

# RWorksheet\_Francisco#4c

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```
#1a
MPG <- read.csv("/cloud/project/worksheet#4/mpg.csv")
MPG
```

##	X	manufacturer	model	displ	year	cyl	trans	drv	cty
## 1	1	audi	a4	1.8	1999	4	auto(l5)	f	18
## 2	2	audi	a4	1.8	1999	4	manual(m5)	f	21
## 3	3	audi	a4	2.0	2008	4	manual(m6)	f	20
## 4	4	audi	a4	2.0	2008	4	auto(av)	f	21
## 5	5	audi	a4	2.8	1999	6	auto(l5)	f	16
## 6	6	audi	a4	2.8	1999	6	manual(m5)	f	18
## 7	7	audi	a4	3.1	2008	6	auto(av)	f	18
## 8	8	audi	a4 quattro	1.8	1999	4	manual(m5)	4	18
## 9	9	audi	a4 quattro	1.8	1999	4	auto(l5)	4	16
## 10	10	audi	a4 quattro	2.0	2008	4	manual(m6)	4	20
## 11	11	audi	a4 quattro	2.0	2008	4	auto(s6)	4	19
## 12	12	audi	a4 quattro	2.8	1999	6	auto(l5)	4	15
## 13	13	audi	a4 quattro	2.8	1999	6	manual(m5)	4	17
## 14	14	audi	a4 quattro	3.1	2008	6	auto(s6)	4	17
## 15	15	audi	a4 quattro	3.1	2008	6	manual(m6)	4	15
## 16	16	audi	a6 quattro	2.8	1999	6	auto(l5)	4	15
## 17	17	audi	a6 quattro	3.1	2008	6	auto(s6)	4	17
## 18	18	audi	a6 quattro	4.2	2008	8	auto(s6)	4	16
## 19	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
## 21	21	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14
## 22	22	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(l4)	r	13
## 23	23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(l4)	r	12
## 24	24	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16
## 25	25	chevrolet	corvette	5.7	1999	8	auto(l4)	r	15
## 26	26	chevrolet	corvette	6.2	2008	8	manual(m6)	r	16
## 27	27	chevrolet	corvette	6.2	2008	8	auto(s6)	r	15
## 28	28	chevrolet	corvette	7.0	2008	8	manual(m6)	r	15
## 29	29	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	14
## 30	30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	11
## 31	31	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(l4)	4	11
## 32	32	chevrolet	k1500 tahoe 4wd	6.5	1999	8	auto(l4)	4	14
## 33	33	chevrolet	malibu	2.4	1999	4	auto(l4)	f	19
## 34	34	chevrolet	malibu	2.4	2008	4	auto(l4)	f	22
## 35	35	chevrolet	malibu	3.1	1999	6	auto(l4)	f	18
## 36	36	chevrolet	malibu	3.5	2008	6	auto(l4)	f	18
## 37	37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17
## 38	38	dodge	caravan 2wd	2.4	1999	4	auto(l3)	f	18

##	39	39	dodge	caravan	2wd	3.0	1999	6	auto(14)	f	17	
##	40	40	dodge	caravan	2wd	3.3	1999	6	auto(14)	f	16	
##	41	41	dodge	caravan	2wd	3.3	1999	6	auto(14)	f	16	
##	42	42	dodge	caravan	2wd	3.3	2008	6	auto(14)	f	17	
##	43	43	dodge	caravan	2wd	3.3	2008	6	auto(14)	f	17	
##	44	44	dodge	caravan	2wd	3.3	2008	6	auto(14)	f	11	
##	45	45	dodge	caravan	2wd	3.8	1999	6	auto(14)	f	15	
##	46	46	dodge	caravan	2wd	3.8	