

Rworksheet_Delgado#6

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Worksheet-6 Worksheet for R Programming

```
library(dplyr)
```

```
##
```

```
## 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
```

```
library(ggplot2)
```

```
mpg1 <- as.data.frame(mpg)
```

```
mpg1
```

```
##      manufacturer      model displ  year  cyl    trans  drv  cty  hwy
## 1         audi          a4    1.8 1999    4  auto(l5)  f   18   29
## 2         audi          a4    1.8 1999    4 manual(m5)  f   21   29
## 3         audi          a4    2.0 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(l5)  f   16   26
## 6         audi          a4    2.8 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(l5)  4   16   25
## 10        audi      a4 quattro  2.0 2008    4 manual(m6)  4   20   28
## 11        audi      a4 quattro  2.0 2008    4  auto(s6)  4   19   27
## 12        audi      a4 quattro  2.8 1999    6  auto(l5)  4   15   25
## 13        audi      a4 quattro  2.8 1999    6 manual(m5)  4   17   25
## 14        audi      a4 quattro  3.1 2008    6  auto(s6)  4   17   25
## 15        audi      a4 quattro  3.1 2008    6 manual(m6)  4   15   25
## 16        audi      a6 quattro  2.8 1999    6  auto(l5)  4   15   24
## 17        audi      a6 quattro  3.1 2008    6  auto(s6)  4   17   25
## 18        audi      a6 quattro  4.2 2008    8  auto(s6)  4   16   23
## 19   chevrolet    c1500 suburban 2wd  5.3 2008    8  auto(l4)  r   14   20
## 20   chevrolet    c1500 suburban 2wd  5.3 2008    8  auto(l4)  r   11   15
## 21   chevrolet    c1500 suburban 2wd  5.3 2008    8  auto(l4)  r   14   20
```

## 22	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(l4)	r	13	17
## 23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(l4)	r	12	17
## 24	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16	26
## 25	chevrolet	corvette	5.7	1999	8	auto(l4)	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(l4)	4	14	19
## 30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	11	14
## 31	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(l4)	4	11	15
## 32	chevrolet	k1500 tahoe 4wd	6.5	1999	8	auto(l4)	4	14	17
## 33	chevrolet	malibu	2.4	1999	4	auto(l4)	f	19	27
## 34	chevrolet	malibu	2.4	2008	4	auto(l4)	f	22	30
## 35	chevrolet	malibu	3.1	1999	6	auto(l4)	f	18	26
## 36	chevrolet	malibu	3.5	2008	6	auto(l4)	f	18	29
## 37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17	26
## 38	dodge	caravan 2wd	2.4	1999	4	auto(l3)	f	18	24
## 39	dodge	caravan 2wd	3.0	1999	6	auto(l4)	f	17	24
## 40	dodge	caravan 2wd	3.3	1999	6	auto(l4)	f	16	22
## 41	dodge	caravan 2wd	3.3	1999	6	auto(l4)	f	16	22
## 42	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24
## 43	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24
## 44	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	11	17
## 45	dodge	caravan 2wd	3.8	1999	6	auto(l4)	f	15	22
## 46	dodge	caravan 2wd	3.8	1999	6	auto(l4)	f	15	21
## 47	dodge	caravan 2wd	3.8	2008	6	auto(l6)	f	16	23
## 48	dodge	caravan 2wd	4.0	2008	6	auto(l6)	f	16	23
## 49	dodge	dakota pickup 4wd	3.7	2008	6	manual(m6)	4	15	19
## 50	dodge	dakota pickup 4wd	3.7	2008	6	auto(l4)	4	14	18
## 51	dodge	dakota pickup 4wd	3.9	1999	6	auto(l4)	4	13	17
## 52	dodge	dakota pickup 4wd	3.9	1999	6	manual(m5)	4	14	17
## 53	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
## 54	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
## 55	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
## 56	dodge	dakota pickup 4wd	5.2	1999	8	manual(m5)	4	11	17
## 57	dodge	dakota pickup 4wd	5.2	1999	8	auto(l4)	4	11	15
## 58	dodge	durango 4wd	3.9	1999	6	auto(l4)	4	13	17
## 59	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
## 60	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	9	12
## 61	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
## 62	dodge	durango 4wd	5.2	1999	8	auto(l4)	4	11	16
## 63	dodge	durango 4wd	5.7	2008	8	auto(l5)	4	13	18
## 64	dodge	durango 4wd	5.9	1999	8	auto(l4)	4	11	15
## 65	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
## 66	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
## 67	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
## 68	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
## 69	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
## 70	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	9	12
## 71	dodge	ram 1500 pickup 4wd	5.2	1999	8	auto(l4)	4	11	15
## 72	dodge	ram 1500 pickup 4wd	5.2	1999	8	manual(m5)	4	11	16
## 73	dodge	ram 1500 pickup 4wd	5.7	2008	8	auto(l5)	4	13	17
## 74	dodge	ram 1500 pickup 4wd	5.9	1999	8	auto(l4)	4	11	15
## 75	ford	expedition 2wd	4.6	1999	8	auto(l4)	r	11	17

## 76	ford	expedition 2wd	5.4	1999	8	auto(14)	r	11	17
## 77	ford	expedition 2wd	5.4	2008	8	auto(16)	r	12	18
## 78	ford	explorer 4wd	4.0	1999	6	auto(15)	4	14	17
## 79	ford	explorer 4wd	4.0	1999	6	manual(m5)	4	15	19
## 80	ford	explorer 4wd	4.0	1999	6	auto(15)	4	14	17
## 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	8	auto(14)	4	13	17
## 84	ford	f150 pickup 4wd	4.2	1999	6	auto(14)	4	14	17
## 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	8	auto(14)	4	13	16
## 88	ford	f150 pickup 4wd	4.6	2008	8	auto(14)	4	13	17
## 89	ford	f150 pickup 4wd	5.4	1999	8	auto(14)	4	11	15
## 90	ford	f150 pickup 4wd	5.4	2008	8	auto(14)	4	13	17
## 91	ford	mustang	3.8	1999	6	manual(m5)	r	18	26
## 92	ford	mustang	3.8	1999	6	auto(14)	r	18	25
## 93	ford	mustang	4.0	2008	6	manual(m5)	r	17	26
## 94	ford	mustang	4.0	2008	6	auto(15)	r	16	24
## 95	ford	mustang	4.6	1999	8	auto(14)	r	15	21
## 96	ford	mustang	4.6	1999	8	manual(m5)	r	15	22
## 97	ford	mustang	4.6	2008	8	manual(m5)	r	15	23
## 98	ford	mustang	4.6	2008	8	auto(15)	r	15	22
## 99	ford	mustang	5.4	2008	8	manual(m6)	r	14	20
## 100	honda	civic	1.6	1999	4	manual(m5)	f	28	33
## 101	honda	civic	1.6	1999	4	auto(14)	f	24	32
## 102	honda	civic	1.6	1999	4	manual(m5)	f	25	32
## 103	honda	civic	1.6	1999	4	manual(m5)	f	23	29
## 104	honda	civic	1.6	1999	4	auto(14)	f	24	32
## 105	honda	civic	1.8	2008	4	manual(m5)	f	26	34
## 106	honda	civic	1.8	2008	4	auto(15)	f	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	hyundai	sonata	2.4	1999	4	auto(14)	f	18	26
## 110	hyundai	sonata	2.4	1999	4	manual(m5)	f	18	27
## 111	hyundai	sonata	2.4	2008	4	auto(14)	f	21	30
## 112	hyundai	sonata	2.4	2008	4	manual(m5)	f	21	31
## 113	hyundai	sonata	2.5	1999	6	auto(14)	f	18	26
## 114	hyundai	sonata	2.5	1999	6	manual(m5)	f	18	26
## 115	hyundai	sonata	3.3	2008	6	auto(15)	f	19	28
## 116	hyundai	tiburon	2.0	1999	4	auto(14)	f	19	26
## 117	hyundai	tiburon	2.0	1999	4	manual(m5)	f	19	29
## 118	hyundai	tiburon	2.0	2008	4	manual(m5)	f	20	28
## 119	hyundai	tiburon	2.0	2008	4	auto(14)	f	20	27
## 120	hyundai	tiburon	2.7	2008	6	auto(14)	f	17	24
## 121	hyundai	tiburon	2.7	2008	6	manual(m6)	f	16	24
## 122	hyundai	tiburon	2.7	2008	6	manual(m5)	f	17	24
## 123	jeep	grand cherokee 4wd	3.0	2008	6	auto(15)	4	17	22
## 124	jeep	grand cherokee 4wd	3.7	2008	6	auto(15)	4	15	19
## 125	jeep	grand cherokee 4wd	4.0	1999	6	auto(14)	4	15	20
## 126	jeep	grand cherokee 4wd	4.7	1999	8	auto(14)	4	14	17
## 127	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	9	12
## 128	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	14	19
## 129	jeep	grand cherokee 4wd	5.7	2008	8	auto(15)	4	13	18

