows x 26 columns]
missing_counts = df1.isna().sum()
print(missing_counts)
     symboling
                           a
     normalized-losses
                           41
                           0
     make
     fuel-type
                           0
     aspiration
                            0
     num-of-doors
                            2
     body-style
                            0
     drive-wheels
                            0
     engine-location
                            0
     wheel-base
                           0
     length
                            0
     width
                           0
```

3

height

0

5500.0

24

30 13950.0

```
curb-weight
                              0
      engine-type
                              0
      num-of-cylinders
                              0
      engine-size
                              0
      fuel-system
                              0
     bore
                              4
      stroke
                              4
      compression-ratio
                              0
     horsepower
                              2
      peak-rpm
                              2
      city-mpg
                              0
                              0
      highway-mpg
      price
                              4
      dtype: int64
columns with missing values = df1.columns[df1.isna().any()].tolist()
print("Columns with at least one missing value:", columns_with_missing_values)
      Columns with at least one missing value: ['num-of-doors', 'bore', 'stroke', 'horsepower', 'peak-rpm', 'price']
#8
missing_indexes = df1[df1["normalized-losses"].isna()].index
print(missing_indexes)
      Int64Index([], dtype='int64')
print(df1.columns)
      Index(['symboling', 'normalized-losses', 'make', 'fuel-type', 'aspiration',
             'num-of-doors', 'body-style', 'drive-wheels', 'engine-location',
'wheel-base', 'length', 'width', 'height', 'curb-weight', 'engine-type',
'num-of-cylinders', 'engine-size', 'fuel-system', 'bore', 'stroke',
'compression-ratio', 'horsepower', 'peak-rpm', 'city-mpg',
              'highway-mpg', 'price'],
            dtype='object')
#9
mean_normalized_losses = df1["normalized-losses"].mean()
mean_stroke = df1["stroke"].mean()
mean_bore = df1["bore"].mean()
df1["normalized-losses"].fillna(mean_normalized_losses, inplace=True)
df1["stroke"].fillna
      <bound method Series.fillna of 0</pre>
                                                 2.68
     1
             2.68
             3.40
     3
     4
             3.40
             3.15
      200
      201
             3.15
      202
             2.87
      203
             3.40
      204
             3.15
      Name: stroke, Length: 201, dtype: float64>
mode_num_of_doors = df1["num-of-doors"].mode()[0]
df1["num-of-doors"].fillna(mode_num_of_doors, inplace=True)
print(df1)
           symboling normalized-losses
                                                     make fuel-type aspiration \
     0
                                     122.0 alfa-romero
                                                                  gas
     1
                    3
                                     122.0 alfa-romero
                                                                  gas
                                                                               std
                                     122.0 alfa-romero
     2
                    1
                                                                               std
                                                                  gas
     3
                    2
                                     164.0
                                                     audi
                                                                  gas
                                                                               std
      4
                    2
                                     164.0
                                                     audi
                                                                  gas
                                                                              std
                                                                  . . .
                                                                               . . .
      200
                   -1
                                      95.0
                                                    volvo
                                                                  gas
                                                                              std
      201
                   -1
                                      95.0
                                                    volvo
                                                                  gas
                                                                            turbo
      202
                   -1
                                      95.0
                                                    volvo
                                                                              std
                                                                  gas
                                      95.0
      203
                   -1
                                                    volvo
                                                              diesel
                                                                            turbo
      204
                   -1
                                      95.0
                                                    volvo
                                                                            turbo
                                                                  gas
```