1999	6	auto(14)	f	15	
##	47	47	dodge	caravan	2wd	3.8	2008	6	auto(16)	f	16	
##	48	48	dodge	caravan	2wd	4.0	2008	6	auto(16)	f	16	
##	49	49	dodge	dakota	pickup	4wd	3.7	2008	6	manual(m6)	4	15
##	50	50	dodge	dakota	pickup	4wd	3.7	2008	6	auto(14)	4	14
##	51	51	dodge	dakota	pickup	4wd	3.9	1999	6	auto(14)	4	13
##	52	52	dodge	dakota	pickup	4wd	3.9	1999	6	manual(m5)	4	14
##	53	53	dodge	dakota	pickup	4wd	4.7	2008	8	auto(15)	4	14
##	54	54	dodge	dakota	pickup	4wd	4.7	2008	8	auto(15)	4	14
##	55	55	dodge	dakota	pickup	4wd	4.7	2008	8	auto(15)	4	9
##	56	56	dodge	dakota	pickup	4wd	5.2	1999	8	manual(m5)	4	11
##	57	57	dodge	dakota	pickup	4wd	5.2	1999	8	auto(14)	4	11
##	58	58	dodge	durango	4wd	3.9	1999	6	auto(14)	4	13	
##	59	59	dodge	durango	4wd	4.7	2008	8	auto(15)	4	13	
##	60	60	dodge	durango	4wd	4.7	2008	8	auto(15)	4	9	
##	61	61	dodge	durango	4wd	4.7	2008	8	auto(15)	4	13	
##	62	62	dodge	durango	4wd	5.2	1999	8	auto(14)	4	11	
##	63	63	dodge	durango	4wd	5.7	2008	8	auto(15)	4	13	
##	64	64	dodge	durango	4wd	5.9	1999	8	auto(14)	4	11	
##	65	65	dodge	ram	1500 pickup	4wd	4.7	2008	8	manual(m6)	4	12
##	66	66	dodge	ram	1500 pickup	4wd	4.7	2008	8	auto(15)	4	9
##	67	67	dodge	ram	1500 pickup	4wd	4.7	2008	8	auto(15)	4	13
##	68	68	dodge	ram	1500 pickup	4wd	4.7	2008	8	auto(15)	4	13
##	69	69	dodge	ram	1500 pickup	4wd	4.7	2008	8	manual(m6)	4	12
##	70	70	dodge	ram	1500 pickup	4wd	4.7	2008	8	manual(m6)	4	9
##	71	71	dodge	ram	1500 pickup	4wd	5.2	1999	8	auto(14)	4	11
##	72	72	dodge	ram	1500 pickup	4wd	5.2	1999	8	manual(m5)	4	11
##	73	73	dodge	ram	1500 pickup	4wd	5.7	2008	8	auto(15)	4	13
##	74	74	dodge	ram	1500 pickup	4wd	5.9	1999	8	auto(14)	4	11
##	75	75	ford	expedition	2wd	4.6	1999	8	auto(14)	r	11	
##	76	76	ford	expedition	2wd	5.4	1999	8	auto(14)	r	11	
##	77	77	ford	expedition	2wd	5.4	2008	8	auto(16)	r	12	
##	78	78	ford	explorer	4wd	4.0	1999	6	auto(15)	4	14	
##	79	79	ford	explorer	4wd	4.0	1999	6	manual(m5)	4	15	
##	80	80	ford	explorer	4wd	4.0	1999	6	auto(15)	4	14	
##	81	81	ford	explorer	4wd	4.0	2008	6	auto(15)	4	13	
##	82	82	ford	explorer	4wd	4.6	2008	8	auto(16)	4	13	
##	83	83	ford	explorer	4wd	5.0	1999	8	auto(14)	4	13	
##	84	84	ford	f150	pickup	4wd	4.2	1999	6	auto(14)	4	14
##	85	85	ford	f150	pickup	4wd	4.2	1999	6	manual(m5)	4	14
##	86	86	ford	f150	pickup	4wd	4.6	1999	8	manual(m5)	4	13
##	87	87	ford	f150	pickup	4wd	4.6	1999	8	auto(14)	4	13
##	88	88	ford	f150	pickup	4wd	4.6	2008	8	auto(14)	4	13
##	89	89	ford	f150	pickup	4wd	5.4	1999	8	auto(14)	4	11
##	90	90	ford	f150	pickup	4wd	5.4	2008	8	auto(14)	4	13
##	91	91	ford	mustang		3.8	1999	6	manual(m5)	r	18	
##	92	92	ford	mustang		3.8	