Worksheet 6

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```
#Use the dataset mpg
library(ggplot2)
## Warning: package 'ggplot2' was built under R version 4.2.2
#to get the mpg dataset, load the ggplot package first
data(mpg)
as.data.frame(data(mpg)) #converting from list to data frame
##
           data(mpg)
## 1
#use of qlimpse() - much tidier compared to str()
library(dplyr) #glimpse() is a function under dplyr package
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##
               filter, lag
## The following objects are masked from 'package:base':
##
##
                intersect, setdiff, setequal, union
mpgdata <- glimpse(mpg)</pre>
## Rows: 234
## Columns: 11
## $ manufacturer <chr> "audi", "audi"
                                         <chr> "a4", "a4", "a4", "a4", "a4", "a4", "a4", "a4", "a4 quattro", "~
## $ model
                                         <dbl> 1.8, 1.8, 2.0, 2.0, 2.8, 2.8, 3.1, 1.8, 1.8, 2.0, 2.0, 2.~
## $ displ
## $ year
                                         <int> 1999, 1999, 2008, 2008, 1999, 1999, 2008, 1999, 1999, 200~
## $ cyl
                                         <int> 4, 4, 4, 4, 6, 6, 6, 4, 4, 4, 6, 6, 6, 6, 6, 6, 8, 8, ~
## $ trans
                                         <chr> "auto(15)", "manual(m5)", "manual(m6)", "auto(av)", "auto~
                                         ## $ drv
## $ cty
                                         <int> 18, 21, 20, 21, 16, 18, 18, 18, 16, 20, 19, 15, 17, 17, 1~
## $ hwy
                                         <int> 29, 29, 31, 30, 26, 26, 27, 26, 25, 28, 27, 25, 25, 25, 2~
## $ fl
                                         <chr> "compact", "compact", "compact", "compact", "c~
## $ class
```

##		manufacturer	model	displ	vear	cvl	trans	drv	ctv	hwy
##	1	audi	a4	-	1999	4	auto(15)	f	18	29
##	2	audi	a4		1999	4	manual(m5)	f	21	29
##	3	audi	a4		2008	4	manual(m6)	f	20	31
##	4	audi	a4	2.0	2008	4	auto(av)	f	21	30
##	5	audi	a4	2.8	1999	6	auto(15)	f	16	26
##	6	audi	a4		1999	6	manual(m5)	f	18	26
##	7	audi	a4	3.1	2008	6	auto(av)	f	18	27
##	8	audi	a4 quattro	1.8	1999	4	manual(m5)	4	18	26
##	9	audi	a4 quattro	1.8	1999	4	auto(15)	4	16	25
##	10	audi	a4 quattro		2008	4	manual(m6)	4	20	28
##	11	audi	a4 quattro		2008	4	auto(s6)	4	19	27
##	12	audi	a4 quattro		1999	6	auto(15)	4	15	25
##	13	audi	a4 quattro		1999	6	manual(m5)	4	17	25
##	14	audi	a4 quattro		2008	6	auto(s6)	4	17	25
##	15	audi	a4 quattro		2008	6	manual(m6)	4	15	25
##	16	audi	a6 quattro		1999	6	auto(15)	4	15	24
##	17	audi	a6 quattro		2008	6	auto(s6)	4	17	25
##	18	audi	a6 quattro		2008	8	auto(s6)	4	16	23
##	19	chevrolet	c1500 suburban 2wd		2008	8	auto(14)	r	14	20
##	20	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(14)	r	11	15
##	21	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(14)	r	14	20
##	22	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(14)	r	13	17
##	23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(14)	r	12	17
##	24	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16	26
##	25	chevrolet	corvette	5.7	1999	8	auto(14)	r	15	23
##	26	chevrolet	corvette	6.2	2008	8	manual(m6)	r	16	26
##	27	chevrolet	corvette	6.2	2008	8	auto(s6)	r	15	25
##	28	chevrolet	corvette	7.0	2008	8	manual(m6)	r	15	24
##	29	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(14)	4	14	19
##	30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(14)	4	11	14
##	31	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(14)	4	11	15
##	32	chevrolet	k1500 tahoe 4wd	6.5	1999	8	auto(14)	4	14	17
##	33	chevrolet	malibu	2.4	1999	4	auto(14)	f	19	27
##	34	chevrolet	malibu	2.4	2008	4	auto(14)	f	22	30
##	35	chevrolet	malibu	3.1	1999	6	auto(14)	f	18	26
##	36	chevrolet	malibu	3.5	2008	6	auto(14)	f	18	29
##	37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17	26
##	38	dodge	caravan 2wd	2.4	1999	4	auto(13)	f	18	24
##	39	dodge	caravan 2wd	3.0	1999	6	auto(14)	f	17	24
##	40	dodge	caravan 2wd		1999	6	auto(14)	f	16	22
##	41	dodge	caravan 2wd		1999	6	auto(14)	f	16	22
##	42	dodge	caravan 2wd		2008	6	auto(14)	f	17	24
##	43	dodge	caravan 2wd		2008	6	auto(14)	f	17	24
##		dodge	caravan 2wd		2008	6	auto(14)	f	11	17
##		dodge	caravan 2wd		1999	6	auto(14)	f	15	22
	46	dodge	caravan 2wd		1999	6	auto(14)	f	15	21
	47	dodge	caravan 2wd		2008	6	auto(16)	f	16	23
	48	dodge	caravan 2wd		2008	6	auto(16)	f	16	23
	49	dodge	dakota pickup 4wd		2008		manual(m6)	4	15	19
##	50	dodge	dakota pickup 4wd	3.7	2008	6	auto(14)	4	14	18

```
## 51
                dodge
                            dakota pickup 4wd
                                                   3.9 1999
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
##
  52
                                                   3.9 1999
                                                                                 4
                                                                                    14
                                                                                         17
                            dakota pickup 4wd
                                                               6 manual(m5)
                dodge
                            dakota pickup 4wd
                                                                    auto(15)
##
  53
                dodge
                                                   4.7 2008
                                                                                 4
                                                                                    14
                                                                                         19
##
   54
                            dakota pickup 4wd
                                                   4.7 2008
                                                                                 4
                                                                                    14
                                                                                         19
                dodge
                                                                8
                                                                    auto(15)
##
   55
                dodge
                            dakota pickup 4wd
                                                   4.7 2008
                                                               8
                                                                    auto(15)
                                                                                 4
                                                                                     9
                                                                                         12
   56
                                                   5.2 1999
                                                                                 4
                                                                                    11
##
                dodge
                            dakota pickup 4wd
                                                               8 manual(m5)
                                                                                         17
                                                   5.2 1999
##
   57
                dodge
                            dakota pickup 4wd
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
## 58
                dodge
                                   durango 4wd
                                                   3.9 1999
                                                               6
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
##
   59
                dodge
                                   durango 4wd
                                                   4.7 2008
                                                               8
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         17
                                                                                         12
##
   60
                dodge
                                   durango 4wd
                                                   4.7 2008
                                                                8
                                                                    auto(15)
                                                                                 4
                                                                                     9
##
   61
                                   durango 4wd
                                                   4.7 2008
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         17
                dodge
##
   62
                                                   5.2 1999
                                                                                         16
                dodge
                                   durango 4wd
                                                               8
                                                                    auto(14)
                                                                                 4
                                                                                    11
##
   63
                                   durango 4wd
                                                   5.7
                                                       2008
                                                               8
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         18
                dodge
                                   durango 4wd
##
   64
                dodge
                                                   5.9 1999
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
##
   65
                                                                                 4
                                                                                    12
                dodge
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                                8 manual(m6)
                                                                                         16
##
   66
                dodge
                          ram 1500 pickup 4wd
                                                   4.7
                                                       2008
                                                               8
                                                                    auto(15)
                                                                                 4
                                                                                     9
                                                                                         12
##
   67
                                                                                 4
                                                                                    13
                                                                                         17
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                               8
                                                                    auto(15)
                dodge
##
   68
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                                    auto(15)
                                                                                    13
                                                                                         17
                dodge
##
   69
                                                   4.7 2008
                                                                                    12
                                                                                         16
                          ram 1500 pickup 4wd
                                                                8 manual(m6)
                                                                                 4
                dodge
##
   70
                dodge
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                                8 manual(m6)
                                                                                 4
                                                                                     9
                                                                                         12
##
   71
                dodge
                          ram 1500 pickup 4wd
                                                   5.2 1999
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
##
   72
                          ram 1500 pickup 4wd
                                                   5.2 1999
                                                                8 manual(m5)
                                                                                 4
                                                                                    11
                                                                                         16
                dodge
  73
                                                   5.7 2008
                                                                                    13
##
                dodge
                          ram 1500 pickup 4wd
                                                               8
                                                                    auto(15)
                                                                                 4
                                                                                         17
   74
                                                   5.9 1999
##
                dodge
                          ram 1500 pickup 4wd
                                                               8
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
                                                   4.6 1999
##
   75
                 ford
                                expedition 2wd
                                                               8
                                                                    auto(14)
                                                                                 r
                                                                                    11
                                                                                         17
   76
                 ford
                                expedition 2wd
                                                   5.4 1999
                                                                8
                                                                    auto(14)
                                                                                r
                                                                                    11
                                                                                         17
##
   77
                                                   5.4 2008
                                                                                    12
                                                                                         18
                 ford
                                expedition 2wd
                                                                8
                                                                    auto(16)
                                                                                 r
##
   78
                 ford
                                  explorer 4wd
                                                   4.0 1999
                                                                6
                                                                    auto(15)
                                                                                 4
                                                                                    14
                                                                                         17
                                                   4.0 1999
##
   79
                                                                                 4
                                                                                    15
                                                                                         19
                 ford
                                  explorer 4wd
                                                                6 manual(m5)
##
   80
                                  explorer 4wd
                                                   4.0 1999
                                                                    auto(15)
                                                                                 4
                                                                                    14
                                                                                         17
                 ford
                                                                6
##
  81
                 ford
                                  explorer 4wd
                                                   4.0 2008
                                                               6
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         19
##
   82
                 ford
                                  explorer 4wd
                                                   4.6 2008
                                                               8
                                                                    auto(16)
                                                                                 4
                                                                                    13
                                                                                         19
##
   83
                 ford
                                  explorer 4wd
                                                   5.0 1999
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
##
   84
                                                                                         17
                              f150 pickup 4wd
                                                   4.2 1999
                                                                    auto(14)
                                                                                 4
                                                                                    14
                 ford
##
   85
                              f150 pickup 4wd
                                                   4.2 1999
                                                                6 manual(m5)
                                                                                 4
                                                                                    14
                                                                                         17
                 ford
                                                   4.6 1999
##
   86
                                                                                 4
                                                                                    13
                                                                                         16
                 ford
                              f150 pickup 4wd
                                                               8 manual(m5)
##
   87
                 ford
                              f150 pickup 4wd
                                                   4.6 1999
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         16
##
   88
                 ford
                              f150 pickup 4wd
                                                   4.6 2008
                                                               8
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
##
   89
                              f150 pickup 4wd
                                                   5.4 1999
                                                               8
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
                 ford
##
   90
                              f150 pickup 4wd
                                                   5.4 2008
                                                                                 4
                                                                                    13
                                                                                         17
                 ford
                                                                8
                                                                    auto(14)
##
   91
                                                                                         26
                 ford
                                       mustang
                                                   3.8 1999
                                                                6 manual(m5)
                                                                                r
                                                                                    18
##
  92
                                                   3.8 1999
                                                                                    18
                                                                                         25
                 ford
                                       mustang
                                                                6
                                                                    auto(14)
                                                                                 r
   93
##
                 ford
                                       mustang
                                                   4.0 2008
                                                                6 manual(m5)
                                                                                r
                                                                                    17
                                                                                         26
##
   94
                                                   4.0 2008
                                                                    auto(15)
                                                                                    16
                                                                                         24
                 ford
                                       mustang
                                                                                 r
##
   95
                 ford
                                       mustang
                                                   4.6 1999
                                                                    auto(14)
                                                                                    15
                                                                                         21
                                                                                 r
## 96
                                                   4.6 1999
                                                                8 manual(m5)
                                                                                    15
                                                                                         22
                 ford
                                       mustang
                                                                                 r
##
   97
                 ford
                                       mustang
                                                   4.6 2008
                                                                8 manual(m5)
                                                                                r
                                                                                    15
                                                                                         23
##
  98
                                                                                         22
                 ford
                                       mustang
                                                   4.6 2008
                                                                    auto(15)
                                                                                 r
                                                                                    15
##
   99
                 ford
                                       mustang
                                                   5.4 2008
                                                                8 manual(m6)
                                                                                    14
                                                                                         20
                                                                                r
##
   100
                honda
                                          civic
                                                   1.6 1999
                                                                4 manual(m5)
                                                                                 f
                                                                                    28
                                                                                         33
##
   101
                                                   1.6 1999
                                                                                 f
                                                                                    24
                                                                                         32
                honda
                                          civic
                                                                    auto(14)
                                                                                 f
                                                                                    25
## 102
                honda
                                          civic
                                                   1.6 1999
                                                                4 manual(m5)
                                                                                         32
## 103
               honda
                                          civic
                                                   1.6 1999
                                                                4 manual(m5)
                                                                                 f
                                                                                    23
                                                                                         29
## 104
                honda
                                          civic
                                                   1.6 1999
                                                                    auto(14)
                                                                                 f
                                                                                    24
                                                                                         32
```