```
body-style drive-wheels engine-location wheel-base ... \
         num-of-doors
     0
                  two
                        convertible
                                             rwd
                                                            front
                                                                         88.6 ...
                        convertible
     1
                  two
                                             rwd
                                                            front
                                                                         88.6
                                                                               . . .
     2
                         hatchback
                                                            front
                                                                         94.5 ...
                  two
                                             rwd
                                                                         99.8 ...
     3
                 four
                              sedan
                                             fwd
                                                            front
     4
                 four
                              sedan
                                             4wd
                                                            front
                                                                         99.4
                                                                              . . .
                  . . .
                               . . .
                                             . . .
                                                             . . .
                                                                               . . .
                                                            front
                 four
                                                                        109.1 ...
     200
                              sedan
                                             rwd
     201
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1
     202
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1 ...
                                                                        109.1 ...
     203
                 four
                              sedan
                                                            front
                                             rwd
     204
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1 ...
          engine-size
                       fuel-system bore stroke compression-ratio horsepower \
     0
                  130
                               mpfi 3.47
                                             2.68
                                                                 9.0
                                                                          111.0
     1
                  130
                               mpfi 3.47
                                             2.68
                                                                 9.0
                                                                          111.0
     2
                  152
                               mpfi
                                     2.68
                                             3.47
                                                                 9.0
                                                                          154.0
                               mpfi
                                             3.40
                                                                10.0
                                                                          102.0
     3
                  109
                                    3.19
     4
                  136
                               mpfi 3.19
                                             3.40
                                                                 8.0
                                                                          115.0
                  . . .
                               . . .
                                      . . .
     200
                               mpfi
                                     3.78
                                                                          114.0
                  141
                                             3.15
                                                                 9.5
     201
                  141
                               mpfi
                                     3.78
                                             3.15
                                                                 8.7
                                                                          160.0
     202
                  173
                               mpfi
                                     3.58
                                             2.87
                                                                 8.8
                                                                          134.0
                               idi 3.01
                                             3.40
                                                                23.0
                                                                          106.0
     203
                  145
     204
                  141
                               mpfi 3.78
                                             3.15
                                                                 9.5
                                                                          114.0
          peak-rpm city-mpg highway-mpg
                                             price
     0
            5000.0
                                           13495.0
                          21
                                       27
     1
            5000.0
                          21
                                       27
                                          16500.0
            5000.0
                                       26 16500.0
     2
                          19
            5500.0
                          24
                                       30
                                          13950.0
     3
            5500.0
                                       22 17450.0
     4
                         18
     200
            5400.0
                                          16845.0
                          23
                                       28
     201
            5300.0
                         19
                                       25 19045.0
     202
            5500.0
                          18
                                       23 21485.0
     203
            4800.0
                          26
                                       27
                                          22470.0
     204
            5400.0
                         19
                                       25 22625.0
     [201 rows x 26 columns]
#12
df1["horsepower"].fillna(method="ffill", inplace=True)
df1["peak-rpm"].fillna(method="ffill", inplace=True)
print(df1)
          symboling normalized-losses
                                                make fuel-type aspiration \
     0
                                  122.0 alfa-romero
                                                            gas
                  3
                                  122.0 alfa-romero
     1
                                                            gas
                                                                       std
     2
                  1
                                  122.0 alfa-romero
                                                            gas
                                                                       std
     3
                  2
                                  164.0
                                                audi
                                                            gas
                                                                       std
     4
                  2
                                  164.0
                                                audi
                                                            gas
                                                                       std
                                                 . . .
                                                            . . .
                                                                       . . .
     200
                 -1
                                   95.0
                                               volvo
                                                            gas
                                                                       std
                                   95.0
     201
                 -1
                                               volvo
                                                            gas
                                                                     turbo
     202
                 -1
                                   95.0
                                               volvo
                                                            gas
                                                                       std
                                                        diesel
     203
                 -1
                                   95.0
                                               volvo
                                                                     turbo
     204
                                   95.0
                                               volvo
                                                                     turbo
                                                            gas
                        body-style drive-wheels engine-location wheel-base ... \
         num-of-doors
                                                                         88.6 ...
     0
                  two
                        convertible
                                             rwd
                                                            front
     1
                  two
                        convertible
                                             rwd
                                                            front
                                                                         88.6
                                                                              . . .
                         hatchback
                                                            front
                                                                         94.5
     2
                  two
                                             rwd
                                                                              . . .
                                                                         99.8 ...
     3
                 four
                              sedan
                                             fwd
                                                            front
     4
                 four
                              sedan
                                             4wd
                                                            front
                                                                         99.4
                                                                               . . .
                  . . .
                               . . .
                                                             . . .
                                                                        109.1 ...
                                                            front
     200
                 four
                              sedan
                                             rwd
     201
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1
     202
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1 ...
                                                                        109.1 ...
                              sedan
                                                            front
     203
                 four
                                             rwd
     204
                 four
                              sedan
                                             rwd
                                                            front
                                                                        109.1 ...
                        fuel-system bore
                                           stroke compression-ratio horsepower \
          engine-size
     0
                  130
                              mpfi 3.47
                                             2.68
                                                                9.0
                                                                          111.0
                  130
                               mpfi
                                    3.47
                                             2.68
                                                                 9.0
                                                                          111.0
     2
                  152
                               mpfi
                                     2.68
                                             3.47
                                                                 9.0
                                                                          154.0
                               mpfi
     3
                  109
                                    3.19
                                             3.40
                                                                10.0
                                                                          102.0
     4
                  136
                               mpfi
                                    3.19
                                             3.40
                                                                 8.0
                                                                          115.0
                  . . .
                               . . .
                                     . . .
                                                                            . . .
                               mpfi
                                     3.78
                                                                          114.0
     200
                  141
                                             3.15
                                                                 9.5
```

201

141

mpfi 3.78

3.15

8.7

160.0

202	173		mpfi	3.58	2.87	8.8	134.0
203	145		idi	3.01	3.40	23.0	106.0
204	141		mpfi	3.78	3.15	9.5	114.0
	peak-rpm cit	y-mpg	highwa	y-mpg	price		
0	5000.0	21		27	13495.0		
1	5000.0	21		27	16500.0		
2	5000.0	19		26	16500.0		
3	5500.0	24		30	13950.0		
4	5500.0	18		22	17450.0		
200	5400.0	23		28	16845.0		
201	5300.0	19		25	19045.0		
202	5500.0	18		23	21485.0		
203	4800.0	26		27	22470.0		
204	5400.0	19		25	22625.0		
[201	rows x 26 cc	lumns]					

[201 10M3 X 20 COTAMM3]

#13
df1.dropna(subset=["price"], inplace=True)
print(df1)

	symboling	normalized-los	505	make	fuel-type	asniration	\
9	3			alfa-romero	gas	std	\
1	3			alfa-romero	gas	std	
2	1			alfa-romero	J	std	
3	2		4.0	aıra-romero	gas gas	std	
4	2		4.0	audi	gas	std	
		20					
200	-1	9	5.0	volvo	gas	std	
201	-1	9	5.0	volvo	gas	turbo	
202	-1	9	5.0	volvo	gas	std	
203	-1	9	5.0	volvo	diesel	turbo	
204	-1	9	5.0	volvo	gas	turbo	
	num-of-doors	body-style	drive	-wheels eng	ine-locatio	n wheel-bas	se
9	two			rwd	fron		.6
1	two			rwd	fron		
2	two			rwd	fron		
3	four	sedan		fwd	fron	t 99.	.8
4	four	sedan		4wd	fron	t 99	.4
200	four	sedan		rwd	fron	t 109	.1
201	four	sedan		rwd	fron	t 109	.1
202	four	sedan		rwd	fron	t 109	.1
203	four	sedan		rwd	fron	t 109	.1
204	four	sedan		rwd	fron	t 109	.1
	engine-size	fuel-system	bore	stroke co	mpression-r	atio horsepo	ower \
9	130		3.47		•		11.0
1	130	mpfi	3.47	2.68		9.0 13	11.0
2	152	mpfi	2.68	3.47		9.0 15	54.0
3	109	mpfi	3.19	3.40		10.0 10	02.0
4	136	mpfi	3.19				15.0
 200	 141		3.78			9.5	 14.0
201	141		3.78				50.0
202	173		3.58				34.0
203	145	•	3.01				36.0
204	141		3.78				14.0
	nook nom ci	ty mng bigbys	u mna	nnico			
a	peak-rpm ci 5000.0		ıy-ınpg 27				
∂ 1	5000.0	21 21	27				
2	5000.0	19	26				
2 3	5500.0	24	30				
4	5500.0	18	22				
200	5400.0	23	28				
201	5300.0	19	25				
202	5500.0	18	23	21485.0			
203	4800.0	26	27	22470.0			
203							

[201 rows x 26 columns]

