

# Rworksheet\_Rabago#4c

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```
library(ggplot2)
write.csv(mpg, "mpg.csv", row.names = FALSE)
```

1.a.

```
mpg <- read.csv("mpg.csv")
mpg
```

##	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(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	3.3	1999	6	auto(14)	f	16	22
## 41	dodge	caravan 2wd	3.3	1999	6	auto(14)	f	16	22
## 42	dodge	caravan 2wd	3.3	2008	6	auto(14)	f	17	24
## 43	dodge	caravan 2wd	3.3	2008	6	auto(14)	f	17	24
## 44	dodge	caravan 2wd	3.3	2008	6	auto(14)	f	11	17
## 45	dodge	caravan 2wd	3.8	1999	6	auto(14)	f	15	22
## 46	dodge	caravan 2wd	3.8	1999	6	auto(14)	f	15	21
## 47	dodge	caravan 2wd	3.8	2008	6	auto(16)	f	16	23
## 48	dodge	caravan 2wd	4.0	2008	6	auto(16)	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(14)	4	14	18
## 51	dodge	dakota pickup 4wd	3.9	1999	6	auto(14)	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(15)	4	14	19
## 54	dodge	dakota pickup 4wd	4.7	2008	8	auto(15)	4	14	19
## 55	dodge	dakota pickup 4wd	4.7	2008	8	auto(15)	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(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
## 60	dodge	durango 4wd	4.7	2008	8	auto(15)	4	9	12
## 61	dodge	durango 4wd	4.7	2008	8	auto(15)	4	13	17
## 62	dodge	durango 4wd	5.2	1999	8	auto(14)	4	11	16
## 63	dodge	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	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(15)	4	9	12
## 67	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(15)	4	13	17
## 68	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(15)	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(l4)	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(l4)	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(l4)	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(l5)	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(l4)	f	18	26
## 156	pontiac	grand prix	3.8	1999	6	auto(l4)	f	16	26
## 157	pontiac	grand prix	3.8	1999	6	auto(l4)	f	17	27
## 158	pontiac	grand prix	3.8	2008	6	auto(l4)	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(l4)	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(l4)	4	20	26
## 165	subaru	forester awd	2.5	2008	4	auto(l4)	4	18	23
## 166	subaru	impreza awd	2.2	1999	4	auto(l4)	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(l4)	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(l4)	4	16	20
## 176	toyota	4runner 4wd	3.4	1999	6	auto(l4)	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(l5)	4	16	20
## 179	toyota	4runner 4wd	4.7	2008	8	auto(l5)	4	14	17
## 180	toyota	camry	2.2	1999	4	manual(m5)	f	21	29
## 181	toyota	camry	2.2	1999	4	auto(l4)	f	21	27
## 182	toyota	camry	2.4	2008	4	manual(m5)	f	21	31
## 183	toyota	camry	2.4	2008	4	auto(l5)	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.b. -The categorical variables in the mpg dataset are manufacturer, model, trans, drv, fl, and class.

1.c. -The continuous variables in the mpg dataset are displ, cty, and hwy.

2.a.

```
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

manumodel<- mpg %>%
  group_by(manufacturer) %>%
  summarise(num_models = n_distinct(model)) %>%
  arrange(desc(num_models))