```
## 105
                honda
                                          civic
                                                   1.8 2008
                                                                4 manual(m5)
                                                                                f
                                                                                    26
                                                                                        34
##
  106
                honda
                                                   1.8 2008
                                                                                f
                                                                                    25
                                                                                        36
                                          civic
                                                                    auto(15)
               honda
##
  107
                                          civic
                                                   1.8 2008
                                                                    auto(15)
                                                                                f
                                                                                    24
                                                                                        36
                                                   2.0 2008
                                                                                        29
##
   108
               honda
                                                                4 manual(m6)
                                                                                f
                                                                                    21
                                          civic
   109
             hyundai
                                         sonata
                                                   2.4 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
## 110
             hyundai
                                                   2.4 1999
                                                                4 manual(m5)
                                                                                f
                                                                                    18
                                                                                        27
                                         sonata
## 111
             hyundai
                                                   2.4 2008
                                                                    auto(14)
                                                                                f
                                                                                    21
                                         sonata
                                                                                        30
## 112
                                                   2.4 2008
                                                                                    21
             hyundai
                                         sonata
                                                                4 manual(m5)
                                                                                f
                                                                                        31
## 113
             hyundai
                                         sonata
                                                   2.5 1999
                                                                6
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
## 114
                                                   2.5 1999
                                                                                        26
             hyundai
                                         sonata
                                                                6 manual(m5)
                                                                                f
                                                                                    18
  115
             hyundai
                                         sonata
                                                   3.3 2008
                                                                    auto(15)
                                                                                f
                                                                                    19
                                                                                        28
                                                                                        26
##
   116
             hyundai
                                                   2.0 1999
                                                                                f
                                                                                    19
                                        tiburon
                                                                    auto(14)
##
   117
             hyundai
                                                   2.0 1999
                                                                4 manual(m5)
                                                                                f
                                                                                    19
                                                                                        29
                                        tiburon
                                                   2.0 2008
                                                                4 manual(m5)
                                                                                    20
## 118
             hyundai
                                        tiburon
                                                                                f
                                                                                        28
## 119
             hyundai
                                                   2.0 2008
                                                                    auto(14)
                                                                                f
                                                                                    20
                                                                                        27
                                        tiburon
## 120
             hyundai
                                        tiburon
                                                   2.7
                                                       2008
                                                                    auto(14)
                                                                                f
                                                                                    17
                                                                                        24
## 121
                                                   2.7 2008
                                                                                f
                                                                                        24
             hyundai
                                                                6 manual(m6)
                                                                                    16
                                        tiburon
##
  122
             hvundai
                                        tiburon
                                                   2.7 2008
                                                                6 manual(m5)
                                                                                f
                                                                                    17
                                                                                        24
##
  123
                                                   3.0 2008
                                                                                    17
                                                                                        22
                           grand cherokee 4wd
                                                                    auto(15)
                                                                                4
                 jeep
##
   124
                 jeep
                           grand cherokee 4wd
                                                   3.7 2008
                                                                    auto(15)
                                                                                4
                                                                                    15
                                                                                        19
##
   125
                           grand cherokee 4wd
                                                   4.0 1999
                                                                    auto(14)
                                                                                4
                                                                                    15
                                                                                        20
                 jeep
## 126
                           grand cherokee 4wd
                                                   4.7 1999
                                                                    auto(14)
                                                                                    14
                                                                                         17
                 jeep
## 127
                           grand cherokee 4wd
                                                   4.7 2008
                                                                    auto(15)
                                                                                4
                                                                                     9
                                                                                        12
                                                               8
                 jeep
                           grand cherokee 4wd
##
   128
                                                   4.7 2008
                                                                                4
                                                                                    14
                                                                                        19
                 jeep
                                                               8
                                                                    auto(15)
                                                                                    13
## 129
                                                                                4
                                                                                        18
                 jeep
                           grand cherokee 4wd
                                                   5.7 2008
                                                                8
                                                                    auto(15)
   130
                 jeep
                           grand cherokee 4wd
                                                   6.1 2008
                                                                8
                                                                    auto(15)
                                                                                4
                                                                                    11
                                                                                        14
##
   131
          land rover
                                                   4.0 1999
                                                                                4
                                                                                    11
                                                                                        15
                                   range rover
                                                               8
                                                                    auto(14)
   132
                                                                                    12
##
          land rover
                                   range rover
                                                   4.2
                                                       2008
                                                               8
                                                                    auto(s6)
                                                                                4
                                                                                        18
##
   133
                                                   4.4 2008
                                                                                4
                                                                                    12
                                                                                        18
          land rover
                                   range rover
                                                                8
                                                                    auto(s6)
  134
          land rover
                                                   4.6 1999
                                                                8
                                                                    auto(14)
                                                                                4
                                                                                    11
                                                                                        15
                                   range rover
##
  135
             lincoln
                                 navigator 2wd
                                                   5.4 1999
                                                               8
                                                                    auto(14)
                                                                                r
                                                                                    11
                                                                                        17
##
   136
             lincoln
                                 navigator 2wd
                                                   5.4 1999
                                                               8
                                                                    auto(14)
                                                                                    11
                                                                                        16
                                                                                r
   137
##
             lincoln
                                 navigator 2wd
                                                   5.4 2008
                                                                    auto(16)
                                                                                    12
                                                                                        18
                                                                                r
                                                                                    14
   138
                                                   4.0 1999
                                                                                        17
##
                              mountaineer 4wd
                                                                6
                                                                    auto(15)
                                                                                4
             mercury
##
   139
                              mountaineer 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    13
                                                                                        19
             mercury
##
   140
                                                   4.6 2008
                                                                    auto(16)
                                                                                4
                                                                                    13
                                                                                        19
             mercury
                              mountaineer 4wd
                                                               8
## 141
             mercury
                              mountaineer 4wd
                                                   5.0 1999
                                                                    auto(14)
                                                                                4
                                                                                    13
                                                                                        17
## 142
                                         altima
                                                   2.4 1999
                                                                4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        20
              nissan
##
  143
                                         altima
                                                   2.4 1999
                                                                    auto(14)
                                                                                f
                                                                                    19
                                                                                        27
              nissan
##
  144
                                         altima
                                                   2.5 2008
                                                                    auto(av)
                                                                                f
                                                                                    23
                                                                                        31
              nissan
   145
                                                   2.5 2008
                                                                4 manual(m6)
                                                                                    23
                                                                                        32
              nissan
                                         altima
                                                                                f
                                                                                    19
##
   146
                                         altima
                                                   3.5 2008
                                                                6 manual(m6)
                                                                                f
                                                                                        27
              nissan
                                                   3.5
                                                       2008
                                                                                    19
                                                                                        26
   147
              nissan
                                         altima
                                                                    auto(av)
                                                                                f
   148
                                                   3.0 1999
                                                                                    18
##
              nissan
                                         maxima
                                                                    auto(14)
                                                                                f
                                                                                        26
  149
                                                                                    19
              nissan
                                         maxima
                                                   3.0 1999
                                                                6 manual(m5)
                                                                                f
                                                                                        25
                                                                                f
## 150
                                                   3.5 2008
                                                                    auto(av)
                                                                                    19
                                                                                        25
              nissan
                                         maxima
                                                                6
##
   151
              nissan
                                pathfinder 4wd
                                                   3.3 1999
                                                                6
                                                                    auto(14)
                                                                                4
                                                                                    14
                                                                                        17
##
   152
                                                                                        17
              nissan
                                pathfinder 4wd
                                                   3.3 1999
                                                                6 manual(m5)
                                                                                4
                                                                                    15
##
   153
              nissan
                                pathfinder 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    14
                                                                                        20
                                                                                    12
##
   154
              nissan
                                pathfinder 4wd
                                                   5.6 2008
                                                                    auto(s5)
                                                                                4
                                                                                        18
##
   155
                                                                                f
                                                                                    18
                                                                                        26
             pontiac
                                    grand prix
                                                   3.1 1999
                                                                6
                                                                    auto(14)
## 156
                                                   3.8 1999
                                                                                f
             pontiac
                                    grand prix
                                                                    auto(14)
                                                                                    16
                                                                                        26
## 157
             pontiac
                                    grand prix
                                                   3.8 1999
                                                               6
                                                                    auto(14)
                                                                                f
                                                                                    17
                                                                                        27
## 158
             pontiac
                                    grand prix
                                                   3.8 2008
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        28
```