## 130	jeep	grand cherokee 4wd	6.1	2008	8	auto(15)	4	11	14
## 131	land rover	range rover	4.0	1999	8	auto(14)	4	11	15
## 132	land rover	range rover	4.2	2008	8	auto(s6)	4	12	18
## 133	land rover	range rover	4.4	2008	8	auto(s6)	4	12	18
## 134	land rover	range rover	4.6	1999	8	auto(14)	4	11	15
## 135	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11	17
## 136	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11	16
## 137	lincoln	navigator 2wd	5.4	2008	8	auto(16)	r	12	18
## 138	mercury	mountaineer 4wd	4.0	1999	6	auto(15)	4	14	17
## 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	mercury	mountaineer 4wd	5.0	1999	8	auto(14)	4	13	17
## 142	nissan	altima	2.4	1999	4	manual(m5)	f	21	29
## 143	nissan	altima	2.4	1999	4	auto(14)	f	19	27
## 144	nissan	altima	2.5	2008	4	auto(av)	f	23	31
## 145	nissan	altima	2.5	2008	4	manual(m6)	f	23	32
## 146	nissan	altima	3.5	2008	6	manual(m6)	f	19	27
## 147	nissan	altima	3.5	2008	6	auto(av)	f	19	26
## 148	nissan	maxima	3.0	1999	6	auto(14)	f	18	26
## 149	nissan	maxima	3.0	1999	6	manual(m5)	f	19	25
## 150	nissan	maxima	3.5	2008	6	auto(av)	f	19	25
## 151	nissan	pathfinder 4wd	3.3	1999	6	auto(14)	4	14	17
## 152	nissan	pathfinder 4wd	3.3	1999	6	manual(m5)	4	15	17
## 153	nissan	pathfinder 4wd	4.0	2008	6	auto(15)	4	14	20
## 154	nissan	pathfinder 4wd	5.6	2008	8	auto(s5)	4	12	18
## 155	pontiac	grand prix	3.1	1999	6	auto(14)	f	18	26
## 156	pontiac	grand prix	3.8	1999	6	auto(14)	f	16	26
## 157	pontiac	grand prix	3.8	1999	6	auto(14)	f	17	27
## 158	pontiac	grand prix	3.8	2008	6	auto(14)	f	18	28
## 159	pontiac	grand prix	5.3	2008	8	auto(s4)	f	16	25
## 160	subaru	forester awd	2.5	1999	4	manual(m5)	4	18	25
## 161	subaru	forester awd	2.5	1999	4	auto(14)	4	18	24
## 162	subaru	forester awd	2.5	2008	4	manual(m5)	4	20	27
## 163	subaru	forester awd	2.5	2008	4	manual(m5)	4	19	25
## 164	subaru	forester awd	2.5	2008	4	auto(14)	4	20	26
## 165	subaru	forester awd	2.5	2008	4	auto(14)	4	18	23
## 166	subaru	impreza awd	2.2	1999	4	auto(14)	4	21	26
## 167	subaru	impreza awd	2.2	1999	4	manual(m5)	4	19	26
## 168	subaru	impreza awd	2.5	1999	4	manual(m5)	4	19	26
## 169	subaru	impreza awd	2.5	1999	4	auto(14)	4	19	26
## 170	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	25
## 171	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	27
## 172	subaru	impreza awd	2.5	2008	4	manual(m5)	4	19	25
## 173	subaru	impreza awd	2.5	2008	4	manual(m5)	4	20	27
## 174	toyota	4runner 4wd	2.7	1999	4	manual(m5)	4	15	20
## 175	toyota	4runner 4wd	2.7	1999	4	auto(14)	4	16	20
## 176	toyota	4runner 4wd	3.4	1999	6	auto(14)	4	15	19
## 177	toyota	4runner 4wd	3.4	1999	6	manual(m5)	4	15	17
## 178	toyota	4runner 4wd	4.0	2008	6	auto(15)	4	16	20
## 179	toyota	4runner 4wd	4.7	2008	8	auto(15)	4	14	17
## 180	toyota	camry	2.2	1999	4	manual(m5)	f	21	29
## 181	toyota	camry	2.2	1999	4	auto(14)	f	21	27
## 182	toyota	camry	2.4	2008	4	manual(m5)	f	21	31
## 183	toyota	camry	2.4	2008	4	auto(15)	f	21	31

## 184	toyota	camry	3.0	1999	6	auto(l4)	f	18	26
## 185	toyota	camry	3.0	1999	6	manual(m5)	f	18	26
## 186	toyota	camry	3.5	2008	6	auto(s6)	f	19	28
## 187	toyota	camry solara	2.2	1999	4	auto(l4)	f	21	27
## 188	toyota	camry solara	2.2	1999	4	manual(m5)	f	21	29
## 189	toyota	camry solara	2.4	2008	4	manual(m5)	f	21	31
## 190	toyota	camry solara	2.4	2008	4	auto(s5)	f	22	31
## 191	toyota	camry solara	3.0	1999	6	auto(l4)	f	18	26
## 192	toyota	camry solara	3.0	1999	6	manual(m5)	f	18	26
## 193	toyota	camry solara	3.3	2008	6	auto(s5)	f	18	27
## 194	toyota	corolla	1.8	1999	4	auto(l3)	f	24	30
## 195	toyota	corolla	1.8	1999	4	auto(l4)	f	24	33
## 196	toyota	corolla	1.8	1999	4	manual(m5)	f	26	35
## 197	toyota	corolla	1.8	2008	4	manual(m5)	f	28	37
## 198	toyota	corolla	1.8	2008	4	auto(l4)	f	26	35
## 199	toyota	land cruiser wagon 4wd	4.7	1999	8	auto(l4)	4	11	15
## 200	toyota	land cruiser wagon 4wd	5.7	2008	8	auto(s6)	4	13	18
## 201	toyota	toyota tacoma 4wd	2.7	1999	4	manual(m5)	4	15	20
## 202	toyota	toyota tacoma 4wd	2.7	1999	4	auto(l4)	4	16	20
## 203	toyota	toyota tacoma 4wd	2.7	2008	4	manual(m5)	4	17	22
## 204	toyota	toyota tacoma 4wd	3.4	1999	6	manual(m5)	4	15	17
## 205	toyota	toyota tacoma 4wd	3.4	1999	6	auto(l4)	4	15	19
## 206	toyota	toyota tacoma 4wd	4.0	2008	6	manual(m6)	4	15	18
## 207	toyota	toyota tacoma 4wd	4.0	2008	6	auto(l5)	4	16	20
## 208	volkswagen	gti	2.0	1999	4	manual(m5)	f	21	29
## 209	volkswagen	gti	2.0	1999	4	auto(l4)	f	19	26
## 210	volkswagen	gti	2.0	2008	4	manual(m6)	f	21	29
## 211	volkswagen	gti	2.0	2008	4	auto(s6)	f	22	29
## 212	volkswagen	gti	2.8	1999	6	manual(m5)	f	17	24
## 213	volkswagen	jetta	1.9	1999	4	manual(m5)	f	33	44
## 214	volkswagen	jetta	2.0	1999	4	manual(m5)	f	21	29
## 215	volkswagen	jetta	2.0	1999	4	auto(l4)	f	19	26
## 216	volkswagen	jetta	2.0	2008	4	auto(s6)	f	22	29
## 217	volkswagen	jetta	2.0	2008	4	manual(m6)	f	21	29
## 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	jetta	2.8	1999	6	auto(l4)	f	16	23
## 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	4	auto(l4)	f	29	41
## 224	volkswagen	new beetle	2.0	1999	4	manual(m5)	f	21	29
## 225	volkswagen	new beetle	2.0	1999	4	auto(l4)	f	19	26
## 226	volkswagen	new beetle	2.5	2008	5	manual(m5)	f	20	28
## 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	volkswagen	passat	1.8	1999	4	auto(l5)	f	18	29
## 230	volkswagen	passat	2.0	2008	4	auto(s6)	f	19	28
## 231	volkswagen	passat	2.0	2008	4	manual(m6)	f	21	29
## 232	volkswagen	passat	2.8	1999	6	auto(l5)	f	16	26
## 233	volkswagen	passat	2.8	1999	6	manual(m5)	f	18	26
## 234	volkswagen	passat	3.6	2008	6	auto(s6)	f	17	26
##	fl	class							
## 1	p	compact							
## 2	p	compact							

## 3	p	compact
## 4	p	compact
## 5	p	compact
## 6	p	compact
## 7	p	compact
## 8	p	compact
## 9	p	compact
## 10	p	compact
## 11	p	compact
## 12	p	compact
## 13	p	compact
## 14	p	compact
## 15	p	compact
## 16	p	midsize
## 17	p	midsize
## 18	p	midsize
## 19	r	suv
## 20	e	suv
## 21	r	suv
## 22	r	suv
## 23	r	suv
## 24	p	2seater
## 25	p	2seater
## 26	p	2seater
## 27	p	2seater
## 28	p	2seater
## 29	r	suv
## 30	e	suv
## 31	r	suv
## 32	d	suv
## 33	r	midsize
## 34	r	midsize
## 35	r	midsize
## 36	r	midsize
## 37	r	midsize
## 38	r	minivan
## 39	r	minivan
## 40	r	minivan
## 41	r	minivan
## 42	r	minivan
## 43	r	minivan
## 44	e	minivan
## 45	r	minivan
## 46	r	minivan
## 47	r	minivan
## 48	r	minivan
## 49	r	pickup
## 50	r	pickup
## 51	r	pickup
## 52	r	pickup
## 53	r	pickup
## 54	r	pickup
## 55	e	pickup
## 56	r	pickup

```

## 57  r    pickup
## 58  r      suv
## 59  r      suv
## 60  e      suv
## 61  r      suv
## 62  r      suv
## 63  r      suv
## 64  r      suv
## 65  r    pickup
## 66  e    pickup
## 67  r    pickup
## 68  r    pickup
## 69  r    pickup
## 70  e    pickup
## 71  r    pickup
## 72  r    pickup
## 73  r    pickup
## 74  r    pickup
## 75  r      suv
## 76  r      suv
## 77  r      suv
## 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  r    pickup
## 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
## 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 r    midsize
## 113 r    midsize
## 114 r    midsize
## 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 e      suv
## 128 r      suv
## 129 r      suv
## 130 p      suv
## 131 p      suv
## 132 r      suv
## 133 r      suv
## 134 p      suv
## 135 r      suv
## 136 p      suv
## 137 r      suv
## 138 r      suv
## 139 r      suv
## 140 r      suv
## 141 r      suv
## 142 r    compact
## 143 r    compact
## 144 r    midsize
## 145 r    midsize
## 146 p    midsize
## 147 p    midsize
## 148 r    midsize
## 149 r    midsize
## 150 p    midsize
## 151 r      suv
## 152 r      suv
## 153 p      suv
## 154 p      suv
## 155 r    midsize
## 156 p    midsize
## 157 r    midsize
## 158 r    midsize
## 159 p    midsize
## 160 r      suv
## 161 r      suv
## 162 r      suv
## 163 p      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 r      compact
## 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 r      midsize
## 186 r      midsize
## 187 r      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 r      compact
## 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 r      pickup
## 206 r      pickup
## 207 r      pickup
## 208 r      compact
## 209 r      compact
## 210 p      compact
## 211 p      compact
## 212 r      compact
## 213 d      compact
## 214 r      compact
## 215 r      compact
## 216 p      compact
## 217 p      compact
## 218 r      compact