1999	6	auto(14)	r	18	

## 93	93	ford	mustang	4.0	2008	6	manual(m5)	r	17
## 94	94	ford	mustang	4.0	2008	6	auto(15)	r	16
## 95	95	ford	mustang	4.6	1999	8	auto(14)	r	15
## 96	96	ford	mustang	4.6	1999	8	manual(m5)	r	15
## 97	97	ford	mustang	4.6	2008	8	manual(m5)	r	15
## 98	98	ford	mustang	4.6	2008	8	auto(15)	r	15
## 99	99	ford	mustang	5.4	2008	8	manual(m6)	r	14
## 100	100	honda	civic	1.6	1999	4	manual(m5)	f	28
## 101	101	honda	civic	1.6	1999	4	auto(14)	f	24
## 102	102	honda	civic	1.6	1999	4	manual(m5)	f	25
## 103	103	honda	civic	1.6	1999	4	manual(m5)	f	23
## 104	104	honda	civic	1.6	1999	4	auto(14)	f	24
## 105	105	honda	civic	1.8	2008	4	manual(m5)	f	26
## 106	106	honda	civic	1.8	2008	4	auto(15)	f	25
## 107	107	honda	civic	1.8	2008	4	auto(15)	f	24
## 108	108	honda	civic	2.0	2008	4	manual(m6)	f	21
## 109	109	hyundai	sonata	2.4	1999	4	auto(14)	f	18
## 110	110	hyundai	sonata	2.4	1999	4	manual(m5)	f	18
## 111	111	hyundai	sonata	2.4	2008	4	auto(14)	f	21
## 112	112	hyundai	sonata	2.4	2008	4	manual(m5)	f	21
## 113	113	hyundai	sonata	2.5	1999	6	auto(14)	f	18
## 114	114	hyundai	sonata	2.5	1999	6	manual(m5)	f	18
## 115	115	hyundai	sonata	3.3	2008	6	auto(15)	f	19
## 116	116	hyundai	tiburon	2.0	1999	4	auto(14)	f	19
## 117	117	hyundai	tiburon	2.0	1999	4	manual(m5)	f	19
## 118	118	hyundai	tiburon	2.0	2008	4	manual(m5)	f	20
## 119	119	hyundai	tiburon	2.0	2008	4	auto(14)	f	20
## 120	120	hyundai	tiburon	2.7	2008	6	auto(14)	f	17
## 121	121	hyundai	tiburon	2.7	2008	6	manual(m6)	f	16
## 122	122	hyundai	tiburon	2.7	2008	6	manual(m5)	f	17
## 123	123	jeep	grand cherokee 4wd	3.0	2008	6	auto(15)	4	17
## 124	124	jeep	grand cherokee 4wd	3.7	2008	6	auto(15)	4	15
## 125	125	jeep	grand cherokee 4wd	4.0	1999	6	auto(14)	4	15
## 126	126	jeep	grand cherokee 4wd	4.7	1999	8	auto(14)	4	14
## 127	127	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	9
## 128	128	jeep	grand cherokee 4wd	4.7	2008	8	auto(15)	4	14
## 129	129	jeep	grand cherokee 4wd	5.7	2008	8	auto(15)	4	13
## 130	130	jeep	grand cherokee 4wd	6.1	2008	8	auto(15)	4	11
## 131	131	land rover	range rover	4.0	1999	8	auto(14)	4	11
## 132	132	land rover	range rover	4.2	2008	8	auto(s6)	4	12
## 133	133	land rover	range rover	4.4	2008	8	auto(s6)	4	12
## 134	134	land rover	range rover	4.6	1999	8	auto(14)	4	11
## 135	135	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11
## 136	136	lincoln	navigator 2wd	5.4	1999	8	auto(14)	r	11
## 137	137	lincoln	navigator 2wd	5.4	2008	8	auto(16)	r	12
## 138	138	mercury	mountaineer 4wd	4.0	1999	6	auto(15)	4	14
## 139	139	mercury	mountaineer 4wd	4.0	2008	6	auto(15)	4	13
## 140	140	mercury	