```
## 159
             pontiac
                                    grand prix
                                                   5.3 2008
                                                                    auto(s4)
                                                                                f
                                                                                    16
                                                                                        25
##
  160
                                  forester awd
                                                   2.5 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    18
                                                                                        25
              subaru
##
   161
              subaru
                                  forester awd
                                                   2.5 1999
                                                                    auto(14)
                                                                                4
                                                                                    18
                                                                                        24
                                                                                        27
##
   162
              subaru
                                  forester awd
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    20
##
   163
              subaru
                                  forester awd
                                                   2.5
                                                       2008
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        25
              subaru
                                  forester awd
                                                   2.5 2008
                                                                                4
                                                                                    20
                                                                                        26
##
   164
                                                                    auto(14)
              subaru
                                                   2.5 2008
##
  165
                                  forester awd
                                                                    auto(14)
                                                                                4
                                                                                    18
                                                                                        23
                                                                                    21
## 166
              subaru
                                   impreza awd
                                                   2.2 1999
                                                                    auto(14)
                                                                                4
                                                                                        26
##
   167
              subaru
                                   impreza awd
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        26
                                                                                        26
##
   168
              subaru
                                   impreza awd
                                                   2.5 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    19
##
   169
              subaru
                                   impreza awd
                                                   2.5 1999
                                                                    auto(14)
                                                                                4
                                                                                    19
                                                                                        26
                                                                                    20
                                                                                        25
##
   170
                                                   2.5
                                                       2008
              subaru
                                   impreza awd
                                                                    auto(s4)
                                                                                4
##
   171
              subaru
                                                   2.5 2008
                                                                    auto(s4)
                                                                                4
                                                                                    20
                                                                                        27
                                   impreza awd
  172
##
              subaru
                                   impreza awd
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        25
## 173
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    20
                                                                                        27
              subaru
                                   impreza awd
## 174
              toyota
                                   4runner 4wd
                                                   2.7 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    15
                                                                                        20
  175
                                                                                4
                                                                                        20
##
                                   4runner 4wd
                                                   2.7 1999
                                                                    auto(14)
                                                                                    16
              toyota
##
   176
                                   4runner 4wd
                                                   3.4 1999
                                                                    auto(14)
                                                                                    15
                                                                                        19
              toyota
  177
                                   4runner 4wd
                                                   3.4 1999
                                                                                    15
                                                                                        17
##
                                                               6 manual(m5)
                                                                                4
              toyota
##
   178
              toyota
                                   4runner 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    16
                                                                                        20
##
   179
              toyota
                                   4runner 4wd
                                                   4.7 2008
                                                               8
                                                                    auto(15)
                                                                                4
                                                                                    14
                                                                                        17
##
  180
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        29
              toyota
                                          camry
## 181
                                                   2.2 1999
                                                                                    21
                                                                                        27
              toyota
                                          camry
                                                                    auto(14)
                                                                                f
   182
                                                   2.4 2008
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        31
##
              toyota
                                          camry
                                                                                f
                                                                                        31
##
  183
              toyota
                                          camry
                                                   2.4 2008
                                                                    auto(15)
                                                                                    21
   184
              toyota
                                          camry
                                                   3.0 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
##
   185
                                                   3.0 1999
                                                                                f
                                                                                    18
                                                                                        26
              toyota
                                          camry
                                                               6 manual(m5)
                                                   3.5 2008
                                                                                    19
##
   186
              toyota
                                          camry
                                                                    auto(s6)
                                                                                f
                                                                                        28
##
   187
                                                   2.2 1999
                                                                                f
                                                                                    21
                                                                                        27
               toyota
                                  camry solara
                                                                    auto(14)
##
  188
                                  camry solara
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        29
              toyota
## 189
              toyota
                                  camry solara
                                                   2.4 2008
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        31
##
   190
                                                   2.4 2008
                                                                    auto(s5)
                                                                                f
                                                                                    22
                                                                                        31
              toyota
                                  camry solara
                                                                                        26
##
   191
                                                   3.0 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
              toyota
                                  camry solara
  192
                                                                                        26
##
                                                   3.0 1999
                                                               6 manual(m5)
                                                                                f
                                                                                    18
              toyota
                                  camry solara
##
   193
                                                   3.3 2008
                                                                    auto(s5)
                                                                                f
                                                                                    18
                                                                                        27
              tovota
                                  camry solara
                                                   1.8 1999
##
   194
                                                                                f
                                                                                    24
                                                                                        30
              toyota
                                       corolla
                                                                    auto(13)
##
   195
              toyota
                                        corolla
                                                   1.8 1999
                                                                    auto(14)
                                                                                f
                                                                                    24
                                                                                        33
## 196
              toyota
                                       corolla
                                                   1.8 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    26
                                                                                        35
##
   197
              toyota
                                                   1.8 2008
                                                               4 manual(m5)
                                                                                f
                                                                                    28
                                                                                        37
                                       corolla
##
  198
                                                   1.8 2008
                                                                                f
                                                                                    26
                                                                                        35
              toyota
                                       corolla
                                                                    auto(14)
   199
                                                                                        15
              toyota land cruiser wagon 4wd
                                                   4.7 1999
                                                                    auto(14)
                                                                                4
                                                                                    11
##
  200
              toyota land cruiser wagon 4wd
                                                   5.7 2008
                                                                    auto(s6)
                                                                                4
                                                                                    13
                                                                                        18
                                                               8
##
   201
              toyota
                            toyota tacoma 4wd
                                                   2.7
                                                       1999
                                                               4 manual(m5)
                                                                                4
                                                                                    15
                                                                                        20
                                                                                4
##
   202
                                                   2.7 1999
                                                                    auto(14)
                                                                                    16
                                                                                        20
              toyota
                            toyota tacoma 4wd
## 203
              toyota
                                                   2.7 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    17
                                                                                        22
                            toyota tacoma 4wd
## 204
                                                   3.4 1999
                                                                                4
                                                                                    15
                                                                                        17
              toyota
                            toyota tacoma 4wd
                                                               6 manual(m5)
##
  205
              toyota
                            toyota tacoma 4wd
                                                   3.4 1999
                                                               6
                                                                    auto(14)
                                                                                4
                                                                                    15
                                                                                        19
##
  206
                                                                                        18
              toyota
                            toyota tacoma 4wd
                                                   4.0 2008
                                                               6 manual(m6)
                                                                                4
                                                                                    15
##
   207
              toyota
                            toyota tacoma 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    16
                                                                                        20
                                                                                    21
##
   208
          volkswagen
                                                   2.0
                                                       1999
                                                               4 manual(m5)
                                                                                f
                                                                                        29
                                            gti
##
   209
                                                                                f
                                                                                    19
                                                                                        26
                                                   2.0 1999
                                                                    auto(14)
          volkswagen
                                            gti
## 210
                                                                                f
          volkswagen
                                            gti
                                                   2.0 2008
                                                               4 manual(m6)
                                                                                    21
                                                                                        29
## 211
          volkswagen
                                                   2.0 2008
                                                                    auto(s6)
                                                                                f
                                                                                    22
                                                                                        29
                                            gti
## 212
          volkswagen
                                                   2.8 1999
                                                               6 manual(m5)
                                                                                f
                                                                                    17
                                                                                        24
                                            gti
```

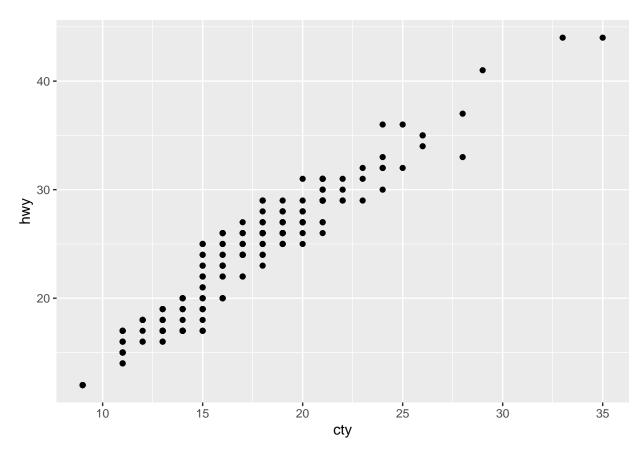
```
## 213
                                                                                   33
          volkswagen
                                         ietta
                                                  1.9 1999
                                                               4 manual(m5)
                                                                               f
                                                                                        44
## 214
          volkswagen
                                                  2.0 1999
                                                               4 manual(m5)
                                                                               f
                                                                                   21
                                                                                        29
                                         jetta
## 215
                                                  2.0 1999
                                                                                   19
                                                                                        26
          volkswagen
                                         jetta
                                                                   auto(14)
                                                                               f
## 216
          volkswagen
                                                  2.0 2008
                                                                                   22
                                                                                       29
                                         jetta
                                                                   auto(s6)
                                                                               f
## 217
                                                                                        29
          volkswagen
                                         jetta
                                                  2.0 2008
                                                               4 manual(m6)
                                                                               f
                                                                                   21
## 218
          volkswagen
                                         jetta
                                                  2.5 2008
                                                               5
                                                                   auto(s6)
                                                                               f
                                                                                   21
                                                                                       29
## 219
          volkswagen
                                         jetta
                                                  2.5 2008
                                                               5 manual(m5)
                                                                               f
                                                                                   21
                                                                                        29
## 220
          volkswagen
                                                  2.8 1999
                                                                                   16
                                                                                       23
                                         jetta
                                                               6
                                                                   auto(14)
                                                                               f
## 221
          volkswagen
                                         jetta
                                                  2.8 1999
                                                               6 manual(m5)
                                                                               f
                                                                                   17
                                                                                        24
## 222
                                   new beetle
                                                  1.9 1999
                                                                                f
                                                                                   35
                                                                                        44
          volkswagen
                                                               4 manual(m5)
## 223
          volkswagen
                                   new beetle
                                                  1.9 1999
                                                                   auto(14)
                                                                               f
                                                                                   29
                                                                                        41
## 224
                                                  2.0 1999
                                                                                   21
                                                                                       29
          volkswagen
                                    new beetle
                                                               4 manual(m5)
                                                                               f
## 225
                                                  2.0 1999
                                                                                   19
                                                                                        26
          volkswagen
                                   new beetle
                                                                   auto(14)
                                                                               f
## 226
                                                                                        28
                                    new beetle
                                                  2.5 2008
                                                               5 manual(m5)
                                                                               f
                                                                                   20
          volkswagen
## 227
          volkswagen
                                   new beetle
                                                  2.5 2008
                                                               5
                                                                   auto(s6)
                                                                               f
                                                                                   20
                                                                                        29
## 228
          volkswagen
                                        passat
                                                  1.8 1999
                                                               4 manual(m5)
                                                                               f
                                                                                   21
                                                                                        29
## 229
                                                  1.8 1999
                                                                               f
                                                                                   18
                                                                                        29
          volkswagen
                                                                   auto(15)
                                        passat
## 230
                                                                                        28
          volkswagen
                                                  2.0 2008
                                                                   auto(s6)
                                                                               f
                                                                                   19
                                        passat
                                                                                       29
## 231
          volkswagen
                                                  2.0 2008
                                                               4 manual(m6)
                                                                               f
                                                                                   21
                                        passat
## 232
                                                                                   16
                                                                                       26
          volkswagen
                                        passat
                                                  2.8 1999
                                                                   auto(15)
                                                                               f
## 233
          volkswagen
                                        passat
                                                  2.8 1999
                                                               6 manual(m5)
                                                                               f
                                                                                   18
                                                                                       26
##
  234
          volkswagen
                                        passat
                                                  3.6 2008
                                                                   auto(s6)
                                                                               f
                                                                                   17
                                                                                       26
##
       fl
                class
## 1
              compact
        p
##
              compact
        p
##
   3
        p
              compact
##
   4
              compact
        p
##
   5
              compact
        p
##
   6
        p
              compact
##
              compact
        p
## 8
        p
              compact
##
   9
              compact
         p
##
   10
              compact
        p
##
   11
              compact
         p
##
   12
              compact
         p
##
   13
        p
              compact
## 14
        p
              compact
## 15
              compact
        p
##
   16
              midsize
        p
##
   17
              midsize
##
   18
              midsize
        p
   19
##
         r
                   suv
##
   20
         e
                   suv
##
   21
                   suv
         r
##
   22
         r
                   suv
##
  23
         r
                   suv
##
   24
         p
              2seater
##
   25
        p
              2seater
   26
##
              2seater
        p
##
   27
              2seater
        p
##
   28
              2seater
        p
##
  29
                  suv
##
  30
                   suv
         е
## 31
                   suv
```

```
## 32
         d
                   suv
## 33
         r
              midsize
## 34
         r
              midsize
## 35
              midsize
         r
## 36
         r
              midsize
## 37
              midsize
         r
## 38
              {\tt minivan}
         r
## 39
         r
              minivan
## 40
         r
              {\tt minivan}
## 41
         r
              minivan
## 42
         r
              {\tt minivan}
## 43
              minivan
         r
## 44
         е
              {\tt minivan}
## 45
         r
              minivan
## 46
         r
              {\tt minivan}
## 47
         r
              {\tt minivan}
## 48
              {\tt minivan}
         r
## 49
         r
               pickup
## 50
               pickup
         r
## 51
         r
                pickup
## 52
         r
                pickup
## 53
         r
                pickup
## 54
         r
                pickup
## 55
         е
                pickup
## 56
         r
                pickup
## 57
         r
               pickup
## 58
         r
                   suv
## 59
         r
                   suv
## 60
                   suv
## 61
         r
                   suv
## 62
         r
                   suv
## 63
         r
                   suv
## 64
         r
                   suv
## 65
                pickup
         r
## 66
                pickup
         е
## 67
         r
                pickup
## 68
         r
                pickup
## 69
         r
               pickup
## 70
         е
                pickup
## 71
         r
                pickup
## 72
         r
               pickup
## 73
                pickup
         r
## 74
         r
                pickup
## 75
         r
                   suv
## 76
         r
                   suv
## 77
         r
                   suv
## 78
         r
                   suv
## 79
         r
                   suv
## 80
                   suv
         r
## 81
         r
                   suv
## 82
                   suv
         r
## 83
         r
                   suv
## 84
         r
                pickup
## 85
         r
                pickup
```

```
## 86
               pickup
        r
## 87
              pickup
        r
## 88
              pickup
## 89
               pickup
        r
  90
##
        r
               pickup
## 91
        r subcompact
## 92
        r subcompact
## 93
        r subcompact
##
  94
        r subcompact
##
  95
        r subcompact
##
  96
        r subcompact
## 97
        r subcompact
##
   98
        r subcompact
        p subcompact
## 99
## 100
        r subcompact
## 101
        r subcompact
## 102
        r subcompact
  103
        p subcompact
## 104
        r subcompact
## 105
        r subcompact
##
  106
        r subcompact
## 107
        c subcompact
## 108
        p subcompact
## 109
        r
             midsize
## 110
        r
             midsize
## 111
        r
             midsize
## 112
        r
             midsize
## 113
        r
             midsize
             midsize
## 114
        r
## 115
             midsize
        r
## 116
        r subcompact
## 117
        r subcompact
## 118
        r subcompact
## 119
        r subcompact
## 120
        r subcompact
## 121
        r subcompact
## 122
        r subcompact
## 123
        d
                  suv
## 124
        r
                  suv
## 125
        r
                  suv
## 126
        r
                  suv
## 127
        е
                  suv
## 128
        r
                  suv
## 129
        r
                  suv
## 130
        p
                  suv
## 131
        p
                  suv
## 132
        r
                  suv
## 133
                  suv
## 134
        p
                  suv
   135
##
        r
                  suv
## 136
        p
                  suv
## 137
        r
                  suv
## 138
        r
                  suv
## 139
        r
                  suv
```

```
## 140 r
                  suv
## 141
                  suv
        r
## 142
             compact
        r
## 143
             compact
        r
             midsize
## 144
        r
## 145
        r
             midsize
## 146
        p
             midsize
## 147
             midsize
        p
## 148
        r
             midsize
## 149
        r
             midsize
## 150
        p
             midsize
## 151
                  suv
        r
## 152
        r
                  suv
## 153
        p
                  suv
## 154
                  suv
        p
## 155
        r
             midsize
## 156
             midsize
        p
## 157
             midsize
        r
## 158
             midsize
        r
## 159
             midsize
        p
## 160
        r
                  suv
## 161
        r
                  suv
## 162
                  suv
        r
## 163
        р
                  suv
## 164
        r
                  suv
## 165
        p
                  suv
## 166
        r subcompact
##
  167
        r subcompact
## 168
        r subcompact
## 169
        r subcompact
## 170
        p
             compact
## 171
        r
             compact
## 172
        p
             compact
## 173
             compact
        r
## 174
        r
                  suv
## 175
        r
                  suv
## 176
        r
                  suv
## 177
        r
                  suv
## 178
        r
                  suv
## 179
        r
                  suv
## 180
        r
             midsize
## 181
        r
             midsize
## 182
        r
             midsize
## 183
        r
             midsize
## 184
        r
             midsize
## 185
             midsize
        r
## 186
        r
             midsize
## 187
             compact
## 188
        r
             compact
## 189
        r
             compact
## 190
        r
             compact
## 191
        r
             compact
## 192
       r
             compact
## 193 r
             compact
```

```
## 194 r
             compact
## 195
       r
             compact
## 196
             compact
## 197
             compact
       r
## 198
        r
             compact
## 199
       r
                 suv
## 200
       r
                 suv
## 201
       r
              pickup
## 202
        r
              pickup
## 203
        r
              pickup
## 204
       r
              pickup
## 205
       r
              pickup
## 206
       r
              pickup
## 207
        r
             pickup
## 208
       r
             compact
## 209
       r
             compact
## 210
        р
             compact
## 211
        p
             compact
## 212
             compact
       r
## 213
       d
             compact
## 214
       r
             compact
## 215
       r
             compact
## 216
      р
             compact
## 217
        p
             compact
## 218
             compact
       r
## 219
       r
             compact
## 220
       r
             compact
## 221
        r
             compact
## 222
        d subcompact
## 223
        d subcompact
## 224
        r subcompact
## 225
        r subcompact
## 226
        r subcompact
## 227
        r subcompact
## 228
             midsize
        p
## 229
             midsize
        p
## 230
       р
            midsize
## 231
        р
            midsize
## 232
        р
             midsize
## 233
            midsize
        р
## 234 p
            midsize
#Example. graph using ggplot()
ggplot(mpg, aes(cty, hwy)) +
 geom_point()
```



```
# 1. How many columns are in mpg dataset? How about the number of rows?