```

```
## 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 p midsize
## 229 p midsize
## 230 p midsize
## 231 p midsize
## 232 p midsize
## 233 p midsize
## 234 p midsize
```

1. How many columns are in mpg dataset? How about the number of rows? Show the codes and its result.
 answer - it has 11 columns and a rows of 234

```
mpg_data <- glimpse(mpg1)
```

```
## Rows: 234
## Columns: 11
## $ manufacturer <chr> "audi", "audi", "audi", "audi", "audi", "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.~
## $ year <int> 1999, 1999, 2008, 2008, 1999, 1999, 2008, 1999, 1999, 200~
## $ cyl <int> 4, 4, 4, 4, 6, 6, 6, 4, 4, 4, 4, 6, 6, 6, 6, 6, 6, 8, 8, ~
## $ trans <chr> "auto(l5)", "manual(m5)", "manual(m6)", "auto(av)", "auto~
## $ drv <chr> "f", "f", "f", "f", "f", "f", "f", "f", "4", "4", "4", "4", "4~
## $ 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> "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p~
## $ class <chr> "compact", "compact", "compact", "compact", "compact", "c~
```

```
mpg_data
```

##	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy
## 1	audi	a4	1.8	1999	4	auto(l5)	f	18	29
## 2	audi	a4	1.8	1999	4	manual(m5)	f	21	29
## 3	audi	a4	2.0	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(l5)	f	16	26
## 6	audi	a4	2.8	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(l5)	4	16	25
## 10	audi	a4 quattro	2.0	2008	4	manual(m6)	4	20	28
## 11	audi	a4 quattro	2.0	2008	4	auto(s6)	4	19	27
## 12	audi	a4 quattro	2.8	1999	6	auto(l5)	4	15	25
## 13	audi	a4 quattro	2.8	1999	6	manual(m5)	4	17	25
## 14	audi	a4 quattro	3.1	2008	6	auto(s6)	4	17	25
## 15	audi	a4 quattro	3.1	2008	6	manual(m6)	4	15	25
## 16	audi	a6 quattro	2.8	1999	6	auto(l5)	4	15	24

## 17	audi	a6 quattro	3.1	2008	6	auto(s6)	4	17	25
## 18	audi	a6 quattro	4.2	2008	8	auto(s6)	4	16	23
## 19	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14	20
## 20	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	11	15
## 21	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14	20
## 22	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(l4)	r	13	17
## 23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(l4)	r	12	17
## 24	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16	26
## 25	chevrolet	corvette	5.7	1999	8	auto(l4)	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(l4)	4	14	19
## 30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	11	14
## 31	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(l4)	4	11	15
## 32	chevrolet	k1500 tahoe 4wd	6.5	1999	8	auto(l4)	4	14	17
## 33	chevrolet	malibu	2.4	1999	4	auto(l4)	f	19	27
## 34	chevrolet	malibu	2.4	2008	4	auto(l4)	f	22	30
## 35	chevrolet	malibu	3.1	1999	6	auto(l4)	f	18	26
## 36	chevrolet	malibu	3.5	2008	6	auto(l4)	f	18	29
## 37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17	26
## 38	dodge	caravan 2wd	2.4	1999	4	auto(l3)	f	18	24
## 39	dodge	caravan 2wd	3.0	1999	6	auto(l4)	f	17	24
## 40	dodge	caravan 2wd	3.3	1999	6	auto(l4)	f	16	22
## 41	dodge	caravan 2wd	3.3	1999	6	auto(l4)	f	16	22
## 42	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24
## 43	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24
## 44	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	11	17
## 45	dodge	caravan 2wd	3.8	1999	6	auto(l4)	f	15	22
## 46	dodge	caravan 2wd	3.8	1999	6	auto(l4)	f	15	21
## 47	dodge	caravan 2wd	3.8	2008	6	auto(l6)	f	16	23
## 48	dodge	caravan 2wd	4.0	2008	6	auto(l6)	f	16	23
## 49	dodge	dakota pickup 4wd	3.7	2008	6	manual(m6)	4	15	19
## 50	dodge	dakota pickup 4wd	3.7	2008	6	auto(l4)	4	14	18
## 51	dodge	dakota pickup 4wd	3.9	1999	6	auto(l4)	4	13	17
## 52	dodge	dakota pickup 4wd	3.9	1999	6	manual(m5)	4	14	17
## 53	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
## 54	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
## 55	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
## 56	dodge	dakota pickup 4wd	5.2	1999	8	manual(m5)	4	11	17
## 57	dodge	dakota pickup 4wd	5.2	1999	8	auto(l4)	4	11	15
## 58	dodge	durango 4wd	3.9	1999	6	auto(l4)	4	13	17
## 59	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
## 60	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	9	12
## 61	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
## 62	dodge	durango 4wd	5.2	1999	8	auto(l4)	4	11	16
## 63	dodge	durango 4wd	5.7	2008	8	auto(l5)	4	13	18
## 64	dodge	durango 4wd	5.9	1999	8	auto(l4)	4	11	15
## 65	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
## 66	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
## 67	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
## 68	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
## 69	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
## 70	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	9	12

## 71	dodge	ram 1500 pickup 4wd	5.2	1999	8	auto(14)	4	11	15
## 72	dodge	ram 1500 pickup 4wd	5.2	1999	8	manual(m5)	4	11	16
## 73	dodge	ram 1500 pickup 4wd	5.7	2008	8	auto(15)	4	13	17
## 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	ford	expedition 2wd	5.4	1999	8	auto(14)	r	11	17
## 77	ford	expedition 2wd	5.4	2008	8	auto(16)	r	12	18
## 78	ford	explorer 4wd	4.0	1999	6	auto(15)	4	14	17
## 79	ford	explorer 4wd	4.0	1999	6	manual(m5)	4	15	19
## 80	ford	explorer 4wd	4.0	1999	6	auto(15)	4	14	17
## 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	8	auto(14)	4	13	17
## 84	ford	f150 pickup 4wd	4.2	1999	6	auto(14)	4	14	17
## 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	8	auto(14)	4	13	16
## 88	ford	f150 pickup 4wd	4.6	2008	8	auto(14)	4	13	17
## 89	ford	f150 pickup 4wd	5.4	1999	8	auto(14)	4	11	15
## 90	ford	f150 pickup 4wd	5.4	2008	8	auto(14)	4	13	17
## 91	ford	mustang	3.8	1999	6	manual(m5)	r	18	26
## 92	ford	mustang	3.8	1999	6	auto(14)	r	18	25
## 93	ford	mustang	4.0	2008	6	manual(m5)	r	17	26
## 94	ford	mustang	4.0	2008	6	auto(15)	r	16	24
## 95	ford	mustang	4.6	1999	8	auto(14)	r	15	21
## 96	ford	mustang	4.6	1999	8	manual(m5)	r	15	22
## 97	ford	mustang	4.6	2008	8	manual(m5)	r	15	23
## 98	ford	mustang	4.6	2008	8	auto(15)	r	15	22
## 99	ford	mustang	5.4	2008	8	manual(m6)	r	14	20
## 100	honda	civic	1.6	1999	4	manual(m5)	f	28	33
## 101	honda	civic	1.6	1999	4	auto(14)	f	24	32
## 102	honda	civic	1.6	1999	4	manual(m5)	f	25	32
## 103	honda	civic	1.6	1999	4	manual(m5)	f	23	29
## 104	honda	civic	1.6	1999	4	auto(14)	f	24	32
## 105	honda	civic	1.8	2008	4	manual(m5)	f	26	34
## 106	honda	civic	1.8	2008	4	auto(15)	f	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	hyundai	sonata	2.4	1999	4	auto(14)	f	18	26
## 110	hyundai	sonata	2.4	1999	4	manual(m5)	f	18	27
## 111	hyundai	sonata	2.4	2008	4	auto(14)	f	21	30
## 112	hyundai	sonata	2.4	2008	4	manual(m5)	f	21	31
## 113	hyundai	sonata	2.5	1999	6	auto(14)	f	18	26
## 114	hyundai	sonata	2.5	1999	6	manual(m5)	f	18	26
## 115	hyundai	sonata	3.3	2008	6	auto(15)	f	19	28
## 116	hyundai	tiburon	2.0	1999	4	auto(14)	f	19	26
## 117	hyundai	tiburon	2.0	1999	4	manual(m5)	f	19	29
## 118	hyundai	tiburon	2.0	2008	4	manual(m5)	f	20	28
## 119	hyundai	tiburon	2.0	2008	4	auto(14)	f	20	27
## 120	hyundai	tiburon	2.7	2008	6	auto(14)	f	17	24
## 121	hyundai	tiburon	2.7	2008	6	manual(m6)	f	16	24
## 122	hyundai	tiburon	2.7	2008	6	manual(m5)	f	17	24
## 123	jeep	grand cherokee 4wd	3.0	2008	6	auto(15)	4	17	22
## 124	jeep	grand cherokee 4wd	3.7	2008	6	auto(15)	4	15	19