mountaineer 4wd	4.6	2008	8	auto(16)	4	13
## 141	141	mercury	mountaineer 4wd	5.0	1999	8	auto(14)	4	13
## 142	142	nissan	altima	2.4	1999	4	manual(m5)	f	21
## 143	143	nissan	altima	2.4	1999	4	auto(14)	f	19
## 144	144	nissan	altima	2.5	2008	4	auto(av)	f	23
## 145	145	nissan	altima	2.5	2008	4	manual(m6)	f	23
## 146	146	nissan	altima	3.5	2008	6	manual(m6)	f	19

## 147 147	nissan	altima	3.5 2008	6	auto(av)	f	19
## 148 148	nissan	maxima	3.0 1999	6	auto(l4)	f	18
## 149 149	nissan	maxima	3.0 1999	6	manual(m5)	f	19
## 150 150	nissan	maxima	3.5 2008	6	auto(av)	f	19
## 151 151	nissan	pathfinder 4wd	3.3 1999	6	auto(l4)	4	14
## 152 152	nissan	pathfinder 4wd	3.3 1999	6	manual(m5)	4	15
## 153 153	nissan	pathfinder 4wd	4.0 2008	6	auto(l5)	4	14
## 154 154	nissan	pathfinder 4wd	5.6 2008	8	auto(s5)	4	12
## 155 155	pontiac	grand prix	3.1 1999	6	auto(l4)	f	18
## 156 156	pontiac	grand prix	3.8 1999	6	auto(l4)	f	16
## 157 157	pontiac	grand prix	3.8 1999	6	auto(l4)	f	17
## 158 158	pontiac	grand prix	3.8 2008	6	auto(l4)	f	18
## 159 159	pontiac	grand prix	5.3 2008	8	auto(s4)	f	16
## 160 160	subaru	forester awd	2.5 1999	4	manual(m5)	4	18
## 161 161	subaru	forester awd	2.5 1999	4	auto(l4)	4	18
## 162 162	subaru	forester awd	2.5 2008	4	manual(m5)	4	20
## 163 163	subaru	forester awd	2.5 2008	4	manual(m5)	4	19
## 164 164	subaru	forester awd	2.5 2008	4	auto(l4)	4	20
## 165 165	subaru	forester awd	2.5 2008	4	auto(l4)	4	18
## 166 166	subaru	impreza awd	2.2 1999	4	auto(l4)	4	21
## 167 167	subaru	impreza awd	2.2 1999	4	manual(m5)	4	19
## 168 168	subaru	impreza awd	2.5 1999	4	manual(m5)	4	19
## 169 169	subaru	impreza awd	2.5 1999	4	auto(l4)	4	19
## 170 170	subaru	impreza awd	2.5 2008	4	auto(s4)	4	20
## 171 171	subaru	impreza awd	2.5 2008	4	auto(s4)	4	20
## 172 172	subaru	impreza awd	2.5 2008	4	manual(m5)	4	19
## 173 173	subaru	impreza awd	2.5 2008	4	manual(m5)	4	20
## 174 174	toyota	4runner 4wd	2.7 1999	4	manual(m5)	4	15
## 175 175	toyota	4runner 4wd	2.7 1999	4	auto(l4)	4	16
## 176 176	toyota	4runner 4wd	3.4 1999	6	auto(l4)	4	15
## 177 177	toyota	4runner 4wd	3.4 1999	6	manual(m5)	4	15
## 178 178	toyota	4runner 4wd	4.0 2008	6	auto(l5)	4	16
## 179 179	toyota	4runner 4wd	4.7 2008	8	auto(l5)	4	14
## 180 180	toyota	camry	2.2 1999	4	manual(m5)	f	21
## 181 181	toyota	camry	2.2 1999	4	auto(l4)	f	21
## 182 182	toyota	camry	2.4 2008	4	manual(m5)	f	21
## 183 183	toyota	camry	2.4 2008	4	auto(l5)	f	21
## 184 184	toyota	camry	3.0 1999	6	auto(l4)	f	18
## 185 185	toyota	camry	3.0 1999	6	manual(m5)	f	18
## 186 186	toyota	camry	3.5 2008	6	auto(s6)	f	19
## 187 187	toyota	camry solara	2.2 1999	