# Show the codes and its result.

# There are 234 rows and 11 columns
```

```
#Code:
mpgdata <- glimpse(mpg)</pre>
```

```
## Rows: 234
## Columns: 11
## $ manufacturer <chr> "audi", "audi"
## $ model
                                                      <chr> "a4", "a4", "a4", "a4", "a4", "a4", "a4", "a4 quattro", "~
## $ displ
                                                        <dbl> 1.8, 1.8, 2.0, 2.0, 2.8, 2.8, 3.1, 1.8, 1.8, 2.0, 2.0, 2.~
                                                      <int> 1999, 1999, 2008, 2008, 1999, 1999, 2008, 1999, 1999, 200~
## $ year
                                                        <int> 4, 4, 4, 4, 6, 6, 6, 4, 4, 4, 4, 6, 6, 6, 6, 6, 6, 8, 8, ~
## $ cyl
## $ trans
                                                        <chr> "auto(15)", "manual(m5)", "manual(m6)", "auto(av)", "auto~
                                                        ## $ drv
## $ cty
                                                        <int> 18, 21, 20, 21, 16, 18, 18, 18, 16, 20, 19, 15, 17, 17, 1~
                                                        <int> 29, 29, 31, 30, 26, 26, 27, 26, 25, 28, 27, 25, 25, 25, 2~
## $ hwy
                                                        ## $ fl
                                                        <chr> "compact", "compact", "compact", "compact", "c~
## $ class
```

as.data.frame(mpgdata)

manufacturer model displ year cyl trans drv cty hwy

```
## 1
                 audi
                                                   1.8 1999
                                                                     auto(15)
                                                                                 f
                                                                                     18
                                                                                         29
                                              a4
## 2
                                                   1.8 1999
                                                                4 manual(m5)
                                                                                 f
                                                                                     21
                                                                                         29
                 audi
                                              a4
## 3
                 audi
                                              а4
                                                   2.0 2008
                                                                4 manual(m6)
                                                                                 f
                                                                                     20
                                                                                         31
##
                                                   2.0 2008
  4
                 audi
                                                                     auto(av)
                                                                                 f
                                                                                     21
                                                                                         30
                                              a4
##
  5
                 audi
                                              а4
                                                   2.8 1999
                                                                     auto(15)
                                                                                 f
                                                                                     16
                                                                                         26
##
   6
                                                   2.8 1999
                                                                                 f
                                                                                     18
                                                                                         26
                 audi
                                              a4
                                                                6 manual(m5)
##
                 audi
                                              a4
                                                   3.1 2008
                                                                     auto(av)
                                                                                 f
                                                                                     18
                                                                                         27
## 8
                 audi
                                    a4 quattro
                                                   1.8 1999
                                                                4 manual(m5)
                                                                                 4
                                                                                     18
                                                                                         26
##
   q
                 audi
                                    a4 quattro
                                                   1.8 1999
                                                                     auto(15)
                                                                                 4
                                                                                     16
                                                                                         25
##
                                                                                         28
  10
                 audi
                                    a4 quattro
                                                   2.0 2008
                                                                  manual(m6)
                                                                                 4
                                                                                     20
   11
                 audi
                                    a4 quattro
                                                   2.0 2008
                                                                     auto(s6)
                                                                                 4
                                                                                     19
                                                                                         27
##
   12
                                                   2.8 1999
                                                                                     15
                                                                                         25
                 audi
                                       quattro
                                                                     auto(15)
                                                                                 4
##
   13
                 audi
                                                   2.8 1999
                                                                6 manual(m5)
                                                                                 4
                                                                                     17
                                                                                         25
                                    a4 quattro
##
   14
                 audi
                                    a4 quattro
                                                   3.1 2008
                                                                     auto(s6)
                                                                                 4
                                                                                     17
                                                                                         25
##
  15
                                                   3.1 2008
                                                                                 4
                                                                                     15
                                                                                         25
                 audi
                                    a4 quattro
                                                                6
                                                                  manual(m6)
##
   16
                 audi
                                    a6 quattro
                                                   2.8 1999
                                                                     auto(15)
                                                                                 4
                                                                                     15
                                                                                         24
##
   17
                                                                                 4
                                                                                         25
                 audi
                                    a6 quattro
                                                   3.1 2008
                                                                6
                                                                     auto(s6)
                                                                                     17
##
   18
                 audi
                                                   4.2 2008
                                                                     auto(s6)
                                                                                     16
                                                                                         23
                                    a6 quattro
                           c1500 suburban 2wd
                                                   5.3 2008
##
   19
           chevrolet
                                                                                         20
                                                                     auto(14)
                                                                                     14
                                                                8
                                                                                 r
##
   20
           chevrolet
                           c1500 suburban 2wd
                                                   5.3 2008
                                                                     auto(14)
                                                                                 r
                                                                                     11
                                                                                         15
##
   21
           chevrolet
                           c1500 suburban 2wd
                                                   5.3 2008
                                                                8
                                                                     auto(14)
                                                                                 r
                                                                                     14
                                                                                         20
##
   22
           chevrolet
                           c1500 suburban 2wd
                                                   5.7 1999
                                                                     auto(14)
                                                                                     13
                                                                                         17
                                                                                 r
## 23
                                                                                         17
                           c1500 suburban 2wd
                                                   6.0 2008
                                                                                     12
           chevrolet
                                                                8
                                                                     auto(14)
                                                                                 r
##
   24
           chevrolet
                                                   5.7 1999
                                                                8 manual(m6)
                                                                                     16
                                                                                         26
                                       corvette
                                                                                 r
##
  25
                                                                                         23
           chevrolet
                                       corvette
                                                   5.7 1999
                                                                     auto(14)
                                                                                 r
                                                                                     15
##
   26
           chevrolet
                                       corvette
                                                   6.2 2008
                                                                8 manual(m6)
                                                                                 r
                                                                                     16
                                                                                         26
##
   27
           chevrolet
                                                   6.2 2008
                                                                     auto(s6)
                                                                                     15
                                                                                         25
                                       corvette
                                                                                 r
   28
                                                   7.0 2008
                                                                                     15
##
           chevrolet
                                       corvette
                                                                8
                                                                  manual(m6)
                                                                                         24
                                                                                 r
##
   29
                              k1500 tahoe 4wd
                                                   5.3 2008
                                                                                 4
                                                                                     14
                                                                                         19
           chevrolet
                                                                     auto(14)
   30
##
           chevrolet
                              k1500 tahoe 4wd
                                                   5.3 2008
                                                                8
                                                                     auto(14)
                                                                                 4
                                                                                     11
                                                                                         14
##
  31
           chevrolet
                              k1500 tahoe 4wd
                                                   5.7 1999
                                                                8
                                                                     auto(14)
                                                                                 4
                                                                                     11
                                                                                         15
##
   32
           chevrolet
                              k1500 tahoe 4wd
                                                   6.5 1999
                                                                8
                                                                     auto(14)
                                                                                 4
                                                                                     14
                                                                                         17
##
   33
                                                                                         27
           chevrolet
                                         malibu
                                                   2.4 1999
                                                                     auto(14)
                                                                                 f
                                                                                     19
##
   34
                                                   2.4 2008
                                                                                     22
                                                                                         30
           chevrolet
                                         malibu
                                                                     auto(14)
                                                                                 f
##
   35
           chevrolet
                                         malibu
                                                   3.1 1999
                                                                     auto(14)
                                                                                 f
                                                                                     18
                                                                                         26
                                                                6
##
   36
           chevrolet
                                                   3.5 2008
                                                                                 f
                                                                                     18
                                                                                         29
                                         malibu
                                                                6
                                                                     auto(14)
##
   37
           chevrolet
                                         malibu
                                                   3.6 2008
                                                                     auto(s6)
                                                                                 f
                                                                                     17
                                                                                         26
##
  38
                                   caravan 2wd
                                                   2.4 1999
                                                                     auto(13)
                                                                                 f
                                                                                     18
                                                                                         24
                dodge
                                                                4
##
   39
                dodge
                                   caravan 2wd
                                                   3.0 1999
                                                                     auto(14)
                                                                                 f
                                                                                     17
                                                                                         24
                                                                6
##
   40
                                                   3.3 1999
                                                                                 f
                                                                                     16
                                                                                         22
                dodge
                                   caravan 2wd
                                                                6
                                                                     auto(14)
##
   41
                                                   3.3 1999
                                                                                         22
                dodge
                                   caravan 2wd
                                                                6
                                                                     auto(14)
                                                                                 f
                                                                                     16
##
   42
                                                   3.3 2008
                                                                     auto(14)
                                                                                 f
                                                                                     17
                                                                                         24
                dodge
                                   caravan 2wd
                                                                6
   43
                                                   3.3 2008
##
                dodge
                                   caravan 2wd
                                                                6
                                                                     auto(14)
                                                                                 f
                                                                                     17
                                                                                         24
##
   44
                                                   3.3 2008
                                                                6
                                                                     auto(14)
                                                                                 f
                                                                                     11
                                                                                         17
                dodge
                                   caravan 2wd
##
   45
                dodge
                                   caravan 2wd
                                                   3.8 1999
                                                                     auto(14)
                                                                                 f
                                                                                     15
                                                                                         22
##
  46
                                                   3.8 1999
                                                                     auto(14)
                                                                                 f
                                                                                     15
                                                                                         21
                dodge
                                   caravan 2wd
                                                                6
##
   47
                dodge
                                   caravan 2wd
                                                   3.8 2008
                                                                6
                                                                     auto(16)
                                                                                 f
                                                                                     16
                                                                                         23
##
   48
                                                                                         23
                dodge
                                   caravan 2wd
                                                   4.0 2008
                                                                     auto(16)
                                                                                 f
                                                                                     16
##
   49
                dodge
                            dakota pickup 4wd
                                                   3.7 2008
                                                                6 manual(m6)
                                                                                 4
                                                                                     15
                                                                                         19
   50
##
                dodge
                            dakota pickup 4wd
                                                   3.7
                                                        2008
                                                                     auto(14)
                                                                                 4
                                                                                     14
                                                                                         18
##
  51
                                                                                 4
                                                                                     13
                                                                                         17
                            dakota pickup 4wd
                                                   3.9 1999
                                                                6
                dodge
                                                                     auto(14)
## 52
                                                                                 4
                dodge
                            dakota pickup 4wd
                                                   3.9 1999
                                                                6 manual(m5)
                                                                                     14
                                                                                         17
## 53
                dodge
                            dakota pickup 4wd
                                                   4.7 2008
                                                                8
                                                                     auto(15)
                                                                                 4
                                                                                     14
                                                                                         19
## 54
                dodge
                            dakota pickup 4wd
                                                   4.7 2008
                                                                     auto(15)
                                                                                 4
                                                                                     14
                                                                                         19
```