## 125	jeep	grand cherokee 4wd	4.0	1999	6	auto(14)	4	15	20
## 126	jeep	grand cherokee 4wd	4.7	1999	8	auto(14)	4	14	17
## 127	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	9	12
## 128	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	14	19
## 129	jeep	grand cherokee 4wd	5.7	2008	8	auto(15)	4	13	18
## 130	jeep	grand cherokee 4wd	6.1	2008	8	auto(15)	4	11	14
## 131	land rover	range rover	4.0	1999	8	auto(14)	4	11	15
## 132	land rover	range rover	4.2	2008	8	auto(s6)	4	12	18
## 133	land rover	range rover	4.4	2008	8	auto(s6)	4	12	18
## 134	land rover	range rover	4.6	1999	8	auto(14)	4	11	15
## 135	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11	17
## 136	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11	16
## 137	lincoln	navigator 2wd	5.4	2008	8	auto(16)	r	12	18
## 138	mercury	mountaineer 4wd	4.0	1999	6	auto(15)	4	14	17
## 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	mercury	mountaineer 4wd	5.0	1999	8	auto(14)	4	13	17
## 142	nissan	altima	2.4	1999	4	manual(m5)	f	21	29
## 143	nissan	altima	2.4	1999	4	auto(14)	f	19	27
## 144	nissan	altima	2.5	2008	4	auto(av)	f	23	31
## 145	nissan	altima	2.5	2008	4	manual(m6)	f	23	32
## 146	nissan	altima	3.5	2008	6	manual(m6)	f	19	27
## 147	nissan	altima	3.5	2008	6	auto(av)	f	19	26
## 148	nissan	maxima	3.0	1999	6	auto(14)	f	18	26
## 149	nissan	maxima	3.0	1999	6	manual(m5)	f	19	25
## 150	nissan	maxima	3.5	2008	6	auto(av)	f	19	25
## 151	nissan	pathfinder 4wd	3.3	1999	6	auto(14)	4	14	17
## 152	nissan	pathfinder 4wd	3.3	1999	6	manual(m5)	4	15	17
## 153	nissan	pathfinder 4wd	4.0	2008	6	auto(15)	4	14	20
## 154	nissan	pathfinder 4wd	5.6	2008	8	auto(s5)	4	12	18
## 155	pontiac	grand prix	3.1	1999	6	auto(14)	f	18	26
## 156	pontiac	grand prix	3.8	1999	6	auto(14)	f	16	26
## 157	pontiac	grand prix	3.8	1999	6	auto(14)	f	17	27
## 158	pontiac	grand prix	3.8	2008	6	auto(14)	f	18	28
## 159	pontiac	grand prix	5.3	2008	8	auto(s4)	f	16	25
## 160	subaru	forester awd	2.5	1999	4	manual(m5)	4	18	25
## 161	subaru	forester awd	2.5	1999	4	auto(14)	4	18	24
## 162	subaru	forester awd	2.5	2008	4	manual(m5)	4	20	27
## 163	subaru	forester awd	2.5	2008	4	manual(m5)	4	19	25
## 164	subaru	forester awd	2.5	2008	4	auto(14)	4	20	26
## 165	subaru	forester awd	2.5	2008	4	auto(14)	4	18	23
## 166	subaru	impreza awd	2.2	1999	4	auto(14)	4	21	26
## 167	subaru	impreza awd	2.2	1999	4	manual(m5)	4	19	26
## 168	subaru	impreza awd	2.5	1999	4	manual(m5)	4	19	26
## 169	subaru	impreza awd	2.5	1999	4	auto(14)	4	19	26
## 170	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	25
## 171	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	27
## 172	subaru	impreza awd	2.5	2008	4	manual(m5)	4	19	25
## 173	subaru	impreza awd	2.5	2008	4	manual(m5)	4	20	27
## 174	toyota	4runner 4wd	2.7	1999	4	manual(m5)	4	15	20
## 175	toyota	4runner 4wd	2.7	1999	4	auto(14)	4	16	20
## 176	toyota	4runner 4wd	3.4	1999	6	auto(14)	4	15	19
## 177	toyota	4runner 4wd	3.4	1999	6	manual(m5)	4	15	17
## 178	toyota	4runner 4wd	4.0	2008	6	auto(15)	4	16	20

## 179	toyota	4runner 4wd	4.7 2008	8	auto(15)	4	14	17
## 180	toyota	camry	2.2 1999	4	manual(m5)	f	21	29
## 181	toyota	camry	2.2 1999	4	auto(14)	f	21	27
## 182	toyota	camry	2.4 2008	4	manual(m5)	f	21	31
## 183	toyota	camry	2.4 2008	4	auto(15)	f	21	31
## 184	toyota	camry	3.0 1999	6	auto(14)	f	18	26
## 185	toyota	camry	3.0 1999	6	manual(m5)	f	18	26
## 186	toyota	camry	3.5 2008	6	auto(s6)	f	19	28
## 187	toyota	camry solara	2.2 1999	4	auto(14)	f	21	27
## 188	toyota	camry solara	2.2 1999	4	manual(m5)	f	21	29
## 189	toyota	camry solara	2.4 2008	4	manual(m5)	f	21	31
## 190	toyota	camry solara	2.4 2008	4	auto(s5)	f	22	31
## 191	toyota	camry solara	3.0 1999	6	auto(14)	f	18	26
## 192	toyota	camry solara	3.0 1999	6	manual(m5)	f	18	26
## 193	toyota	camry solara	3.3 2008	6	auto(s5)	f	18	27
## 194	toyota	corolla	1.8 1999	4	auto(13)	f	24	30
## 195	toyota	corolla	1.8 1999	4	auto(14)	f	24	33
## 196	toyota	corolla	1.8 1999	4	manual(m5)	f	26	35
## 197	toyota	corolla	1.8 2008	4	manual(m5)	f	28	37
## 198	toyota	corolla	1.8 2008	4	auto(14)	f	26	35
## 199	toyota	land cruiser wagon 4wd	4.7 1999	8	auto(14)	4	11	15
## 200	toyota	land cruiser wagon 4wd	5.7 2008	8	auto(s6)	4	13	18
## 201	toyota	toyota tacoma 4wd	2.7 1999	4	manual(m5)	4	15	20
## 202	toyota	toyota tacoma 4wd	2.7 1999	4	auto(14)	4	16	20
## 203	toyota	toyota tacoma 4wd	2.7 2008	4	manual(m5)	4	17	22
## 204	toyota	toyota tacoma 4wd	3.4 1999	6	manual(m5)	4	15	17
## 205	toyota	toyota tacoma 4wd	3.4 1999	6	auto(14)	4	15	19
## 206	toyota	toyota tacoma 4wd	4.0 2008	6	manual(m6)	4	15	18
## 207	toyota	toyota tacoma 4wd	4.0 2008	6	auto(15)	4	16	20
## 208	volkswagen	gti	2.0 1999	4	manual(m5)	f	21	29
## 209	volkswagen	gti	2.0 1999	4	auto(14)	f	19	26
## 210	volkswagen	gti	2.0 2008	4	manual(m6)	f	21	29
## 211	volkswagen	gti	2.0 2008	4	auto(s6)	f	22	29
## 212	volkswagen	gti	2.8 1999	6	manual(m5)	f	17	24
## 213	volkswagen	jetta	1.9 1999	4	manual(m5)	f	33	44
## 214	volkswagen	jetta	2.0 1999	4	manual(m5)	f	21	29
## 215	volkswagen	jetta	2.0 1999	4	auto(14)	f	19	26
## 216	volkswagen	jetta	2.0 2008	4	auto(s6)	f	22	29
## 217	volkswagen	jetta	2.0 2008	4	manual(m6)	f	21	29
## 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	jetta	2.8 1999	6	auto(14)	f	16	23
## 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	4	auto(14)	f	29	41
## 224	volkswagen	new beetle	2.0 1999	4	manual(m5)	f	21	29
## 225	volkswagen	new beetle	2.0 1999	4	auto(14)	f	19	26
## 226	volkswagen	new beetle	2.5 2008	5	manual(m5)	f	20	28
## 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	volkswagen	passat	1.8 1999	4	auto(15)	f	18	29
## 230	volkswagen	passat	2.0 2008	4	auto(s6)	f	19	28
## 231	volkswagen	passat	2.0 2008	4	manual(m6)	f	21	29
## 232	volkswagen	passat	2.8 1999	6	auto(15)	f	16	26

## 233	volkswagen	passat	2.8	1999	6	manual(m5)	f	18	26
## 234	volkswagen	passat	3.6	2008	6	auto(s6)	f	17	26
##	fl	class							
## 1	p	compact							
## 2	p	compact							
## 3	p	compact							
## 4	p	compact							
## 5	p	compact							
## 6	p	compact							
## 7	p	compact							
## 8	p	compact							
## 9	p	compact							
## 10	p	compact							
## 11	p	compact							
## 12	p	compact							
## 13	p	compact							
## 14	p	compact							
## 15	p	compact							
## 16	p	midsize							
## 17	p	midsize							
## 18	p	midsize							
## 19	r	suv							
## 20	e	suv							
## 21	r	suv							
## 22	r	suv							
## 23	r	suv							
## 24	p	2seater							
## 25	p	2seater							
## 26	p	2seater							
## 27	p	2seater							
## 28	p	2seater							
## 29	r	suv							
## 30	e	suv							
## 31	r	suv							
## 32	d	suv							
## 33	r	midsize							
## 34	r	midsize							
## 35	r	midsize							
## 36	r	midsize							
## 37	r	midsize							
## 38	r	minivan							
## 39	r	minivan							
## 40	r	minivan							
## 41	r	minivan							
## 42	r	minivan							
## 43	r	minivan							
## 44	e	minivan							
## 45	r	minivan							
## 46	r	minivan							
## 47	r	minivan							
## 48	r	minivan							
## 49	r	pickup							
## 50	r	pickup							
## 51	r	pickup							

```

## 52  r    pickup
## 53  r    pickup
## 54  r    pickup
## 55  e    pickup
## 56  r    pickup
## 57  r    pickup
## 58  r      suv
## 59  r      suv
## 60  e      suv
## 61  r      suv
## 62  r      suv
## 63  r      suv
## 64  r      suv
## 65  r    pickup
## 66  e    pickup
## 67  r    pickup
## 68  r    pickup
## 69  r    pickup
## 70  e    pickup
## 71  r    pickup
## 72  r    pickup
## 73  r    pickup
## 74  r    pickup
## 75  r      suv
## 76  r      suv
## 77  r      suv
## 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  r    pickup
## 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
## 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 r midsize
113 r midsize
114 r midsize
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 e suv
128 r suv
129 r suv
130 p suv
131 p suv
132 r suv
133 r suv
134 p suv
135 r suv
136 p suv
137 r suv
138 r suv
139 r suv
140 r suv
141 r suv
142 r compact
143 r compact
144 r midsize
145 r midsize
146 p midsize
147 p midsize
148 r midsize
149 r midsize
150 p midsize
151 r suv
152 r suv
153 p suv
154 p suv
155 r midsize
156 p midsize
157 r midsize
158 r midsize
159 p midsize

```

## 160 r      suv
## 161 r      suv
## 162 r      suv
## 163 p      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 r      compact
## 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 r      midsize
## 186 r      midsize
## 187 r      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 r      compact
## 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 r      pickup
## 206 r      pickup
## 207 r      pickup
## 208 r      compact
## 209 r      compact
## 210 p      compact
## 211 p      compact
## 212 r      compact
## 213 d      compact

```

```
## 214 r compact
## 215 r compact
## 216 p compact
## 217 p compact
## 218 r compact
## 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 p midsize
## 229 p midsize
## 230 p midsize
## 231 p midsize
## 232 p midsize
## 233 p midsize
## 234 p midsize
```

2. Which manufacturer has the most models in this data set? Which model has the most variations? answer: Dodge, it has 37 models.