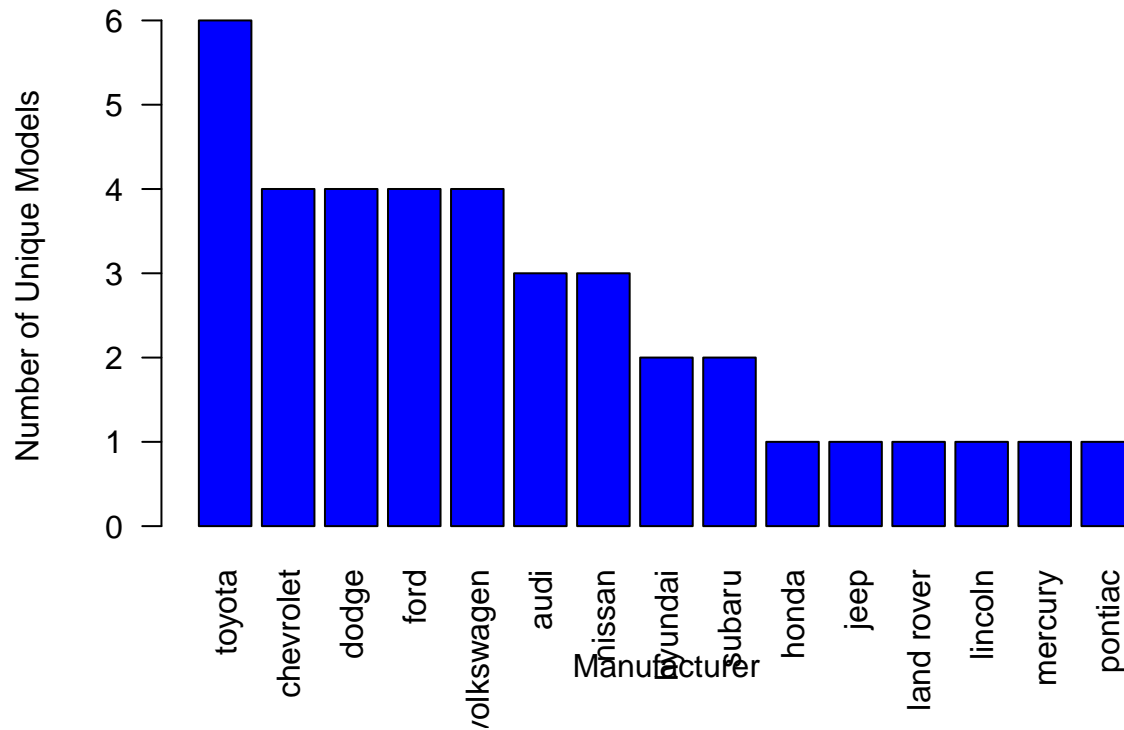
manumodel

## # A tibble: 15 x 2
##   manufacturer num_models
##   <chr>         <int>
## 1 toyota         6
## 2 chevrolet      4
## 3 dodge          4
## 4 ford           4
## 5 volkswagen     4
## 6 audi           3
## 7 nissan          3
## 8 hyundai        2
## 9 subaru         2
## 10 honda         1
## 11 jeep          1
## 12 land rover    1
## 13 lincoln       1
## 14 mercury       1
## 15 pontiac       1
```