```
## 55
                dodge
                            dakota pickup 4wd
                                                   4.7 2008
                                                                    auto(15)
                                                                                 4
                                                                                      9
                                                                                         12
                                                                8
##
                                                                                 4
                                                                                     11
                                                                                         17
  56
                            dakota pickup 4wd
                                                   5.2 1999
                                                                8 manual(m5)
                dodge
##
   57
                dodge
                            dakota pickup 4wd
                                                   5.2 1999
                                                                    auto(14)
                                                                                 4
                                                                                     11
                                                                                         15
##
   58
                                   durango 4wd
                                                   3.9 1999
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
                dodge
                                                                6
##
   59
                dodge
                                   durango 4wd
                                                   4.7 2008
                                                                8
                                                                    auto(15)
                                                                                 4
                                                                                     13
                                                                                         17
   60
                                                                                 4
                                                                                      9
                                                                                         12
##
                                   durango 4wd
                                                   4.7 2008
                                                                8
                                                                    auto(15)
                dodge
                                                                                    13
##
   61
                dodge
                                   durango 4wd
                                                   4.7 2008
                                                                8
                                                                    auto(15)
                                                                                 4
                                                                                         17
## 62
                dodge
                                   durango 4wd
                                                   5.2 1999
                                                                8
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         16
                dodge
##
   63
                                   durango 4wd
                                                   5.7
                                                       2008
                                                                8
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         18
##
   64
                dodge
                                   durango 4wd
                                                   5.9 1999
                                                                8
                                                                    auto(14)
                                                                                 4
                                                                                    11
                                                                                         15
##
   65
                dodge
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                                8 manual(m6)
                                                                                 4
                                                                                    12
                                                                                         16
##
   66
                                                       2008
                                                                                      9
                                                                                         12
                dodge
                          ram 1500 pickup 4wd
                                                   4.7
                                                                8
                                                                    auto(15)
                                                                                 4
##
   67
                          ram 1500 pickup 4wd
                                                   4.7
                                                        2008
                                                                8
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         17
                dodge
##
   68
                dodge
                          ram 1500 pickup 4wd
                                                   4.7
                                                        2008
                                                                    auto(15)
                                                                                 4
                                                                                     13
                                                                                         17
##
   69
                                                                                 4
                                                                                    12
                dodge
                          ram 1500 pickup 4wd
                                                   4.7 2008
                                                                8 manual(m6)
                                                                                         16
##
   70
                dodge
                          ram 1500 pickup 4wd
                                                   4.7
                                                       2008
                                                                  manual(m6)
                                                                                 4
                                                                                      9
                                                                                         12
   71
                                                                                 4
                                                                                         15
##
                          ram 1500 pickup 4wd
                                                   5.2 1999
                                                                8
                                                                    auto(14)
                                                                                    11
                dodge
##
   72
                          ram 1500 pickup 4wd
                                                   5.2 1999
                                                                8 manual(m5)
                                                                                     11
                                                                                         16
                dodge
##
   73
                          ram 1500 pickup 4wd
                                                   5.7 2008
                                                                    auto(15)
                                                                                 4
                                                                                    13
                                                                                         17
                dodge
                                                                8
##
   74
                dodge
                          ram 1500 pickup 4wd
                                                   5.9
                                                       1999
                                                                8
                                                                    auto(14)
                                                                                 4
                                                                                     11
                                                                                         15
##
   75
                 ford
                                expedition 2wd
                                                   4.6 1999
                                                                8
                                                                    auto(14)
                                                                                 r
                                                                                    11
                                                                                         17
##
   76
                                                   5.4 1999
                                                                    auto(14)
                                                                                    11
                                                                                         17
                 ford
                                expedition 2wd
                                                                                 r
  77
                                                   5.4 2008
                                                                                    12
##
                 ford
                                expedition 2wd
                                                                8
                                                                    auto(16)
                                                                                         18
                                                                                 r
                                                   4.0 1999
##
   78
                 ford
                                  explorer 4wd
                                                                6
                                                                    auto(15)
                                                                                 4
                                                                                    14
                                                                                         17
                                                   4.0 1999
                                                                                 4
##
   79
                 ford
                                  explorer 4wd
                                                                6 manual(m5)
                                                                                    15
                                                                                         19
   80
                 ford
                                  explorer 4wd
                                                   4.0 1999
                                                                6
                                                                    auto(15)
                                                                                 4
                                                                                    14
                                                                                         17
##
   81
                                                   4.0 2008
                                                                                 4
                                                                                    13
                                                                                         19
                 ford
                                  explorer 4wd
                                                                6
                                                                    auto(15)
##
   82
                 ford
                                  explorer 4wd
                                                   4.6 2008
                                                                8
                                                                    auto(16)
                                                                                 4
                                                                                     13
                                                                                         19
                                                                                    13
##
   83
                                                   5.0 1999
                                                                                 4
                 ford
                                  explorer 4wd
                                                                    auto(14)
                                                                                         17
##
   84
                              f150 pickup 4wd
                                                   4.2 1999
                                                                    auto(14)
                                                                                 4
                                                                                    14
                                                                                         17
                 ford
                                                                6
##
   85
                 ford
                              f150 pickup 4wd
                                                   4.2 1999
                                                                6 manual(m5)
                                                                                 4
                                                                                    14
                                                                                         17
##
   86
                 ford
                              f150 pickup 4wd
                                                   4.6 1999
                                                                8 manual(m5)
                                                                                 4
                                                                                    13
                                                                                         16
##
   87
                 ford
                              f150 pickup 4wd
                                                   4.6 1999
                                                                    auto(14)
                                                                                 4
                                                                                     13
                                                                                         16
##
                                                                                         17
   88
                              f150 pickup 4wd
                                                   4.6 2008
                                                                    auto(14)
                                                                                 4
                                                                                    13
                 ford
                                                                8
##
   89
                              f150 pickup 4wd
                                                   5.4 1999
                                                                    auto(14)
                                                                                 4
                                                                                     11
                                                                                         15
                 ford
                                                                8
                                                   5.4 2008
##
   90
                                                                                 4
                                                                                    13
                 ford
                              f150 pickup 4wd
                                                                8
                                                                    auto(14)
                                                                                         17
##
   91
                 ford
                                        mustang
                                                   3.8 1999
                                                                6 manual(m5)
                                                                                 r
                                                                                     18
                                                                                         26
##
  92
                                                   3.8 1999
                                                                    auto(14)
                                                                                    18
                                                                                         25
                 ford
                                        mustang
                                                                6
                                                                                 r
##
   93
                                                   4.0 2008
                                                                6 manual(m5)
                                                                                     17
                                                                                         26
                 ford
                                        mustang
                                                                                 r
##
   94
                                                   4.0 2008
                                                                                         24
                 ford
                                        mustang
                                                                6
                                                                    auto(15)
                                                                                    16
                                                                                 r
##
   95
                 ford
                                        mustang
                                                   4.6 1999
                                                                    auto(14)
                                                                                 r
                                                                                    15
                                                                                         21
##
   96
                                                   4.6 1999
                                                                8 manual(m5)
                                                                                    15
                                                                                         22
                 ford
                                        mustang
                                                                                 r
##
   97
                 ford
                                        mustang
                                                   4.6 2008
                                                                8 manual(m5)
                                                                                 r
                                                                                    15
                                                                                         23
##
   98
                                                   4.6 2008
                                                                    auto(15)
                                                                                     15
                                                                                         22
                 ford
                                        mustang
                                                                                 r
##
   99
                 ford
                                        mustang
                                                   5.4 2008
                                                                8 manual(m6)
                                                                                    14
                                                                                         20
                                                                                 r
                                                                                     28
## 100
                                                   1.6 1999
                                                                  manual(m5)
                                                                                 f
                                                                                         33
                honda
                                          civic
##
  101
                honda
                                          civic
                                                   1.6 1999
                                                                    auto(14)
                                                                                 f
                                                                                     24
                                                                                         32
  102
                                                                                 f
                                                                                     25
                                                                                         32
##
                honda
                                          civic
                                                   1.6 1999
                                                                4 manual(m5)
##
  103
                honda
                                                   1.6 1999
                                                                4 manual(m5)
                                                                                 f
                                                                                     23
                                                                                         29
                                          civic
##
   104
                honda
                                          civic
                                                   1.6
                                                       1999
                                                                    auto(14)
                                                                                 f
                                                                                     24
                                                                                         32
##
   105
                                                   1.8 2008
                                                                                 f
                                                                                     26
                                                                                         34
                                                                4 manual(m5)
                honda
                                          civic
                                                                                 f
## 106
                honda
                                          civic
                                                   1.8 2008
                                                                    auto(15)
                                                                                    25
                                                                                         36
## 107
               honda
                                          civic
                                                   1.8 2008
                                                                4
                                                                    auto(15)
                                                                                 f
                                                                                    24
                                                                                         36
## 108
                honda
                                          civic
                                                   2.0 2008
                                                                4 manual(m6)
                                                                                 f
                                                                                    21
                                                                                         29
```

```
## 109
             hvundai
                                         sonata
                                                   2.4 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
## 110
             hyundai
                                                   2.4 1999
                                                                4 manual(m5)
                                                                                f
                                                                                    18
                                                                                        27
                                         sonata
## 111
             hyundai
                                         sonata
                                                   2.4 2008
                                                                    auto(14)
                                                                                f
                                                                                    21
                                                                                        30
## 112
             hyundai
                                                   2.4 2008
                                                                                        31
                                                                4 manual(m5)
                                                                                f
                                                                                    21
                                         sonata
##
   113
             hyundai
                                         sonata
                                                   2.5 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
## 114
             hyundai
                                                   2.5 1999
                                                                6 manual(m5)
                                                                                f
                                                                                    18
                                                                                        26
                                         sonata
## 115
             hyundai
                                                   3.3 2008
                                                                                f
                                                                                    19
                                         sonata
                                                                    auto(15)
                                                                                        28
## 116
                                                   2.0 1999
                                                                                    19
             hyundai
                                        tiburon
                                                                    auto(14)
                                                                                f
                                                                                        26
  117
             hyundai
                                        tiburon
                                                   2.0 1999
                                                                4 manual(m5)
                                                                                f
                                                                                    19
                                                                                         29
## 118
                                                   2.0 2008
                                                                                    20
                                                                                        28
             hyundai
                                        tiburon
                                                                4 manual(m5)
                                                                                f
   119
             hyundai
                                        tiburon
                                                   2.0 2008
                                                                    auto(14)
                                                                                f
                                                                                    20
                                                                                        27
   120
##
             hyundai
                                                   2.7 2008
                                                                    auto(14)
                                                                                f
                                                                                    17
                                                                                        24
                                        tiburon
##
   121
             hyundai
                                        tiburon
                                                   2.7
                                                       2008
                                                                6 manual(m6)
                                                                                f
                                                                                    16
                                                                                        24
## 122
             hyundai
                                        tiburon
                                                   2.7
                                                       2008
                                                                 manual(m5)
                                                                                f
                                                                                    17
                                                                                        24
## 123
                                                   3.0 2008
                                                                                4
                                                                                    17
                                                                                        22
                 jeep
                           grand cherokee 4wd
                                                                    auto(15)
## 124
                           grand cherokee 4wd
                                                   3.7 2008
                                                                6
                                                                    auto(15)
                                                                                4
                                                                                    15
                                                                                        19
                 jeep
##
  125
                                                                                4
                                                                                    15
                                                                                        20
                           grand cherokee 4wd
                                                   4.0 1999
                                                                6
                                                                    auto(14)
                 jeep
##
   126
                 jeep
                           grand cherokee 4wd
                                                   4.7 1999
                                                                    auto(14)
                                                                                    14
                                                                                         17
##
  127
                                                   4.7 2008
                                                                                     9
                                                                                        12
                           grand cherokee 4wd
                                                                    auto(15)
                                                                                4
                 jeep
                                                               8
##
   128
                 jeep
                           grand cherokee 4wd
                                                   4.7
                                                       2008
                                                               8
                                                                    auto(15)
                                                                                4
                                                                                    14
                                                                                        19
##
  129
                           grand cherokee 4wd
                                                   5.7 2008
                                                               8
                                                                    auto(15)
                                                                                4
                                                                                    13
                                                                                        18
                 jeep
## 130
                           grand cherokee 4wd
                                                   6.1 2008
                                                                    auto(15)
                                                                                4
                                                                                    11
                                                                                         14
                 jeep
## 131
                                                   4.0 1999
                                                                                4
                                                                                    11
                                                                                        15
          land rover
                                   range rover
                                                               8
                                                                    auto(14)
##
   132
          land rover
                                                   4.2 2008
                                                                                4
                                                                                    12
                                                                                        18
                                   range rover
                                                               8
                                                                    auto(s6)
##
  133
                                                   4.4 2008
                                                                                4
                                                                                        18
          land rover
                                   range rover
                                                               8
                                                                    auto(s6)
                                                                                    12
   134
          land rover
                                   range rover
                                                   4.6 1999
                                                                8
                                                                    auto(14)
                                                                                4
                                                                                    11
                                                                                        15
   135
##
             lincoln
                                 navigator 2wd
                                                   5.4 1999
                                                                                    11
                                                                                        17
                                                               8
                                                                    auto(14)
                                                                                r
   136
##
             lincoln
                                 navigator 2wd
                                                   5.4 1999
                                                               8
                                                                    auto(14)
                                                                                    11
                                                                                        16
                                                                                r
##
   137
                                                   5.4 2008
                                                                                    12
                                                                                        18
             lincoln
                                 navigator 2wd
                                                                    auto(16)
                                                                                r
## 138
                              mountaineer 4wd
                                                   4.0 1999
                                                                6
                                                                    auto(15)
                                                                                4
                                                                                    14
                                                                                        17
             mercury
## 139
             mercury
                              mountaineer 4wd
                                                   4.0 2008
                                                                6
                                                                    auto(15)
                                                                                4
                                                                                    13
                                                                                        19
##
   140
             mercury
                              mountaineer 4wd
                                                   4.6 2008
                                                                8
                                                                    auto(16)
                                                                                4
                                                                                    13
                                                                                        19
##
   141
                              mountaineer 4wd
                                                   5.0 1999
                                                                    auto(14)
                                                                                 4
                                                                                    13
                                                                                         17
             mercury
   142
                                                   2.4 1999
                                                                                    21
                                                                                        29
##
                                         altima
                                                                4 manual(m5)
                                                                                f
              nissan
##
   143
              nissan
                                         altima
                                                   2.4 1999
                                                                    auto(14)
                                                                                f
                                                                                    19
                                                                                        27
##
   144
                                                   2.5 2008
                                                                                f
                                                                                    23
                                                                                        31
              nissan
                                         altima
                                                                    auto(av)
##
  145
              nissan
                                         altima
                                                   2.5 2008
                                                                4 manual(m6)
                                                                                f
                                                                                    23
                                                                                        32
## 146
                                         altima
                                                   3.5 2008
                                                                6 manual(m6)
                                                                                f
                                                                                    19
                                                                                        27
              nissan
## 147
              nissan
                                         altima
                                                   3.5 2008
                                                                    auto(av)
                                                                                f
                                                                                    19
                                                                                        26
##
  148
                                                   3.0 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
              nissan
                                         maxima
   149
                                                   3.0 1999
                                                                6 manual(m5)
                                                                                    19
                                                                                        25
              nissan
                                        maxima
                                                                                f
                                                                                    19
##
   150
                                                   3.5 2008
                                                                    auto(av)
                                                                                f
                                                                                        25
              nissan
                                        maxima
##
   151
              nissan
                                pathfinder 4wd
                                                   3.3 1999
                                                                6
                                                                    auto(14)
                                                                                4
                                                                                    14
                                                                                        17
                                                                                4
                                                                                    15
##
   152
              nissan
                                pathfinder 4wd
                                                   3.3 1999
                                                                6 manual(m5)
                                                                                        17
## 153
              nissan
                                pathfinder 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    14
                                                                                        20
                                                                                    12
## 154
                                                   5.6 2008
                                                                                4
                                                                                        18
              nissan
                                pathfinder 4wd
                                                               8
                                                                    auto(s5)
##
   155
             pontiac
                                    grand prix
                                                   3.1 1999
                                                                6
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
##
   156
                                                   3.8 1999
                                                                                f
                                                                                        26
             pontiac
                                    grand prix
                                                                    auto(14)
                                                                                    16
##
   157
             pontiac
                                    grand prix
                                                   3.8 1999
                                                                    auto(14)
                                                                                f
                                                                                    17
                                                                                        27
##
   158
             pontiac
                                    grand prix
                                                   3.8
                                                       2008
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        28
##
   159
                                                   5.3
                                                       2008
                                                                                f
                                                                                    16
                                                                                        25
             pontiac
                                    grand prix
                                                                    auto(s4)
                                                   2.5 1999
## 160
              subaru
                                  forester awd
                                                                4 manual(m5)
                                                                                4
                                                                                    18
                                                                                        25
## 161
              subaru
                                  forester awd
                                                   2.5 1999
                                                                    auto(14)
                                                                                4
                                                                                    18
                                                                                        24
                                                   2.5 2008
## 162
               subaru
                                  forester awd
                                                                4 manual(m5)
                                                                                 4
                                                                                    20
                                                                                        27
```