```
most_model <- mpg_data %>%
  group_by(manufacturer, model) %>% tally(sort = TRUE)
most_model
```

```
## # A tibble: 38 x 3
## # Groups:   manufacturer [15]
##   manufacturer model          n
##   <chr>         <chr>      <int>
## 1 dodge        caravan 2wd      11
## 2 dodge        ram 1500 pickup 4wd    10
## 3 dodge        dakota pickup 4wd     9
## 4 ford         mustang         9
## 5 honda        civic          9
## 6 volkswagen    jetta          9
## 7 audi         a4 quattro      8
## 8 jeep          grand cherokee 4wd     8
## 9 subaru        impreza awd       8
## 10 audi         a4              7
## # ... with 28 more rows
```

a. Group the manufacturers and find the unique models. Copy the codes and result.

```
unique_model <- mpg_data %>% group_by(manufacturer,model) %>%
  distinct(model) %>% count()
unique_model
```

```
## # A tibble: 38 x 3
## # Groups:   manufacturer, model [38]
```

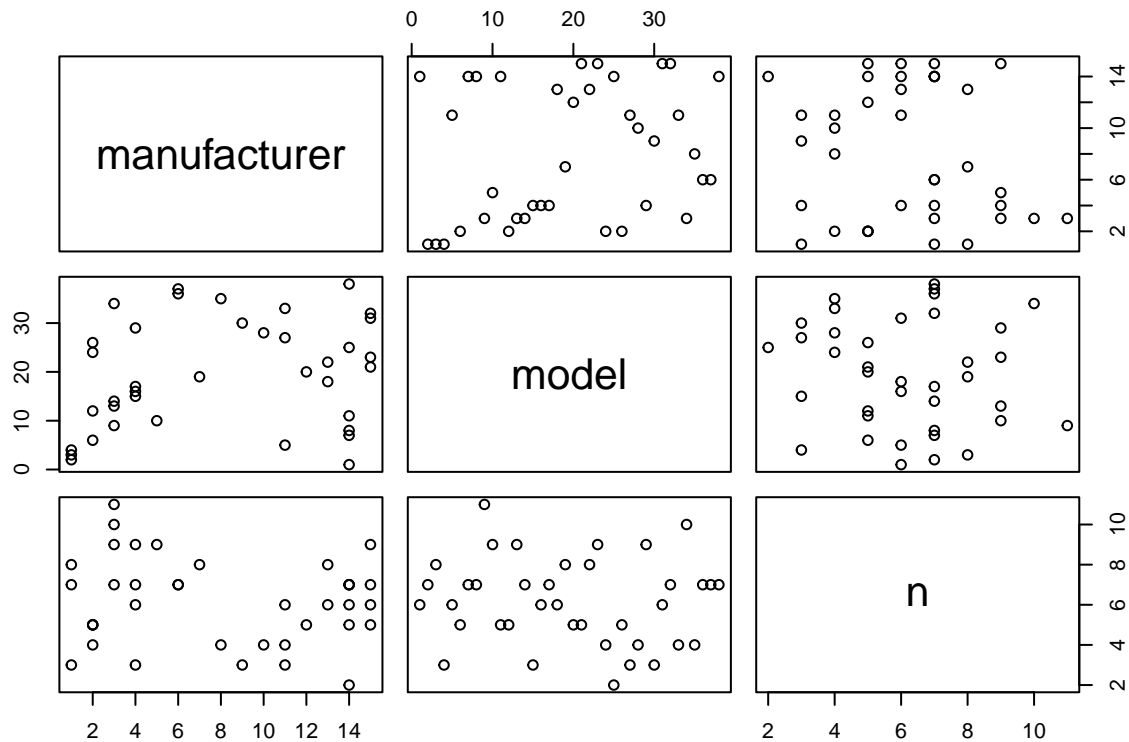
```
##      manufacturer model          n
##      <chr>          <chr>        <int>
## 1 audi             a4             1
## 2 audi             a4 quattro      1
## 3 audi             a6 quattro      1
## 4 chevrolet        c1500 suburban 2wd 1
## 5 chevrolet        corvette        1
## 6 chevrolet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

colnames(unique_model) <- c("Manufacturer", "Model", "Counts")
unique_model
```

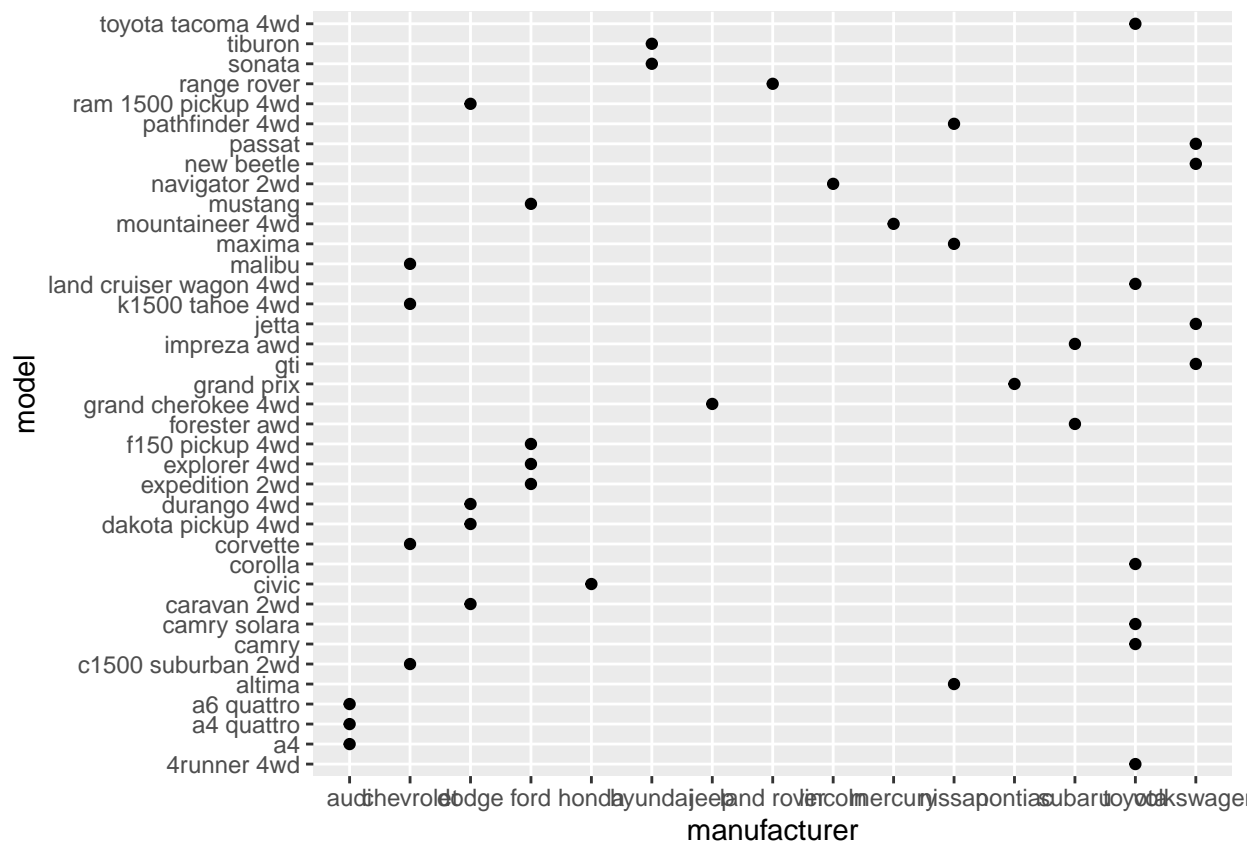
```
## # A tibble: 38 x 3
## # Groups:   Manufacturer, Model [38]
##   Manufacturer Model          Counts
##   <chr>          <chr>        <int>
## 1 audi             a4             1
## 2 audi             a4 quattro      1
## 3 audi             a6 quattro      1
## 4 chevrolet        c1500 suburban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

b. Graph the result by using `plot()` and `ggplot()`. Write the codes and its result.

```
plot(unique_model)
```

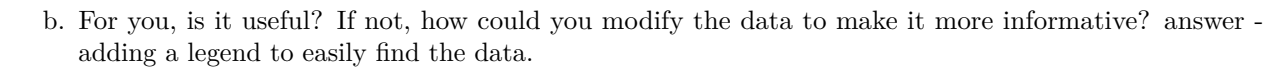


```
ggplot(most_model, aes( manufacturer,model)) + geom_point()
```



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

```
ggplot(mpg1, aes(model, manufacturer)) + geom_point()
```



```
cars_model <- mpg_data %>% group_by(model) %>% count()
cars_model
```