4	auto(l4)	f	21
## 188 188	toyota	camry solara	2.2 1999	4	manual(m5)	f	21
## 189 189	toyota	camry solara	2.4 2008	4	manual(m5)	f	21
## 190 190	toyota	camry solara	2.4 2008	4	auto(s5)	f	22
## 191 191	toyota	camry solara	3.0 1999	6	auto(l4)	f	18
## 192 192	toyota	camry solara	3.0 1999	6	manual(m5)	f	18
## 193 193	toyota	camry solara	3.3 2008	6	auto(s5)	f	18
## 194 194	toyota	corolla	1.8 1999	4	auto(l3)	f	24
## 195 195	toyota	corolla	1.8 1999	4	auto(l4)	f	24
## 196 196	toyota	corolla	1.8 1999	4	manual(m5)	f	26
## 197 197	toyota	corolla	1.8 2008	4	manual(m5)	f	28
## 198 198	toyota	corolla	1.8 2008	4	auto(l4)	f	26
## 199 199	toyota	land cruiser wagon 4wd	4.7 1999	8	auto(l4)	4	11
## 200 200	toyota	land cruiser wagon 4wd	5.7 2008	8	auto(s6)	4	13

##	201	201	toyota	toyota tacoma 4wd	2.7	1999	4	manual(m5)	4	15
##	202	202	toyota	toyota tacoma 4wd	2.7	1999	4	auto(l4)	4	16
##	203	203	toyota	toyota tacoma 4wd	2.7	2008	4	manual(m5)	4	17
##	204	204	toyota	toyota tacoma 4wd	3.4	1999	6	manual(m5)	4	15
##	205	205	toyota	toyota tacoma 4wd	3.4	1999	6	auto(l4)	4	15
##	206	206	toyota	toyota tacoma 4wd	4.0	2008	6	manual(m6)	4	15
##	207	207	toyota	toyota tacoma 4wd	4.0	2008	6	auto(l5)	4	16
##	208	208	volkswagen	gti	2.0	1999	4	manual(m5)	f	21
##	209	209	volkswagen	gti	2.0	1999	4	auto(l4)	f	19
##	210	210	volkswagen	gti	2.0	2008	4	manual(m6)	f	21
##	211	211	volkswagen	gti	2.0	2008	4	auto(s6)	f	22
##	212	212	volkswagen	gti	2.8	1999	6	manual(m5)	f	17
##	213	213	volkswagen	jetta	1.9	1999	4	manual(m5)	f	33
##	214	214	volkswagen	jetta	2.0	1999	4	manual(m5)	f	21
##	215	215	volkswagen	jetta	2.0	1999	4	auto(l4)	f	19
##	216	216	volkswagen	jetta	2.0	2008	4	auto(s6)	f	22
##	217	217	volkswagen	jetta	2.0	2008	4	manual(m6)	f	21
##	218	218	volkswagen	jetta	2.5	2008	5	auto(s6)	f	21
##	219	219	volkswagen	jetta	2.5	2008	5	manual(m5)	f	21
##	220	220	volkswagen	jetta	2.8	1999	6	auto(l4)	f	16
##	221	221	volkswagen	jetta	2.8	1999	6	manual(m5)	f	17
##	222	222	volkswagen	new beetle	1.9	1999	4	manual(m5)	f	35
##	223	223	volkswagen	new beetle	1.9	1999	4	auto(l4)	f	29
##	224	224	volkswagen	new beetle	2.0	1999	4	manual(m5)	f	21
##	225	225	volkswagen	new beetle	2.0	1999	4	auto(l4)	f	19
##	226	226	volkswagen	new beetle	2.5	2008	5	manual(m5)	f	20
##	227	227	volkswagen	new beetle	2.5	2008	5	auto(s6)	f	20
##	228	228	volkswagen	passat	1.8	1999	4	manual(m5)	f	21
##	229	229	volkswagen	passat	1.8	1999	4	auto(l5)	f	18
##	230	230	volkswagen	passat	2.0	2008	4	auto(s6)	f	19
##	231	231	volkswagen	passat	2.0	2008	4	manual(m6)	f	21
##	232	232	volkswagen	passat	2.8	1999	6	auto(l5)	f	16
##	233	233	volkswagen	