```
## 163
               subaru
                                  forester awd
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        25
##
                                                   2.5 2008
                                                                                4
                                                                                    20
                                                                                        26
  164
               subaru
                                  forester awd
                                                               4
                                                                    auto(14)
##
   165
               subaru
                                  forester awd
                                                   2.5 2008
                                                                    auto(14)
                                                                                4
                                                                                    18
                                                                                        23
   166
                                                   2.2 1999
                                                                    auto(14)
                                                                                4
                                                                                    21
                                                                                        26
##
              subaru
                                   impreza awd
##
   167
               subaru
                                   impreza awd
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        26
                                                   2.5 1999
                                                                                4
                                                                                    19
                                                                                        26
##
   168
              subaru
                                   impreza awd
                                                               4 manual(m5)
                                                                                    19
## 169
               subaru
                                   impreza awd
                                                   2.5 1999
                                                                    auto(14)
                                                                                4
                                                                                        26
                                                                                    20
## 170
              subaru
                                   impreza awd
                                                   2.5 2008
                                                                    auto(s4)
                                                                                4
                                                                                        25
##
   171
               subaru
                                   impreza awd
                                                   2.5 2008
                                                                    auto(s4)
                                                                                4
                                                                                    20
                                                                                        27
##
  172
              subaru
                                   impreza awd
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    19
                                                                                        25
  173
              subaru
                                                   2.5 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    20
                                                                                        27
                                   impreza awd
   174
                                                   2.7 1999
                                                                                    15
                                                                                        20
##
               toyota
                                   4runner 4wd
                                                               4 manual(m5)
                                                                                4
##
   175
                                   4runner 4wd
                                                   2.7 1999
                                                                    auto(14)
                                                                                4
                                                                                    16
                                                                                        20
               toyota
## 176
               toyota
                                   4runner 4wd
                                                   3.4 1999
                                                                    auto(14)
                                                                                4
                                                                                    15
                                                                                        19
## 177
                                                                                    15
                                                                                        17
               toyota
                                   4runner 4wd
                                                   3.4 1999
                                                               6 manual(m5)
                                                                                4
## 178
                                   4runner 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    16
                                                                                        20
               toyota
## 179
                                                                                4
                                   4runner 4wd
                                                   4.7 2008
                                                               8
                                                                                    14
                                                                                        17
               toyota
                                                                    auto(15)
##
  180
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        29
               toyota
                                          camry
  181
                                                                                        27
##
                                                   2.2 1999
                                                                    auto(14)
                                                                                f
                                                                                    21
              toyota
                                          camry
##
   182
              toyota
                                          camry
                                                   2.4 2008
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        31
##
   183
               toyota
                                          camry
                                                   2.4 2008
                                                                    auto(15)
                                                                                f
                                                                                    21
                                                                                        31
   184
                                                   3.0 1999
                                                                    auto(14)
                                                                                f
                                                                                    18
                                                                                        26
##
               toyota
                                          camry
## 185
               toyota
                                                   3.0 1999
                                                               6 manual(m5)
                                                                                f
                                                                                    18
                                                                                        26
                                          camry
                                                   3.5 2008
                                                                                f
                                                                                        28
##
   186
               toyota
                                          camry
                                                                    auto(s6)
                                                                                    19
                                                                    auto(14)
                                                                                f
## 187
               toyota
                                  camry solara
                                                   2.2 1999
                                                                                    21
                                                                                        27
   188
               toyota
                                  camry solara
                                                   2.2 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        29
##
   189
                                                   2.4 2008
                                                                                f
                                                                                    21
                                                                                        31
               toyota
                                  camry solara
                                                               4 manual(m5)
##
   190
               toyota
                                                   2.4 2008
                                                                    auto(s5)
                                                                                f
                                                                                    22
                                                                                        31
                                  camry solara
##
  191
                                                   3.0 1999
                                                                                f
                                                                                    18
                                                                                        26
               toyota
                                  camry solara
                                                                    auto(14)
## 192
                                                   3.0 1999
                                                               6 manual(m5)
                                                                                f
                                                                                    18
                                                                                        26
               toyota
                                  camry solara
## 193
               toyota
                                  camry solara
                                                   3.3 2008
                                                               6
                                                                    auto(s5)
                                                                                f
                                                                                    18
                                                                                        27
##
   194
                                       corolla
                                                   1.8 1999
                                                                    auto(13)
                                                                                f
                                                                                    24
                                                                                        30
               toyota
##
   195
                                       corolla
                                                   1.8 1999
                                                                    auto(14)
                                                                                f
                                                                                    24
                                                                                        33
               toyota
  196
                                                                                    26
                                                                                        35
##
                                                   1.8 1999
                                                               4 manual(m5)
                                                                                f
               toyota
                                       corolla
##
   197
                                        corolla
                                                   1.8
                                                       2008
                                                                                f
                                                                                    28
                                                                                        37
               toyota
                                                               4 manual(m5)
##
  198
                                                                                f
                                                                                    26
                                                                                        35
               toyota
                                       corolla
                                                   1.8 2008
                                                                    auto(14)
## 199
               toyota land cruiser wagon 4wd
                                                   4.7 1999
                                                                    auto(14)
                                                                                4
                                                                                    11
                                                                                        15
## 200
                                                   5.7 2008
                                                               8
                                                                    auto(s6)
                                                                                4
                                                                                    13
                                                                                        18
              toyota land cruiser wagon 4wd
## 201
                                                   2.7 1999
                                                               4 manual(m5)
                                                                                4
                                                                                    15
                                                                                        20
              toyota
                            toyota tacoma 4wd
##
  202
                                                                                4
                                                                                    16
                                                                                        20
               toyota
                            toyota tacoma 4wd
                                                   2.7 1999
                                                                    auto(14)
   203
                                                                                        22
              toyota
                            toyota tacoma 4wd
                                                   2.7 2008
                                                               4 manual(m5)
                                                                                4
                                                                                    17
##
  204
                                                   3.4 1999
                                                               6 manual(m5)
                                                                                4
                                                                                    15
                                                                                        17
               toyota
                            toyota tacoma 4wd
##
   205
              toyota
                            toyota tacoma 4wd
                                                   3.4 1999
                                                               6
                                                                    auto(14)
                                                                                4
                                                                                    15
                                                                                        19
                                                                                4
##
   206
                                                   4.0 2008
                                                               6 manual(m6)
                                                                                    15
                                                                                        18
               toyota
                            toyota tacoma 4wd
  207
##
               toyota
                            toyota tacoma 4wd
                                                   4.0 2008
                                                                    auto(15)
                                                                                4
                                                                                    16
                                                                                        20
## 208
                                                                                    21
                                                   2.0 1999
                                                                                f
                                                                                        29
          volkswagen
                                            gti
                                                               4 manual(m5)
##
  209
          volkswagen
                                            gti
                                                   2.0 1999
                                                                    auto(14)
                                                                                f
                                                                                    19
                                                                                        26
## 210
                                                                                f
                                                                                        29
          volkswagen
                                            gti
                                                   2.0 2008
                                                               4 manual(m6)
                                                                                    21
## 211
          volkswagen
                                                   2.0 2008
                                                                    auto(s6)
                                                                                f
                                                                                    22
                                                                                        29
                                            gti
## 212
          volkswagen
                                                   2.8
                                                       1999
                                                               6 manual(m5)
                                                                                f
                                                                                    17
                                                                                        24
                                            gti
## 213
                                                                                f
                                                                                    33
                                                                                        44
                                                   1.9 1999
                                                               4 manual(m5)
          volkswagen
                                          jetta
## 214
          volkswagen
                                          jetta
                                                   2.0 1999
                                                               4 manual(m5)
                                                                                f
                                                                                    21
                                                                                        29
                                                                                    19
## 215
          volkswagen
                                                   2.0 1999
                                                               4
                                                                    auto(14)
                                                                                f
                                                                                        26
                                          jetta
## 216
          volkswagen
                                                   2.0 2008
                                                                    auto(s6)
                                                                                f
                                                                                    22
                                                                                        29
                                          jetta
```

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## 217
                                         jetta
                                                                                   21
          volkswagen
                                                  2.0 2008
                                                               4 manual(m6)
                                                                                f
                                                                                        29
## 218
                                                                                        29
          volkswagen
                                                  2.5 2008
                                                               5
                                                                   auto(s6)
                                                                                f
                                                                                   21
                                         jetta
## 219
          volkswagen
                                                               5 manual(m5)
                                                                                   21
                                                                                        29
                                         jetta
                                                  2.5 2008
                                                                                f
## 220
          volkswagen
                                                  2.8 1999
                                                                                   16
                                                                                        23
                                         jetta
                                                                   auto(14)
                                                                                f
## 221
          volkswagen
                                         jetta
                                                  2.8 1999
                                                               6 manual(m5)
                                                                                f
                                                                                   17
                                                                                        24
## 222
          volkswagen
                                    new beetle
                                                  1.9 1999
                                                               4 manual(m5)
                                                                                f
                                                                                   35
                                                                                        44
## 223
          volkswagen
                                    new beetle
                                                  1.9 1999
                                                                   auto(14)
                                                                                f
                                                                                   29
                                                                                        41
## 224
          volkswagen
                                                  2.0 1999
                                                               4 manual(m5)
                                                                                f
                                                                                   21
                                                                                        29
                                    new beetle
## 225
          volkswagen
                                    new beetle
                                                  2.0 1999
                                                                   auto(14)
                                                                                f
                                                                                   19
                                                                                        26
## 226
                                                  2.5 2008
                                                                                f
                                                                                   20
                                                                                        28
          volkswagen
                                    new beetle
                                                               5 manual(m5)
## 227
          volkswagen
                                    new beetle
                                                  2.5 2008
                                                                   auto(s6)
                                                                                f
                                                                                   20
                                                                                        29
## 228
                                                  1.8 1999
                                                                                   21
                                                                                        29
          volkswagen
                                        passat
                                                               4 manual(m5)
                                                                                f
## 229
                                                                                   18
                                                                                        29
          volkswagen
                                        passat
                                                  1.8 1999
                                                                   auto(15)
                                                                                f
## 230
                                                  2.0 2008
                                                                   auto(s6)
                                                                                f
                                                                                   19
                                                                                        28
          volkswagen
                                        passat
## 231
          volkswagen
                                                  2.0 2008
                                                               4 manual(m6)
                                                                                f
                                                                                   21
                                                                                        29
                                        passat
## 232
          volkswagen
                                        passat
                                                  2.8 1999
                                                               6
                                                                   auto(15)
                                                                                f
                                                                                   16
                                                                                        26
## 233
          volkswagen
                                                  2.8 1999
                                                                                f
                                                                                   18
                                                                                        26
                                                               6 manual(m5)
                                        passat
   234
##
          volkswagen
                                        passat
                                                  3.6 2008
                                                                   auto(s6)
                                                                                   17
                                                                                        26
##
       fl
                class
##
   1
        p
              compact
##
   2
        p
              compact
##
   3
              compact
        p
##
              compact
        р
##
              compact
        p
##
  6
        p
              compact
##
   7
        p
              compact
##
   8
              compact
        p
##
   9
        p
              compact
## 10
        p
              compact
## 11
              compact
        p
## 12
        p
              compact
##
   13
         p
              compact
##
   14
              compact
        p
##
   15
              compact
         p
##
   16
              midsize
        p
##
   17
              midsize
        p
##
   18
        p
              midsize
## 19
                   suv
        r
   20
##
                   suv
         е
##
   21
                   suv
         r
   22
##
                   suv
         r
##
   23
                   suv
         r
##
   24
        p
              2seater
##
   25
              2seater
        p
##
   26
              2seater
        p
##
   27
              2seater
        p
##
   28
         p
              2seater
##
   29
                   suv
   30
##
         е
                   suv
##
   31
         r
                   suv
##
   32
         d
                   suv
##
   33
         r
              midsize
##
  34
              midsize
        r
```