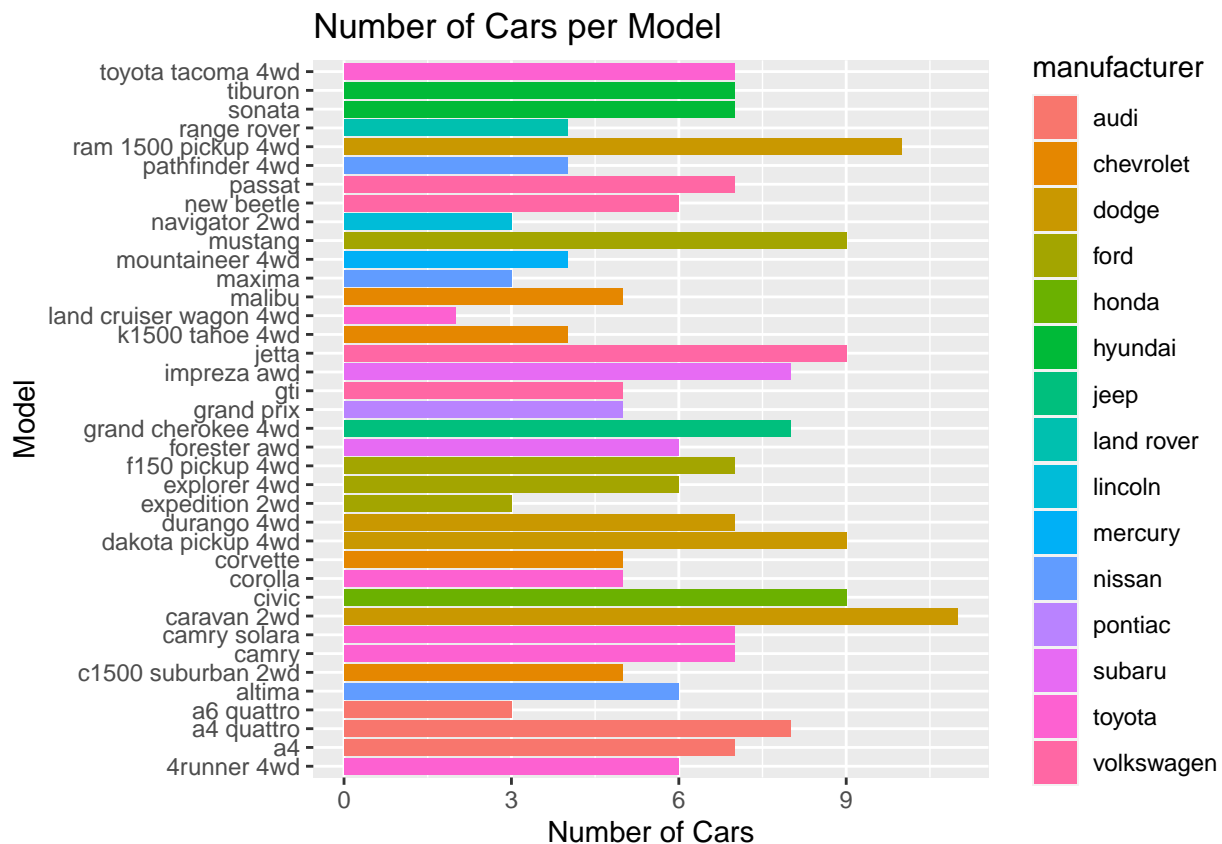
22

```
## 10 civic          9
## # ... with 28 more rows
colnames(cars_model) <- c("Model", "Counts")
```

a. Plot using the `geom_bar()` + `coord_flip()` just like what is shown below. Show codes and its result.

```
qplot(model, data = mpg1,
      main = "Number of Cars per Model",
      xlab = "Model",
      ylab = "Number of Cars", geom = "bar", fill = manufacturer) + coord_flip()
```

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



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

```
top <- cars_model[1:20,] %>% top_n(2)
```

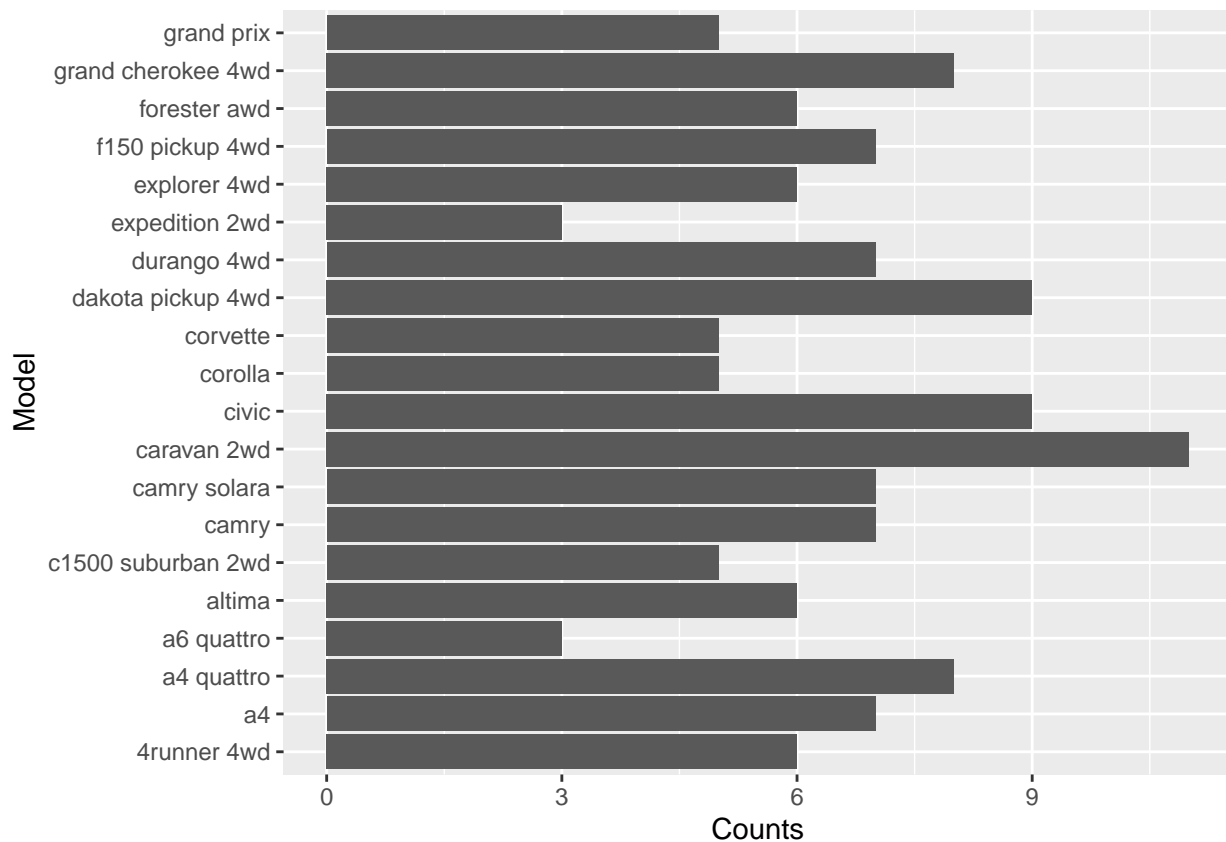
```
## Selecting by Counts
```

```
top
```

```
## # A tibble: 20 x 2
## # Groups:   Model [20]
##   Model          Counts
```

```
##      <chr>                <int>
## 1 4runner 4wd              6
## 2 a4                      7
## 3 a4 quattro              8
## 4 a6 quattro              3
## 5 altima                  6
## 6 c1500 suburban 2wd      5
## 7 camry                   7
## 8 camry solara            7
## 9 caravan 2wd            11
## 10 civic                  9
## 11 corolla                5
## 12 corvette               5
## 13 dakota pickup 4wd      9
## 14 durango 4wd            7
## 15 expedition 2wd        3
## 16 explorer 4wd          6
## 17 f150 pickup 4wd        7
## 18 forester awd          6
## 19 grand cherokee 4wd     8
## 20 grand prix             5
```

```
ggplot(top,aes(x = Model, y = Counts)) +
  geom_bar(stat = "Identity") +coord_flip()
```