2.b.

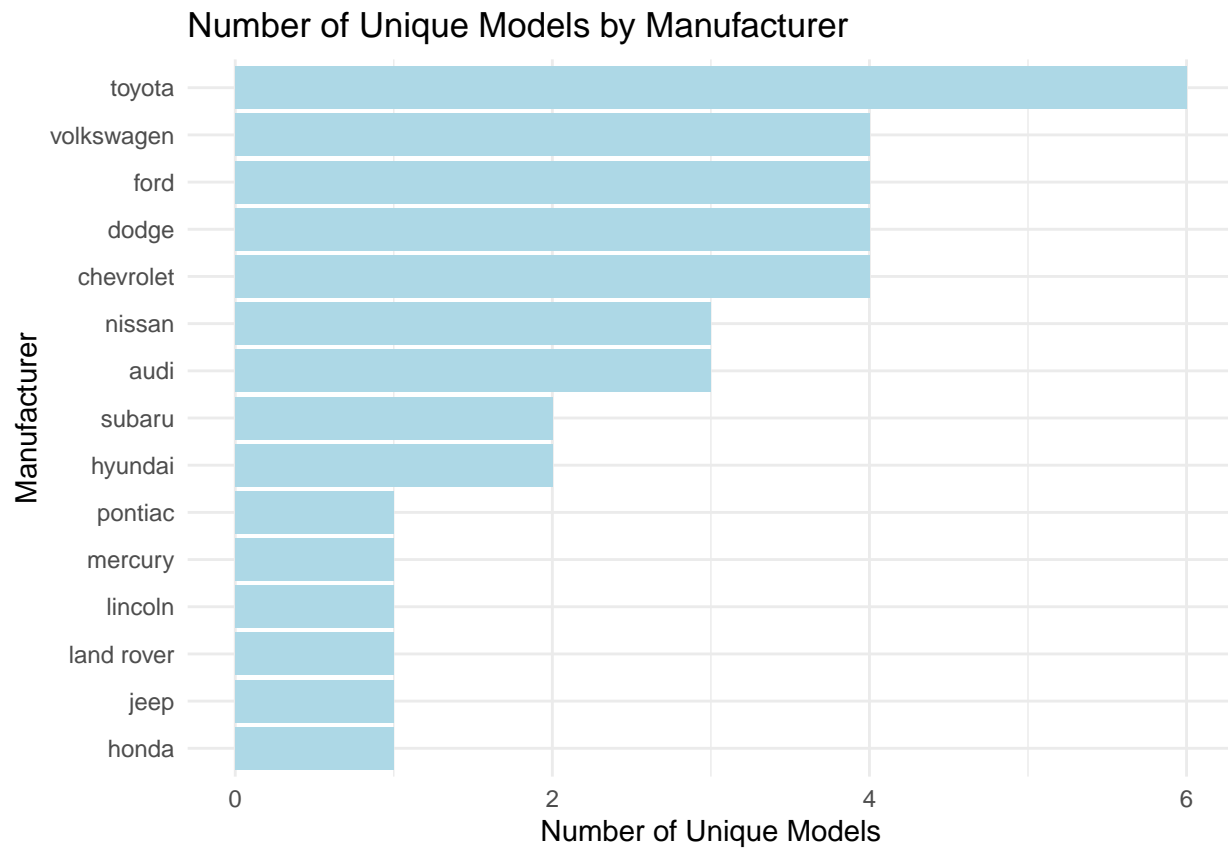
```
barplot(manumodel$num_models,
        names.arg = manumodel$manufacturer,
        las = 2,col = "blue",
        main = "Number of Unique Models by Manufacturer",
        xlab = "Manufacturer",
        ylab = "Number of Unique Models")
```

**Number of Unique Models by Manufacturer**



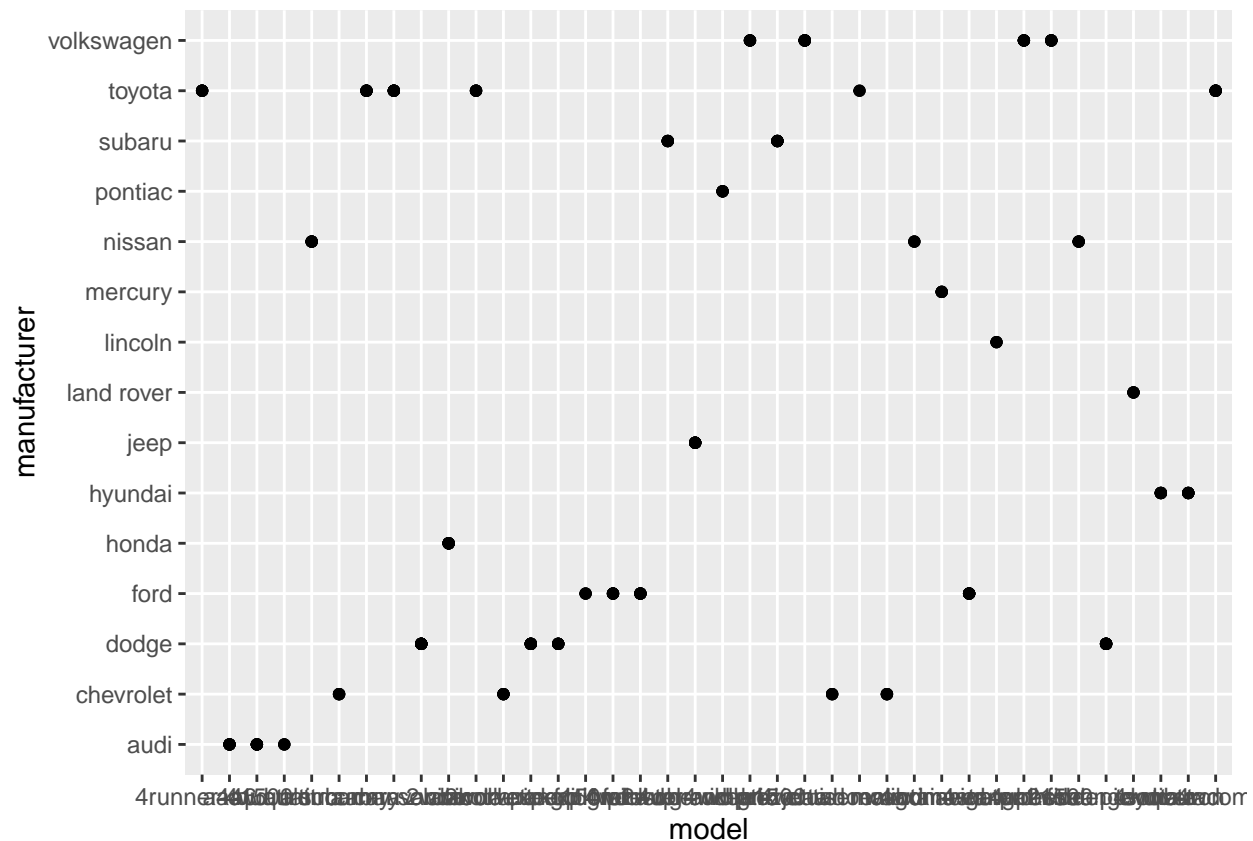
```
library(ggplot2)