```
#14
```

```
column_data_types = df1.dtypes
print(column_data_types)
```

```
symboling
                       int64
normalized-losses
                     float64
                      object
                      object
fuel-type
                      object
aspiration
num-of-doors
                      object
body-style
                      object
drive-wheels
                      object
engine-location
                      object
wheel-base
                     float64
length
                     float64
width
                     float64
height
                     float64
curb-weight
                       int64
engine-type
                      object
num-of-cylinders
                      object
engine-size
                       int64
fuel-system
                      object
                     float64
bore
stroke
                     float64
compression-ratio
                     float64
                     float64
horsepower
peak-rpm
                     float64
city-mpg
                       int64
highway-mpg
                       int64
                     float64
price
dtype: object
```

```
#15
df1["bore"] = df1["bore"].astype(float)
df1["stroke"] = df1["stroke"].astype(float)
column_data_types = df1.dtypes
print(column_data_types)
```

symboling int64 normalized-losses float64 make object fuel-type object object aspiration num-of-doors object body-style drive-wheels object engine-location object wheel-base float64 length float64 float64 width height float64 curb-weight int64 object engine-type num-of-cylinders object engine-size int64 fuel-system object bore float64 stroke float64 compression-ratio float64 horsepower float64 peak-rpm float64 city-mpg int64 highway-mpg int64 float64 price dtype: object

columns_to_normalize = ["length", "width", "height"]
for column in columns_to_normalize:

 $df1[column] = (df1[column] - df1[column].min()) / (df1[column].max() - df1[column].min()) \\ print(df1[columns_to_normalize])$

```
length width height
0 0.413433 0.324786 0.083333
1 0.413433 0.324786 0.083333
2 0.449254 0.444444 0.383333
3 0.529851 0.504274 0.541667
4 0.529851 0.521368 0.541667
```

200 0.711940 0.735043 0.641667 201 0.711940 0.726496 0.641667 202 0.711940 0.735043 0.641667 203 0.711940 0.735043 0.641667 204 0.711940 0.735043 0.641667

[201 rows x 3 columns]