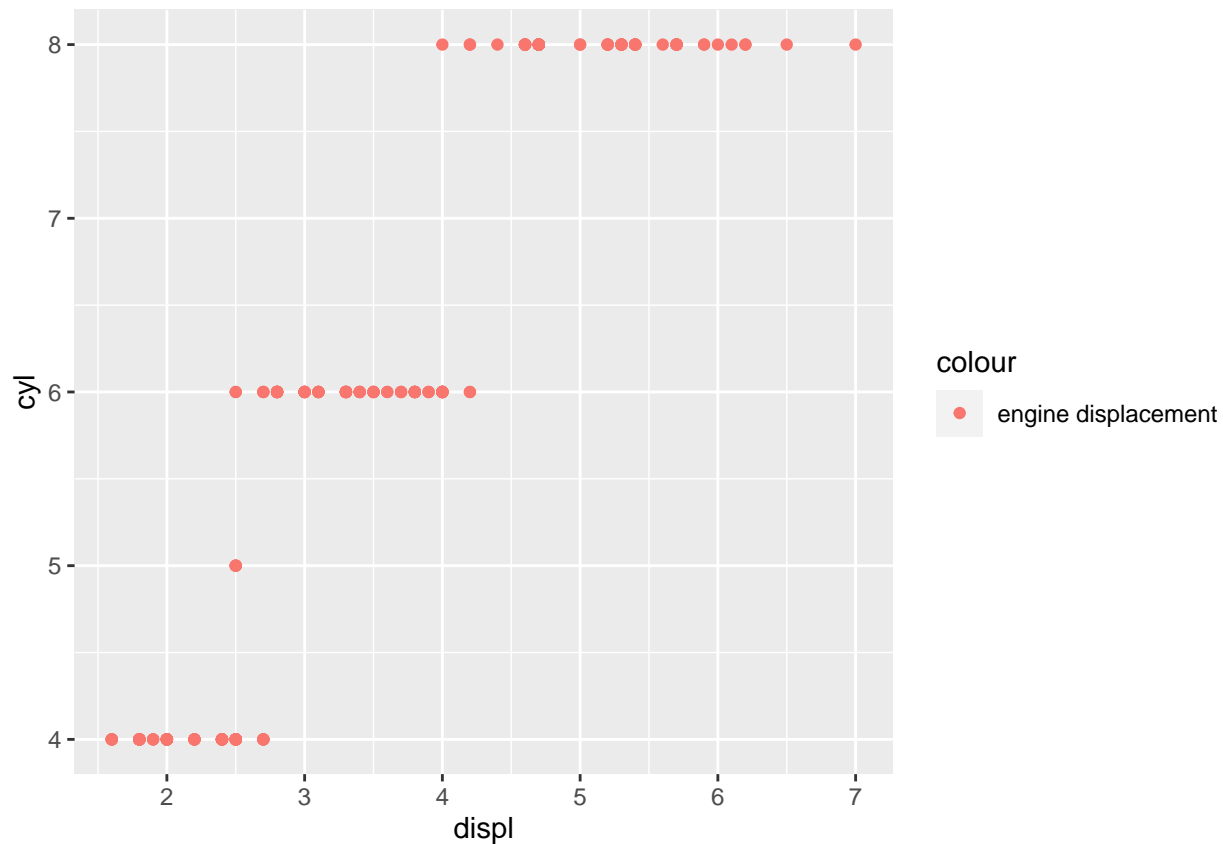


5. Plot the relationship between cyl - number of cylinders and displ - engine displacement using geom_point with aesthetic colour = engine displacement. Title should be “Relationship between No. of Cylinders and

Engine Displacement”.

a. Show the codes and its result.

```
ggplot(data = mpg_data , mapping = aes(x = displ, y = cyl, main = "Relationship  
between No of Cylinders and  
Engine Displacement")) +  
geom_point(mapping=aes(colour = "engine displacement"))
```



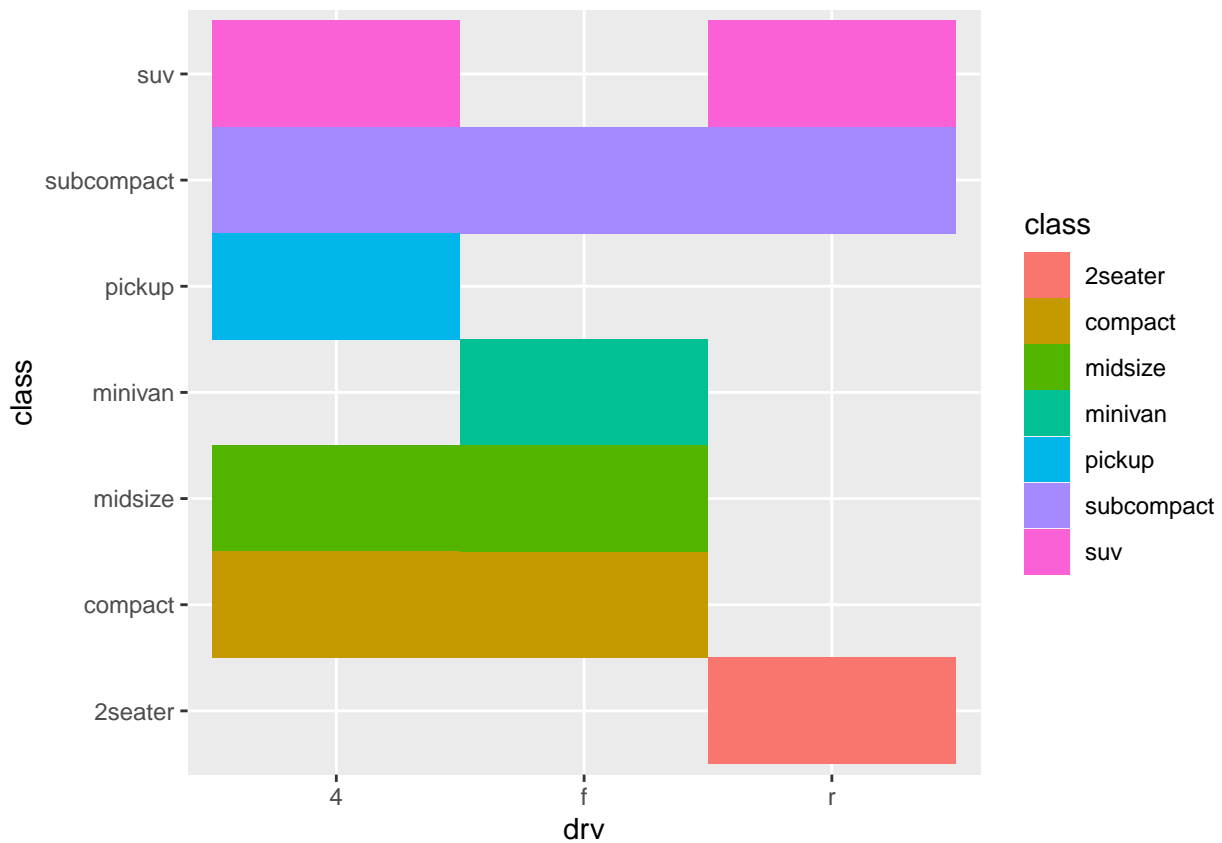
b. How would you describe its relationship? answer - the scatter plot shows that the cyl is in vertical lines(y-axis) and the displ are in in horizontal lines(x-axis). To easily locate the clustered data, just one look we can figure out wheres the Engine Displacement is. By having the engine displacement name in right middle side.

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.

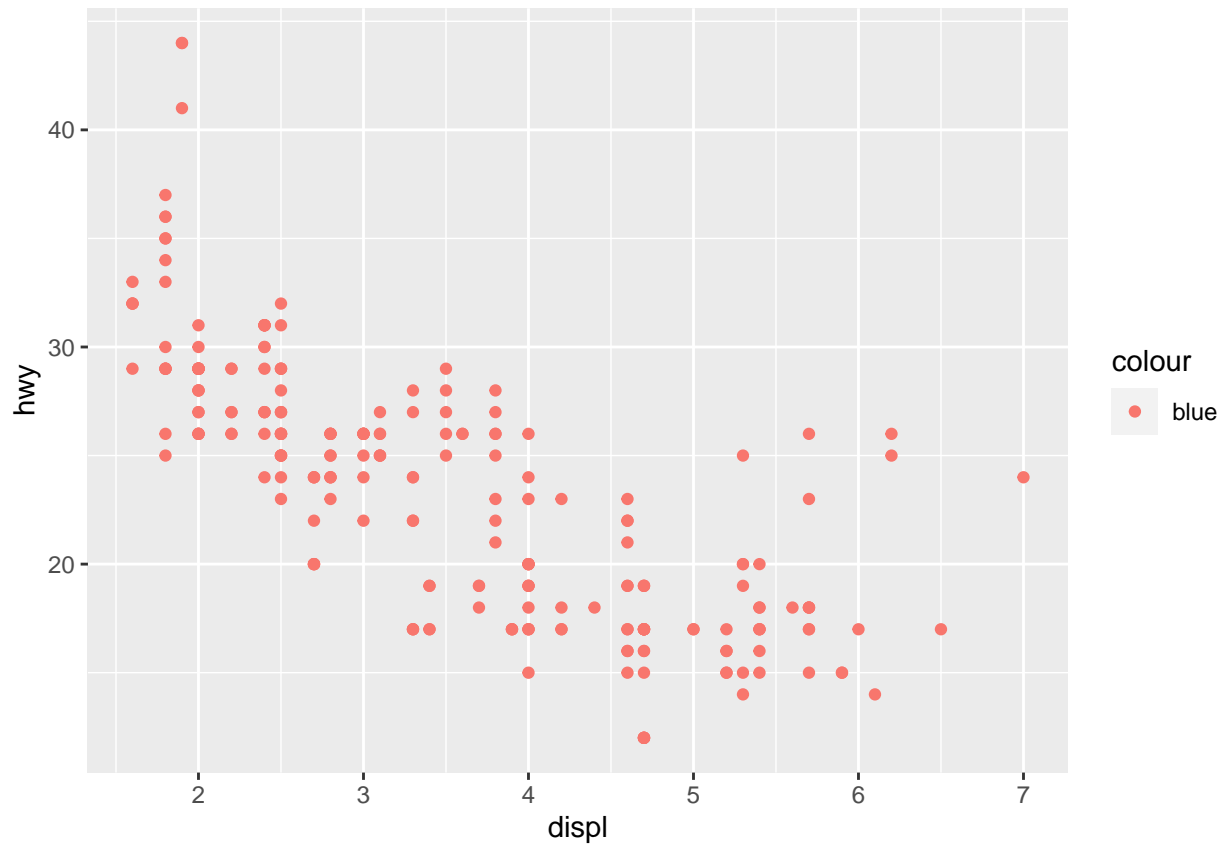
```
ggplot(data = mpg_data, mapping = aes(x = drv, y = class)) +  
geom_tile(aes(fill=class))
```



b. Interpret the result. answer - by mapping a geometric tile, the geom_title was shown in a different colors, the drv are in the X axis while the class are in the Y axis.