ggplot(manumodel, aes(x = reorder(manufacturer, num_models), y = num_models)) +
  geom_bar(stat = "identity", fill = "lightblue") +
  coord_flip() + # Flip coordinates for better readability
  labs(title = "Number of Unique Models by Manufacturer",
       x = "Manufacturer",
       y = "Number of Unique Models") +
  theme_minimal()
```



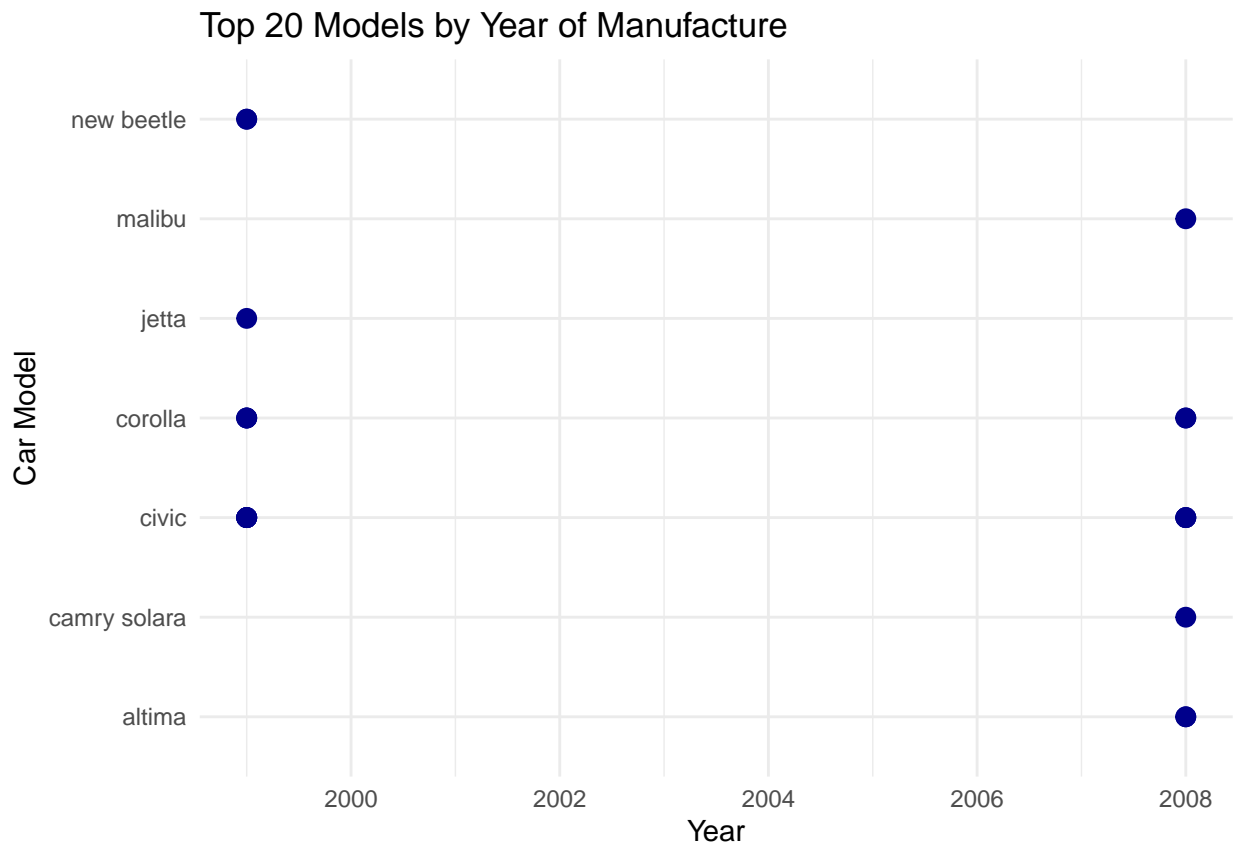
2.a.

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



The code creates a scatter plot showing car models and their manufacturers. However, this plot isn't very helpful because many models come from the same manufacturer, causing the points to overlap and making it hard to see individual models. Also, both the x-axis and y-axis use categories, which doesn't work well for showing relationships. To make the data clearer, using bar plots or boxplots would be more effective.

3.



4