35

midsize

```
## 36
              midsize
         r
## 37
              midsize
        r
## 38
         r
              minivan
## 39
              minivan
         r
## 40
         r
              minivan
## 41
              minivan
         r
## 42
         r
              {\tt minivan}
## 43
         r
              minivan
## 44
         е
              {\tt minivan}
## 45
         r
              minivan
## 46
         r
              minivan
## 47
              minivan
         r
## 48
         r
              {\tt minivan}
## 49
         r
               pickup
## 50
         r
               pickup
## 51
         r
               pickup
## 52
         r
               pickup
## 53
         r
               pickup
## 54
               pickup
         r
## 55
         е
               pickup
## 56
         r
               pickup
## 57
         r
               pickup
## 58
         r
                   suv
## 59
         r
                   suv
## 60
         е
                   suv
## 61
         r
                   suv
## 62
                   suv
         r
## 63
         r
                   suv
## 64
         r
                   suv
## 65
         r
               pickup
## 66
         е
               pickup
## 67
         r
               pickup
## 68
         r
               pickup
## 69
         r
               pickup
## 70
         е
               pickup
## 71
         r
               pickup
## 72
         r
               pickup
## 73
         r
               pickup
## 74
         r
               pickup
## 75
         r
                   suv
## 76
         r
                   suv
## 77
                   suv
         r
## 78
         r
                   suv
## 79
         r
                   suv
## 80
         r
                   suv
## 81
         r
                   suv
## 82
         r
                   suv
## 83
         r
                   suv
## 84
         r
               pickup
## 85
         r
               pickup
## 86
         r
               pickup
## 87
         r
               pickup
## 88
        r
               pickup
## 89
               pickup
```

```
## 90
               pickup
        r
## 91
        r subcompact
## 92
        r subcompact
## 93
        r subcompact
   94
##
        r subcompact
##
  95
        r subcompact
## 96
        r subcompact
## 97
        r subcompact
##
  98
        r subcompact
## 99
        p subcompact
  100
        r subcompact
  101
##
        r subcompact
   102
##
        r subcompact
## 103
        p subcompact
## 104
        r subcompact
## 105
        r subcompact
## 106
        r subcompact
  107
        c subcompact
## 108
        p subcompact
## 109
        r
             midsize
## 110
        r
             midsize
## 111
        r
             midsize
## 112
             midsize
        r
## 113
        r
             midsize
## 114
             midsize
        r
## 115
        r
             midsize
## 116
        r subcompact
  117
        r subcompact
## 118
        r subcompact
## 119
        r subcompact
## 120
        r subcompact
## 121
        r subcompact
## 122
        r subcompact
## 123
        d
                  suv
## 124
        r
                  suv
## 125
        r
                  suv
## 126
        r
                  suv
## 127
        е
                  suv
## 128
        r
                  suv
## 129
        r
                  suv
## 130
        р
                  suv
## 131
                  suv
        p
## 132
        r
                  suv
## 133
        r
                  suv
## 134
                  suv
        p
## 135
                  suv
        r
## 136
        p
                  suv
## 137
                  suv
## 138
        r
                  suv
## 139
        r
                  suv
## 140
        r
                  suv
## 141
        r
                  suv
## 142
        r
             compact
## 143
             compact
       r
```

```
## 144 r
             midsize
## 145
             midsize
        r
## 146
             midsize
        p
## 147
             midsize
        р
## 148
        r
             midsize
## 149
        r
             midsize
## 150
        р
             midsize
## 151
        r
                  suv
## 152
        r
                  suv
## 153
                  suv
        p
## 154
        p
                  suv
## 155
        r
             midsize
## 156
             midsize
        p
             midsize
## 157
        r
## 158
        r
             midsize
## 159
        p
             midsize
## 160
                  suv
        r
## 161
        r
                  suv
## 162
        r
                  suv
## 163
        p
                  suv
## 164
        r
                  suv
## 165
        р
                  suv
## 166
        r subcompact
## 167
        r subcompact
## 168
        r subcompact
## 169
        r subcompact
## 170
        p
             compact
## 171
        r
             compact
## 172
        p
             compact
## 173
             compact
        r
## 174
        r
                  suv
## 175
        r
                  suv
## 176
                  suv
## 177
                  suv
        r
## 178
        r
                  suv
## 179
        r
                  suv
## 180
        r
             midsize
## 181
        r
             midsize
             midsize
## 182
        r
## 183
             midsize
        r
## 184
        r
             midsize
## 185
             midsize
        r
## 186
        r
             midsize
## 187
        r
             compact
## 188
        r
             compact
## 189
             compact
        r
## 190
        r
             compact
## 191
             compact
## 192
        r
             compact
## 193
        r
             compact
## 194
        r
             compact
## 195
        r
             compact
## 196
             compact
       r
## 197 r
             compact
```

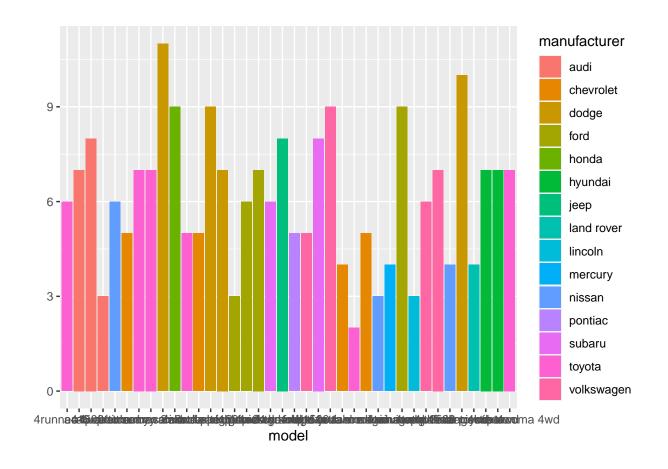
```
## 198 r
             compact
## 199 r
                 suv
## 200 r
                 suv
## 201 r
             pickup
## 202
        r
              pickup
## 203
       r
              pickup
## 204
       r
              pickup
## 205
              pickup
       r
## 206
        r
              pickup
## 207
        r
             pickup
## 208
             compact
## 209
             compact
        r
## 210
        р
             compact
## 211
             compact
        p
## 212
       r
             compact
## 213
        d
             compact
## 214
       r
             compact
## 215
             compact
## 216
            compact
       р
## 217
             compact
        р
## 218
       r
             compact
## 219
       r
             compact
## 220
             compact
      r
## 221
       r
             compact
## 222
       d subcompact
## 223
        d subcompact
## 224
        r subcompact
## 225
        r subcompact
## 226
        r subcompact
## 227
        r subcompact
## 228
        p
            midsize
## 229
        p
            midsize
## 230
            midsize
        p
            midsize
## 231
        p
## 232
            midsize
        p
## 233
            midsize
       р
## 234 p
            midsize
nrow(mpgdata)
## [1] 234
ncol(mpgdata)
## [1] 11
# 2. Which manufacturer has the most models in this data set? Which model has
# the most variations? Ans:
manuf_count <- mpgdata %>% group_by(manufacturer) %>%
count()
manuf_count
```

```
## # A tibble: 15 x 2
## # Groups: manufacturer [15]
##
     manufacturer n
##
     <chr>
                <int>
## 1 audi
                   19
## 2 chevrolet
## 3 dodge
## 4 ford
                    25
## 5 honda
                    9
## 6 hyundai
                   14
## 7 jeep
## 8 land rover
                     4
## 9 lincoln
                      3
## 10 mercury
                      4
## 11 nissan
                     13
## 12 pontiac
                    5
## 13 subaru
                     14
## 14 toyota
                     34
## 15 volkswagen
                     27
colnames(manuf_count) <- c("Manufacturer", "Counts")</pre>
manuf_count
## # A tibble: 15 x 2
## # Groups: Manufacturer [15]
     Manufacturer Counts
##
     <chr>
                <int>
## 1 audi
                    18
## 2 chevrolet
                    19
## 3 dodge
## 4 ford
                      25
## 5 honda
                     9
## 6 hyundai
                     14
## 7 jeep
                      8
## 8 land rover
                      4
## 9 lincoln
                       3
## 10 mercury
## 11 nissan
                     13
## 12 pontiac
                     5
## 13 subaru
                      14
## 14 toyota
                      34
## 15 volkswagen
                      27
# a. Group the manufacturers and find the unique models.
# Copy the codes and result.
unique_mods <- mpgdata %>% group_by(manufacturer, model) %>%
distinct() %>% count()
unique_mods
## # A tibble: 38 x 3
```

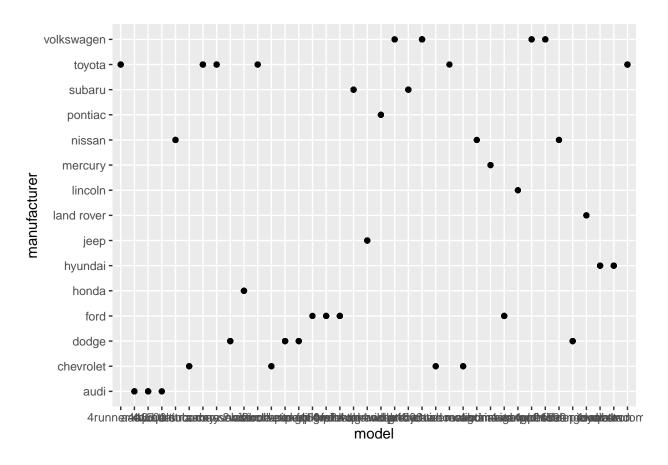
Groups: manufacturer, model [38]

```
manufacturer model
##
                                         n
     <chr> <chr>
##
                                   <int>
            a4
a4 quattro
a6 quattro
## 1 audi
                                      7
## 2 audi
## 3 audi
                                         3
## 4 chevrolet c1500 suburban 2wd
                                         4
## 5 chevrolet corvette
## 6 chevrolet k1500 tahoe 4wd
                                         4
## 7 chevrolet malibu
                                         5
## 8 dodge caravan 2wd
## 9 dodge dakota pickup 4wd
## 10 dodge durango 4wd
                                         9
                                         6
## # ... with 28 more rows
colnames(unique_mods) <- c("Manufacturer", "Model", "Counts")</pre>
unique_mods
## # A tibble: 38 x 3
## # Groups: Manufacturer, Model [38]
     Manufacturer Model Counts
##
     <chr> <chr>
                                     <int>
## 1 audi a4
## 2 audi a4 quattro
## 3 audi a6 quattro
                                         7
                                          8
## 4 chevrolet c1500 suburban 2wd
## 5 chevrolet corvette
## 6 chevrolet k1500 tahoe 4wd
                                          4
## 7 chevrolet malibu
                                          5
## 8 dodge caravan 2wd
## 9 dodge
                 dakota pickup 4wd
                                          8
            durango 4wd
## 10 dodge
                                          6
## # ... with 28 more rows
# b. Graph the result by using plot() and ggplot().
# Write the codes and its result.
qplot(model, data = mpg,geom = "bar", fill=manufacturer)
```

Warning: 'qplot()' was deprecated in ggplot2 3.4.0.



ggplot(mpg, aes(model, manufacturer)) + geom_point()



3. Same dataset will be used. You are going to show the relationship of the model and the manufacturer.

```
mpgdata <- mpg
manufmod <- mpgdata %>% group_by(manufacturer, model) %>%
distinct() %>% count()
manufmod
```

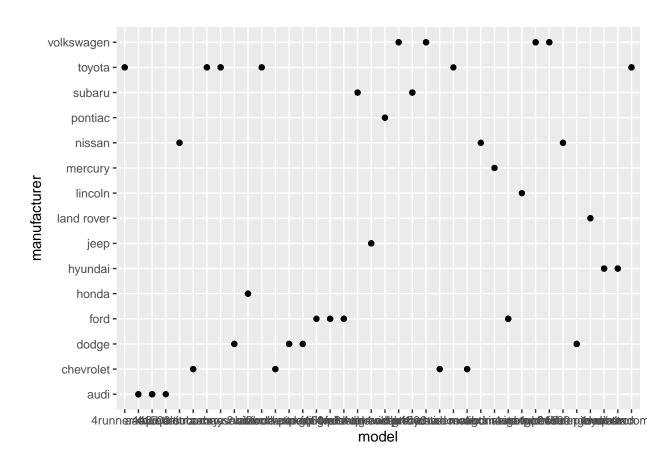
```
## # A tibble: 38 x 3
## # Groups:
              manufacturer, model [38]
     manufacturer model
                                         n
##
     <chr>
                 <chr>
                                     <int>
##
   1 audi
                  a4
##
   2 audi
                 a4 quattro
                                         8
   3 audi
                 a6 quattro
## 4 chevrolet
                 c1500 suburban 2wd
## 5 chevrolet
                  corvette
                                         5
## 6 chevrolet k1500 tahoe 4wd
##
  7 chevrolet
                  malibu
                                         5
   8 dodge
                                         9
##
                  caravan 2wd
  9 dodge
                  dakota pickup 4wd
                                         8
##
## 10 dodge
                                         6
                  durango 4wd
## # ... with 28 more rows
```

colnames(manufmod) <- c("Manufacturer", "Model") manufmod</pre>

```
## # A tibble: 38 x 3
              Manufacturer, Model [38]
## # Groups:
     Manufacturer Model
##
##
     <chr>
                  <chr>
                                    <int>
   1 audi
                  a4
##
   2 audi
                a4 quattro
                                        8
##
  3 audi
                                        3
##
                a6 quattro
## 4 chevrolet c1500 suburban 2wd
                                        4
## 5 chevrolet
                 corvette
                                        5
## 6 chevrolet k1500 tahoe 4wd
                                        4
## 7 chevrolet malibu
##
  8 dodge
                  caravan 2wd
                                        9
## 9 dodge
                  dakota pickup 4wd
                                        8
## 10 dodge
                  durango 4wd
                                        6
## # ... with 28 more rows
```

a. What does ggplot(mpg, aes(model, manufacturer)) + geom_point() show?