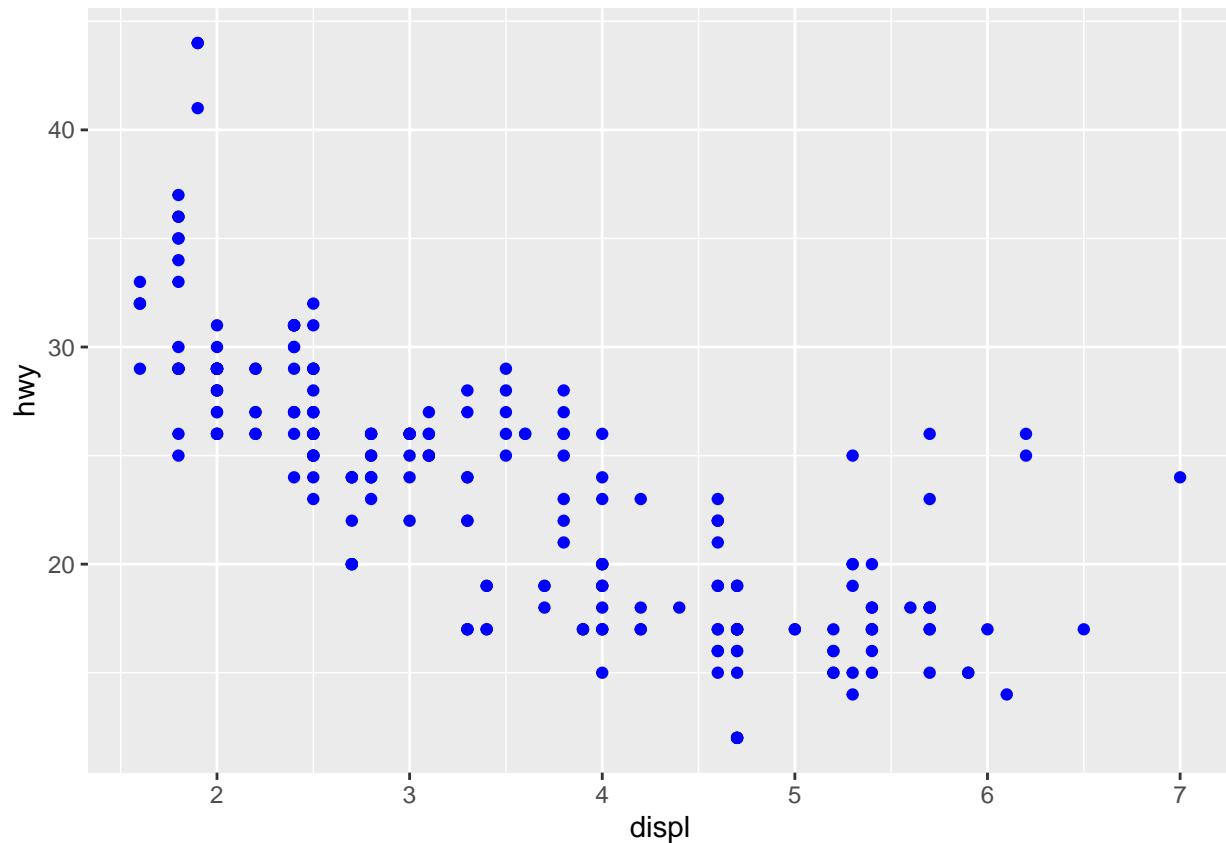
7. Discuss the difference between these codes. Its outputs for each are shown below. answer - the graph are almost the same but the first code the colour blue ignore while in the second code the colour blue displayed. The r studio are too much sensitive in placing a proper code in the source code. first code

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



second code

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

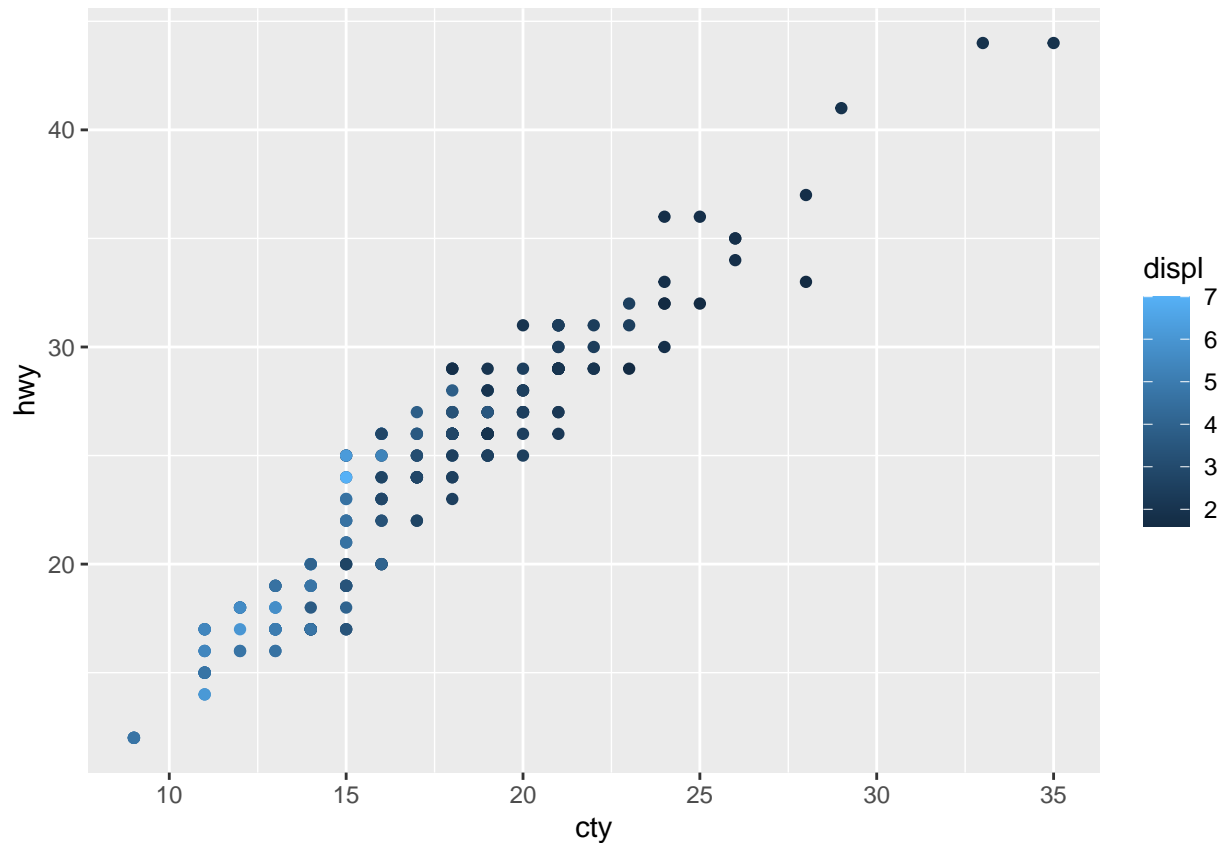


8. Try to run the command `?mpg`. What is the result of this command? answer - the result are in the help option, it shows the description for the data set of mpg.

```
?mpg
```

- Which variables from mpg dataset are categorical? answer - The manufacturer, model, trans, drv, fl, class are the categorical variables of mpg data set.
- Which are continuous variables? answer - The dsipl, year, cyl, cty, and hwy are the continous variables of mpg data set.
- 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? answer - The data graph shows the data set of hwy,cyt and displ.

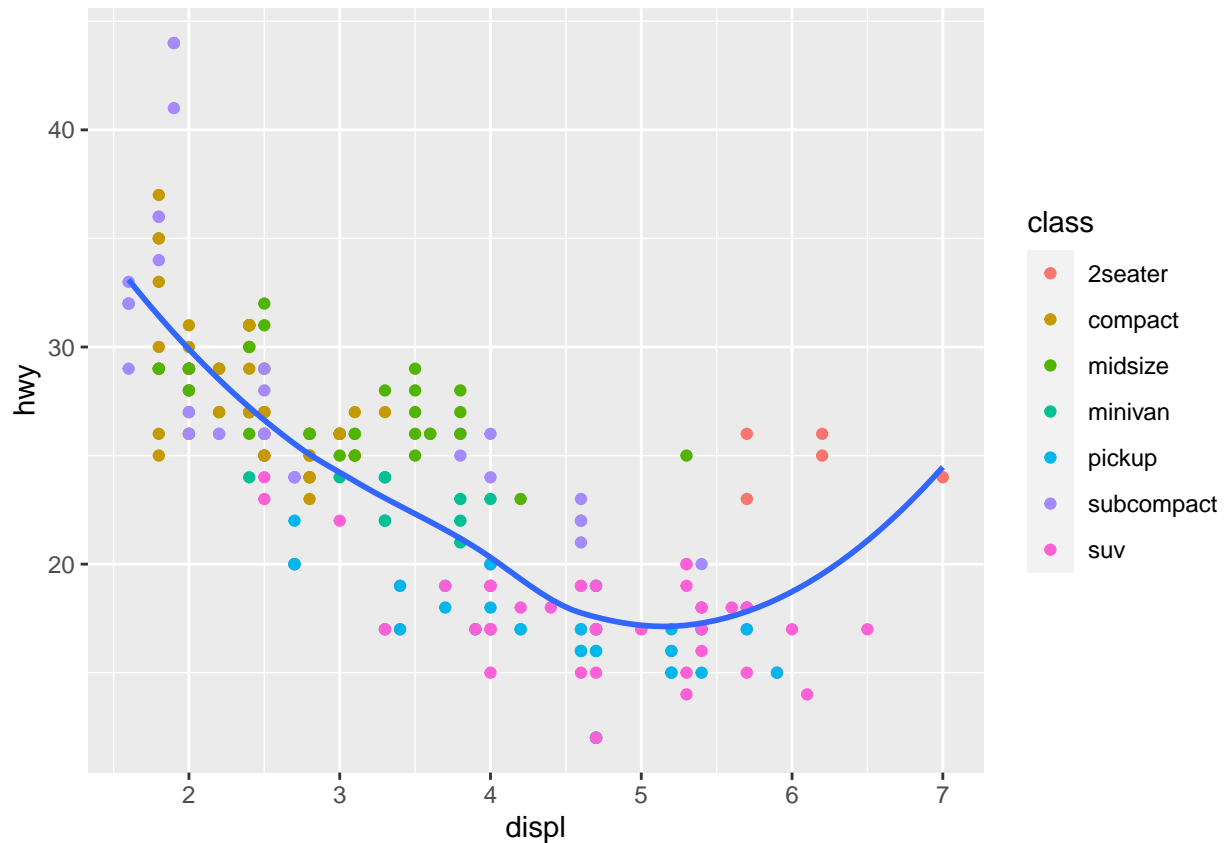
```
ggplot(mpg, aes(x = cty, y = hwy, colour = displ)) + geom_point()
```



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, method = lm)
```

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