```
library(dplyr)
library(ggplot2)
```

```
modelcount <- mpg %>%
  group_by(model) %>%
  summarise(num_cars = n()) %>%
  arrange(desc(num_cars))
```

```
modelcount
```

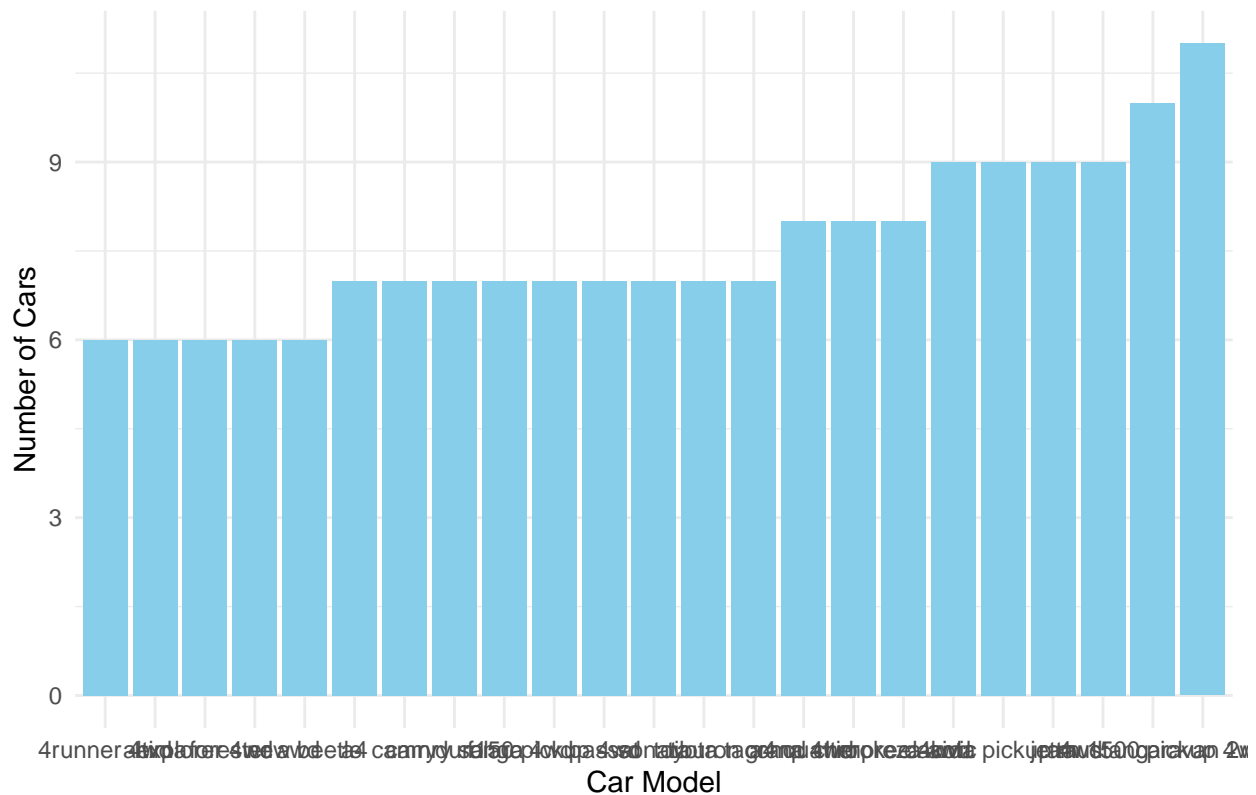
```
## # A tibble: 38 x 2
##   model          num_cars
##   <chr>          <int>
## 1 caravan 2wd         11
## 2 ram 1500 pickup 4wd  10
## 3 civic              9
## 4 dakota pickup 4wd    9
## 5 jetta              9
## 6 mustang             9
## 7 a4 quattro          8
## 8 grand cherokee 4wd   8
##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