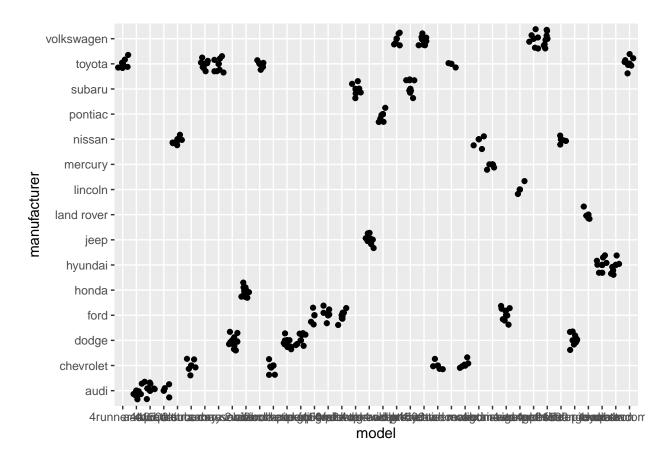
ggplot(mpg, aes(model, manufacturer)) + geom_point()



#geometric point graph of mpg(model and manufacturer)

b. For you, is it useful? If not, how could you modify the data to make it # more informative?

```
ggplot(mpg, aes(model, manufacturer)) +
  geom_point() +
  geom_jitter()
```



4. Using the pipe (%>%), group the model and get the number of cars per model.

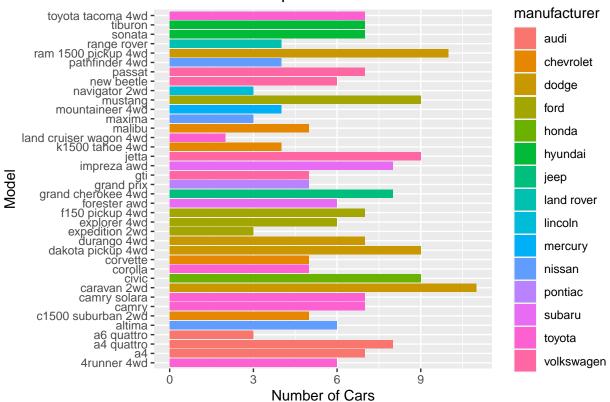
Show codes and its result.

mpgdataset <- mpgdata %>% group_by(model) %>% count()
mpgdataset

```
## # A tibble: 38 x 2
## # Groups: model [38]
      model
##
                             n
##
      <chr>
                         <int>
   1 4runner 4wd
##
                             6
##
    2 a4
                             7
## 3 a4 quattro
                             8
## 4 a6 quattro
                             3
## 5 altima
                             6
```

```
## 6 c1500 suburban 2wd
## 7 camry
## 8 camry solara
                            7
## 9 caravan 2wd
                           11
## 10 civic
                            9
## # ... with 28 more rows
colnames(mpgdataset) <- c("Model", "Counts")</pre>
mpgdataset
## # A tibble: 38 x 2
## # Groups: Model [38]
##
     Model
                        Counts
     <chr>
                         <int>
##
## 1 4runner 4wd
## 2 a4
                             7
## 3 a4 quattro
                             8
## 4 a6 quattro
## 5 altima
                             6
## 6 c1500 suburban 2wd
                             5
## 7 camry
                             7
## 8 camry solara
                             7
## 9 caravan 2wd
                            11
## 10 civic
                             9
## # ... with 28 more rows
# a. Plot using the geom_bar() + coord_flip() just like what is shown below.
# Show codes and its result.
qplot(model,data = mpg,main = "Number of Cars per Model", xlab = "Model",
 ylab = "Number of Cars", geom = "bar", fill = manufacturer) +
 coord_flip()
```

Number of Cars per Model



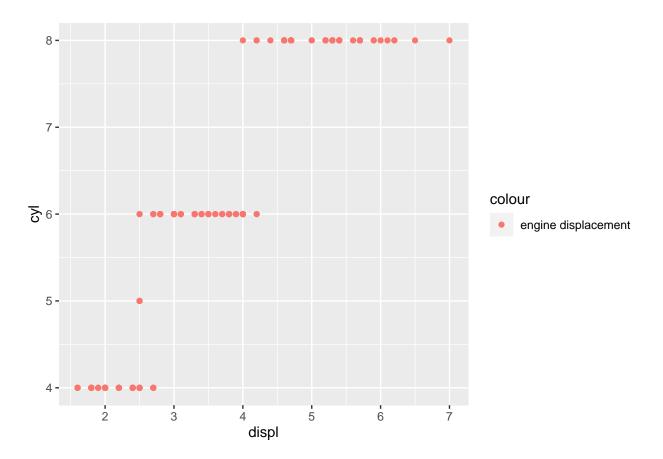
b. Use only the top 20 observations. Show code and results.

```
mpgdataset <- mpg %>% group_by(model)%>%
  tally(sort = TRUE)
mpgdataset
```

```
## # A tibble: 38 x 2
##
      model
                                n
##
      <chr>
                           <int>
##
    1 caravan 2wd
                               11
                               10
##
    2 ram 1500 pickup 4wd
##
    3 civic
                                9
                                9
##
    4 dakota pickup 4wd
##
    5 jetta
                                9
##
                                9
    6 mustang
                                8
##
    7 a4 quattro
    8 grand cherokee 4wd
                                8
##
                                8
##
    9 impreza awd
## 10 a4
                                7
## # ... with 28 more rows
```

```
# 5. Plot the relationship between cyl - number of cylinders and
# displ - engine displacement using geom_point with aesthetic
# colour = engine displacement. Title should be
# "Relationship between No. of Cylinders and Engine Displacement".
```

a. Show the codes and its result.



b. How would you describe its relationship?

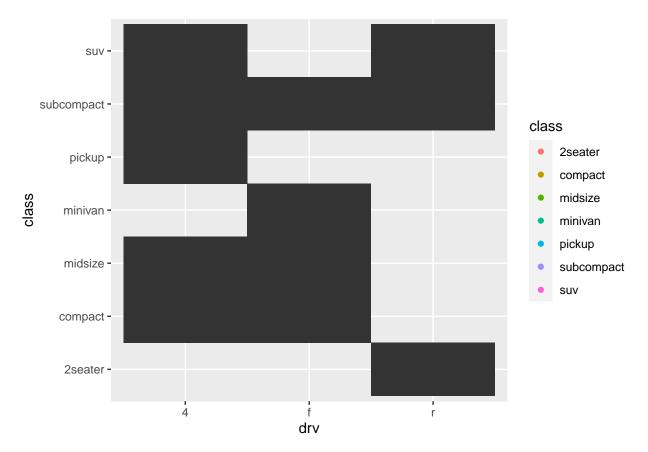
```
# Answer:
# Based on my data, the relationship between cyl and displ is shown through
# the jittered graph and the pink dots in a horizontal position represent
# the engine displacement.
```

```
# 6. Get the total number of observations for drv - type of drive train
# (f = front-wheel drive, r = rear wheel drive, 4 = 4wd) and
# class - type of class (Example: suv, 2seater, etc.).
```

Plot using the geom_tile() where the number of observations for class be
used as a fill for aesthetics.

a. Show the codes and its result for the narrative in #6.

```
ggplot(data = mpg, mapping = aes(x = drv, y = class)) +
  geom_point(mapping=aes(color=class)) +
  geom_tile()
```



```
# b. Interpret the result.

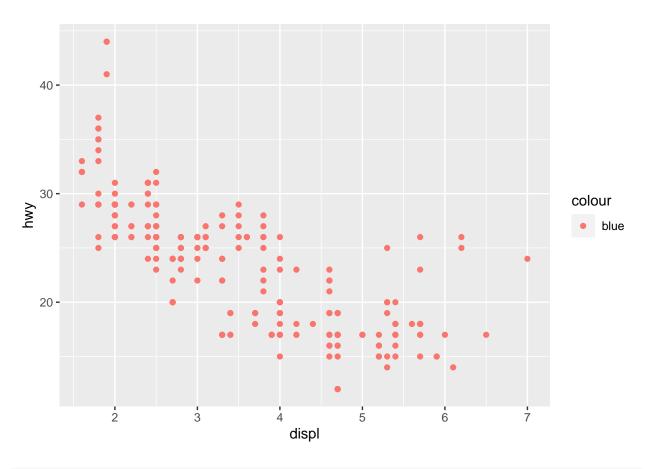
# Answer:

# Based on the mapping graph, the drv represents the x-axis, and the class
# represents the y-axis. As you noticed, the areas in the graph that are
# mapped are occupied by black shades.
```

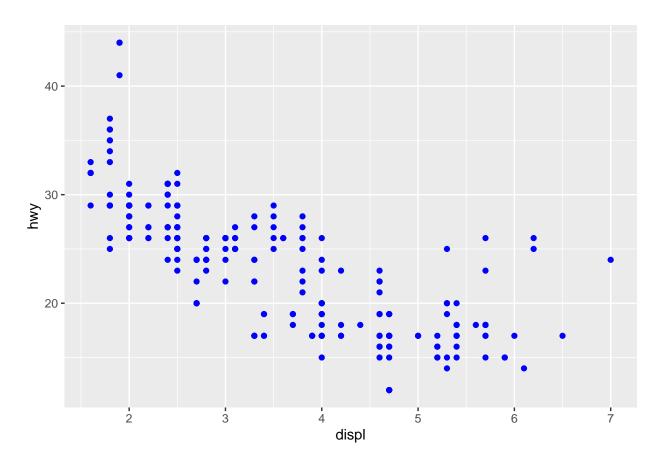
7. Discuss the difference between these codes.

Its outputs for each are shown below.

```
# Code #1
ggplot(data = mpg) +
geom_point(mapping = aes(x = displ, y = hwy, colour = "blue"))
```



```
# Code #2
ggplot(data = mpg) +
geom_point(mapping = aes(x = displ, y = hwy), colour = "blue")
```



#8. Try to run the command?mpg. What is the result of this command?

?mpg

starting httpd help server ... done

```
# Answer:
# The result of the command shows the data on the help tab about fuel economy
# from 1999 to 2008 for 38 popular models.
```

```
# a. Which variables from mpg dataset are categorical?

# Answer:
# The categorical variables in the mpg dataset are manufacturer, model,
# trans (type of transmission), drv (front-wheel drive, rear-wheel, 4wd),
# fl (fuel type), and class (type of car).
```

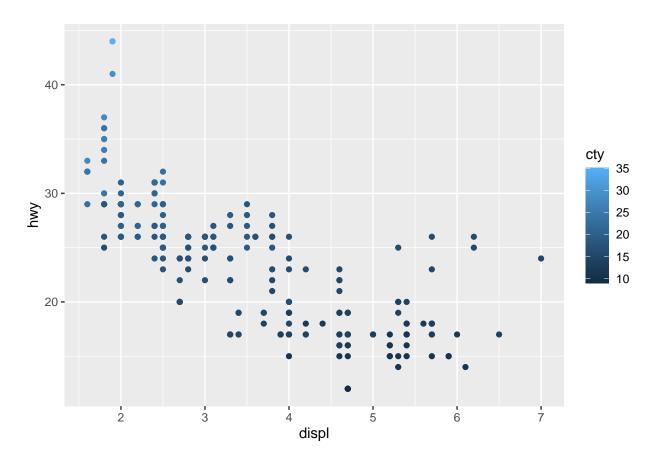
b. Which are continuous variables? # Answer: # In contrast, the continuous variables in the mpg dataset are # displ (engine displacement, in litres), year (year of manufacture), # cyl (number of cylinders), cty (city miles per gallon), # and hwy (highway miles per gallon).

```
# c. Plot the relationship between displ (engine displacement) and hwy

# (highway miles per gallon). Mapped it with a continuous variable you have

identified in #5-b. What is its result? Why it produced such output?
```

```
# Code:
ggplot(mpg, aes(x = displ, y = hwy, colour = cty)) + geom_point()
```

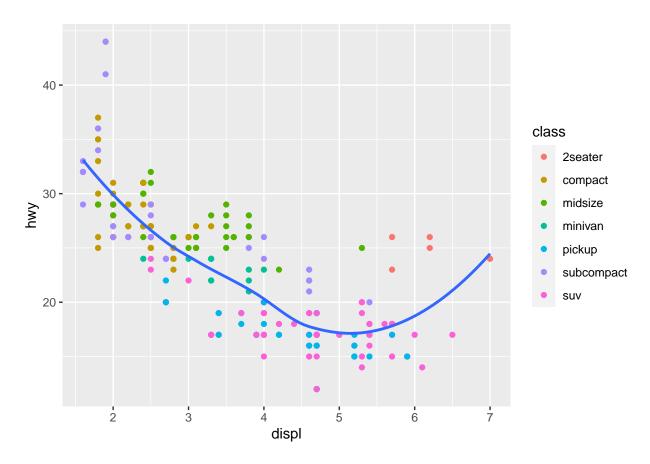


```
# Answer:
# City miles per gallon, or cty, is a continuous variable.
# The continuous variable employs a scale that ranges from light to
# dark blue instead of distinct colors.
```

```
# 9. Plot the relationship between displ (engine displacement) and hwy
# (highway miles per gallon) using geom_point(). Add a trend line over the
# existing plot using geom_smooth() with se = FALSE.
# Default method is "loess"
```

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
geom_point(mapping=aes(color=class)) +
geom_smooth(se = FALSE)
```

'geom_smooth()' using method = 'loess' and formula = 'y ~ x'



10. Using the relationship of displ and hwy, add a trend line over
existing plot. Set these = FALSE to remove the confidence interval and
method = lm to check for linear modeling.

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy, color = class)) +
  geom_point() +
  geom_smooth(se = FALSE)
```

```
## 'geom_smooth()' using method = 'loess' and formula = 'y ~ x'

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 5.6935

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.5065

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 0

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 0.65044
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = \#\# parametric, : pseudoinverse used at 4.008
```

Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
parametric, : neighborhood radius 0.708

Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
parametric, : reciprocal condition number 0

Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
parametric, : There are other near singularities as well. 0.25