passat	2.8	1999	6	manual(m5)	f	18
##	234	234	volkswagen	passat	3.6	2008	6	auto(s6)	f	17
##			hwy	fl						
##	1	29	p	compact						
##	2	29	p	compact						
##	3	31	p	compact						
##	4	30	p	compact						
##	5	26	p	compact						
##	6	26	p	compact						
##	7	27	p	compact						
##	8	26	p	compact						
##	9	25	p	compact						
##	10	28	p	compact						
##	11	27	p	compact						
##	12	25	p	compact						
##	13	25	p	compact						
##	14	25	p	compact						
##	15	25	p	compact						
##	16	24	p	midsize						
##	17	25	p	midsize						
##	18	23	p	midsize						
##	19	20	r	suv						

##	20	15	e	suv
##	21	20	r	suv
##	22	17	r	suv
##	23	17	r	suv
##	24	26	p	2seater
##	25	23	p	2seater
##	26	26	p	2seater
##	27	25	p	2seater
##	28	24	p	2seater
##	29	19	r	suv
##	30	14	e	suv
##	31	15	r	suv
##	32	17	d	suv
##	33	27	r	midsize
##	34	30	r	midsize
##	35	26	r	midsize
##	36	29	r	midsize
##	37	26	r	midsize
##	38	24	r	minivan
##	39	24	r	minivan
##	40	22	r	minivan
##	41	22	r	minivan
##	42	24	r	minivan
##	43	24	r	minivan
##	44	17	e	minivan
##	45	22	r	minivan
##	46	21	r	minivan
##	47	23	r	minivan
##	48	23	r	minivan
##	49	19	r	pickup
##	50	18	r	pickup
##	51	17	r	pickup
##	52	17	r	pickup
##	53	19	r	pickup
##	54	19	r	pickup
##	55	12	e	pickup
##	56	17	r	pickup
##	57	15	r	pickup
##	58	17	r	suv
##	59	17	r	suv
##	60	12	e	suv
##	61	17	r	suv
##	62	16	r	suv
##	63	18	r	suv
##	64	15	r	suv
##	65	16	r	pickup
##	66	12	e	pickup
##	67	17	r	pickup
##	68	17	r	pickup
##	69	16	r	pickup
##	70	12	e	pickup
##	71	15	r	pickup
##	72	16	r	pickup
##	73	17	r	pickup

##	74	15	r	pickup
##	75	17	r	suv
##	76	17	r	suv
##	77	18	r	suv
##	78	17	r	suv
##	79	19	r	suv
##	80	17	r	suv
##	81	19	r	suv
##	82	19	r	suv
##	83	17	r	suv
##	84	17	r	pickup
##	85	17	r	pickup
##	86	16	r	pickup
##	87	16	r	pickup
##	88	17	r	pickup
##	89	15	r	pickup
##	90	17	r	pickup
##	91	26	r	subcompact
##	92	25	r	subcompact
##	93	26	r	subcompact
##	94	24	r	subcompact
##	95	21	r	subcompact
##	96	22	r	subcompact
##	97	23	r	subcompact
##	98	22	r	subcompact
##	99	20	p	subcompact
##	100	33	r	subcompact
##	101	32	r	subcompact
##	102	32	r	subcompact
##	103	29	p	subcompact
##	104	32	r	subcompact
##	105	34	r	subcompact
##	106	36	r	subcompact
##	107	36	c	subcompact
##	108	29	p	subcompact
##	109	26	r	midsize
##	110	27	r	midsize
##	111	30	r	midsize
##	112	31	r	midsize
##	113	26	r	midsize
##	114	26	r	midsize
##	115	28	r	midsize
##	116	26	r	subcompact
##	117	29	r	subcompact
##	118	28	r	subcompact
##	119	27	r	subcompact
##	120	24	r	subcompact
##	121	24	r	subcompact
##	122	24	r	subcompact
##	123	22	d	suv
##	124	19	r	suv
##	125	20	r	suv
##	126	17	r	suv
##	127	12	e	