4.a.

```
top20 <- modelcount %>%
  top_n(20, num_cars)
```

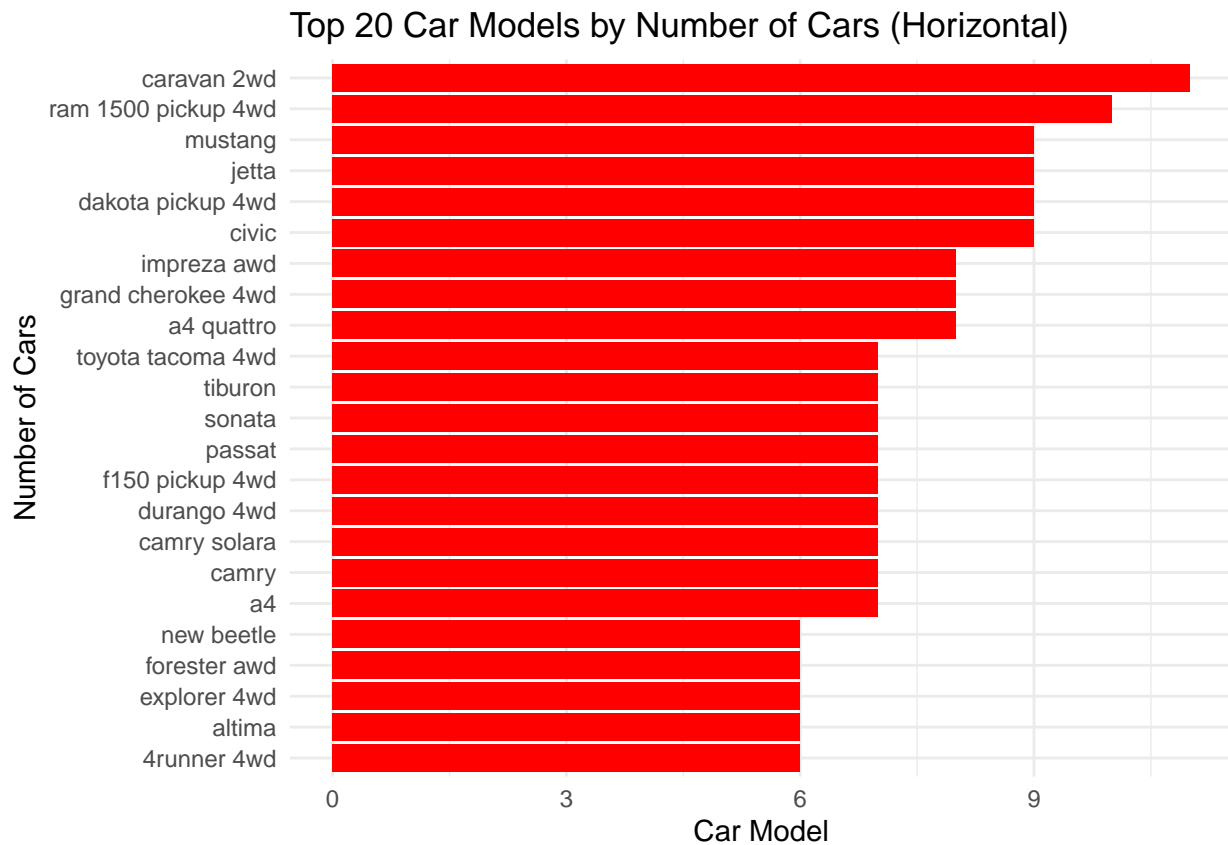
```
ggplot(top20, aes(x = reorder(model, num_cars), y = num_cars)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  labs(title = "Top 20 Car Models by Number of Cars",
       x = "Car Model",
       y = "Number of Cars") +
  theme_minimal()
```

Top 20 Car Models by Number of Cars



4.b.

```
ggplot(top20, aes(x = reorder(model, num_cars), y = num_cars)) +
  geom_bar(stat = "identity", fill = "red") +
  coord_flip() +
  labs(title = "Top 20 Car Models by Number of Cars (Horizontal)",
       x = "Number of Cars",
       y = "Car Model") +
  theme_minimal()
```

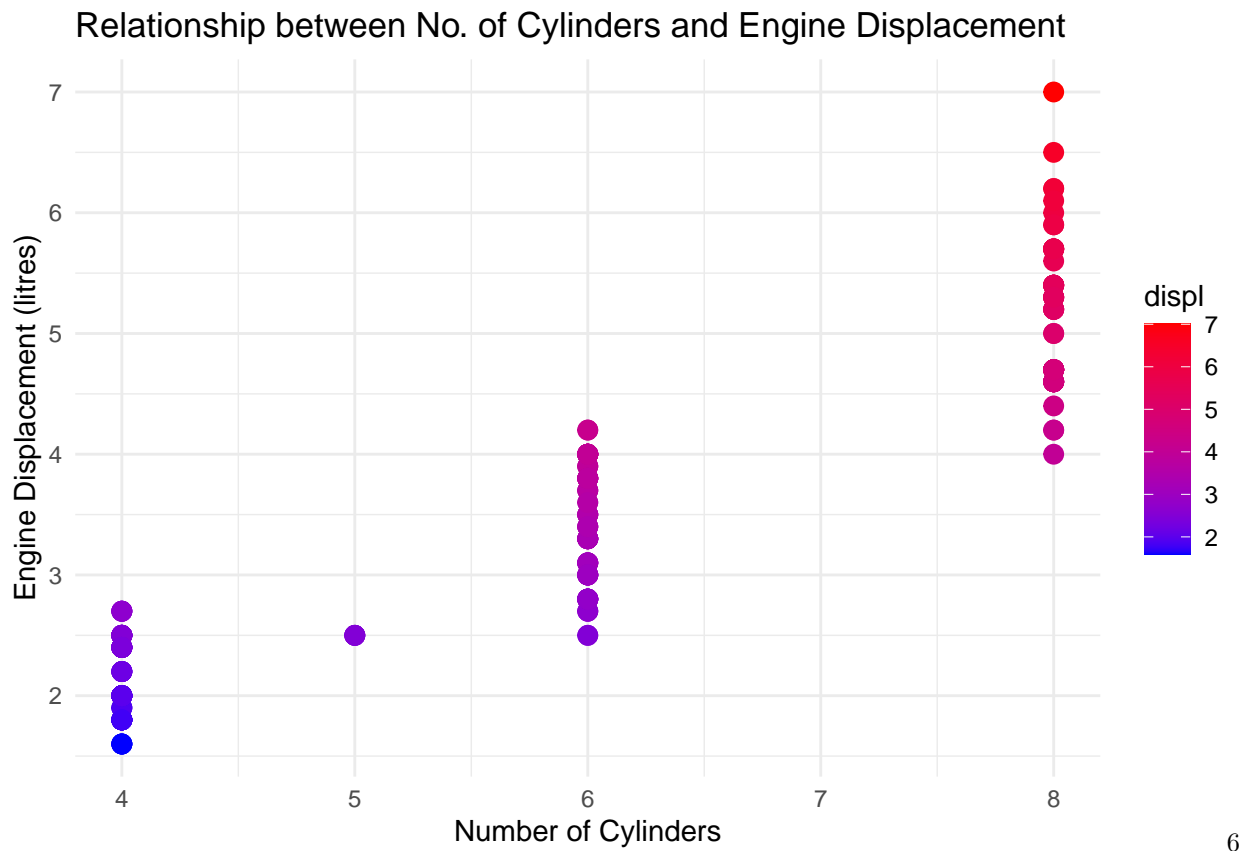


5.

```
library(ggplot2)

ggplot(mpg, aes(x = cyl, y = displ, color = displ)) +
  geom_point(size = 3) +
  labs(title = "Relationship between No. of Cylinders and Engine Displacement",
       x = "Number of Cylinders",
       y = "Engine Displacement (litres)") +
  theme_minimal() +
  scale_color_gradient(low = "blue", high = "red")
```

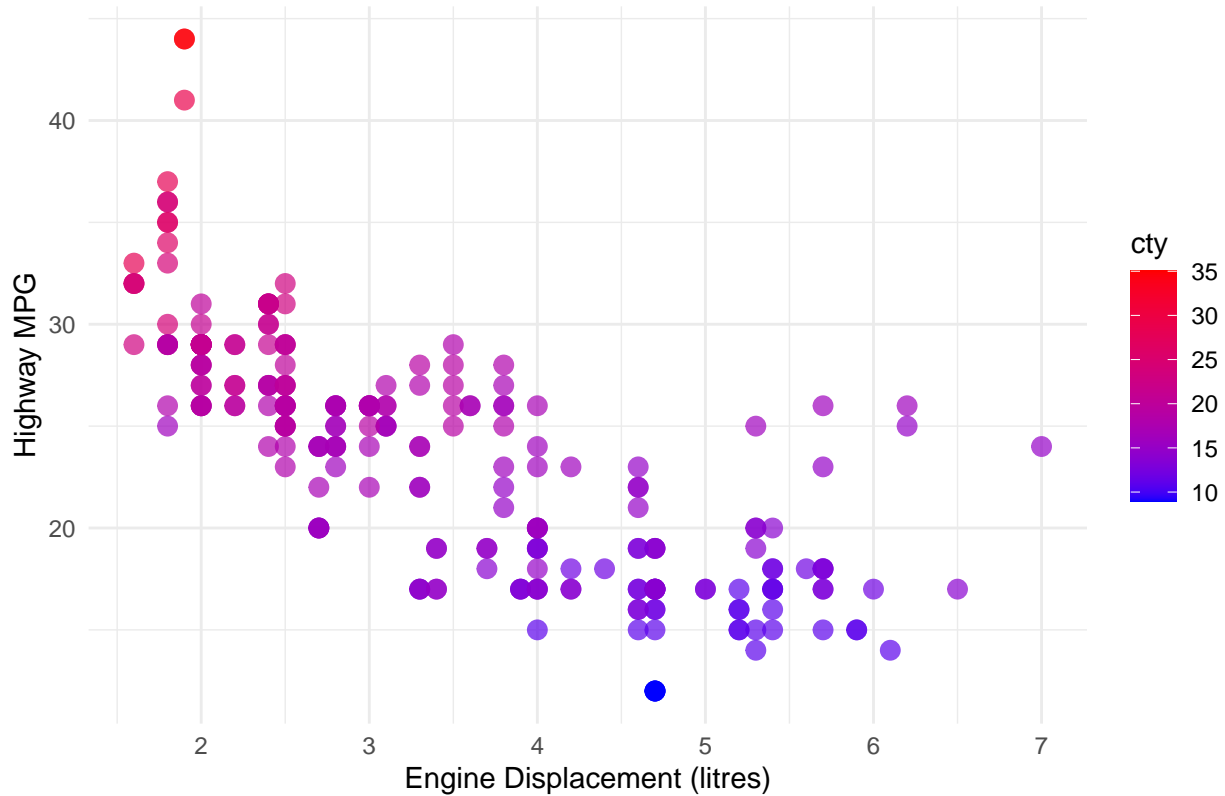




```
library(ggplot2)

ggplot(mpg, aes(x = displ, y = hwy, color = cty)) +
  geom_point(size = 3, alpha = 0.7) +
  labs(title = "Relationship between Engine Displacement and Highway MPG",
       x = "Engine Displacement (litres)",
       y = "Highway MPG") +
  theme_minimal() +
  scale_color_gradient(low = "blue", high = "red") # Color gradient from blue to red
```

Relationship between Engine Displacement and Highway MPG



-When you run the code, it generates a scatter plot showing the relationship between engine displacement and highway miles per gallon (MPG), with points colored by city MPG. Typically, you'll observe a negative trend: as engine displacement increases, highway MPG decreases, since larger engines tend to consume more fuel. The color coding adds context, with blue points (lower city MPG) often linked to higher displacement and lower highway MPG, while red points (higher city MPG) cluster at lower displacement and higher highway MPG. This illustrates the trade-off between engine size and fuel efficiency.