suv

##	128	19	r	suv
##	129	18	r	suv
##	130	14	p	suv
##	131	15	p	suv
##	132	18	r	suv
##	133	18	r	suv
##	134	15	p	suv
##	135	17	r	suv
##	136	16	p	suv
##	137	18	r	suv
##	138	17	r	suv
##	139	19	r	suv
##	140	19	r	suv
##	141	17	r	suv
##	142	29	r	compact
##	143	27	r	compact
##	144	31	r	midsize
##	145	32	r	midsize
##	146	27	p	midsize
##	147	26	p	midsize
##	148	26	r	midsize
##	149	25	r	midsize
##	150	25	p	midsize
##	151	17	r	suv
##	152	17	r	suv
##	153	20	p	suv
##	154	18	p	suv
##	155	26	r	midsize
##	156	26	p	midsize
##	157	27	r	midsize
##	158	28	r	midsize
##	159	25	p	midsize
##	160	25	r	suv
##	161	24	r	suv
##	162	27	r	suv
##	163	25	p	suv
##	164	26	r	suv
##	165	23	p	suv
##	166	26	r	subcompact
##	167	26	r	subcompact
##	168	26	r	subcompact
##	169	26	r	subcompact
##	170	25	p	compact
##	171	27	r	compact
##	172	25	p	compact
##	173	27	r	compact
##	174	20	r	suv
##	175	20	r	suv
##	176	19	r	suv
##	177	17	r	suv
##	178	20	r	suv
##	179	17	r	suv
##	180	29	r	midsize
##	181	27	r	midsize



##	182	31	r	midsize
##	183	31	r	midsize
##	184	26	r	midsize
##	185	26	r	midsize
##	186	28	r	midsize
##	187	27	r	compact
##	188	29	r	compact
##	189	31	r	compact
##	190	31	r	compact
##	191	26	r	compact
##	192	26	r	compact
##	193	27	r	compact
##	194	30	r	compact
##	195	33	r	compact
##	196	35	r	compact
##	197	37	r	compact
##	198	35	r	compact
##	199	15	r	suv
##	200	18	r	suv
##	201	20	r	pickup
##	202	20	r	pickup
##	203	22	r	pickup
##	204	17	r	pickup
##	205	19	r	pickup
##	206	18	r	pickup
##	207	20	r	pickup
##	208	29	r	compact
##	209	26	r	compact
##	210	29	p	compact
##	211	29	p	compact
##	212	24	r	compact
##	213	44	d	compact
##	214	29	r	compact
##	215	26	r	compact
##	216	29	p	compact
##	217	29	p	compact
##	218	29	r	compact
##	219	29	r	compact
##	220	23	r	compact
##	221	24	r	compact
##	222	44	d	subcompact
##	223	41	d	subcompact
##	224	29	r	subcompact
##	225	26	r	subcompact
##	226	28	r	subcompact
##	227	29	r	subcompact
##	228	29	p	midsize
##	229	29	p	midsize
##	230	28	p	midsize
##	231	29	p	midsize
##	232	26	p	midsize
##	233	26	p	midsize
##	234	26	p	midsize

```

#1b
# The manufacturer, model, rans, drv, fl, and class
#1c
# The display, cty and hwy

#2
car_manufacturer <- table(MPG$manufacturer)
car_model <- table(MPG$model)
# The manufacturer that has the most models is dodge with 37 models.
# The model that has the most variations is caravan 2wd with 11 variations.

#2a
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

unique_model <- MPG %>%
  group_by(manufacturer) %>%
  summarise(models = n_distinct(model))
unique_model

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

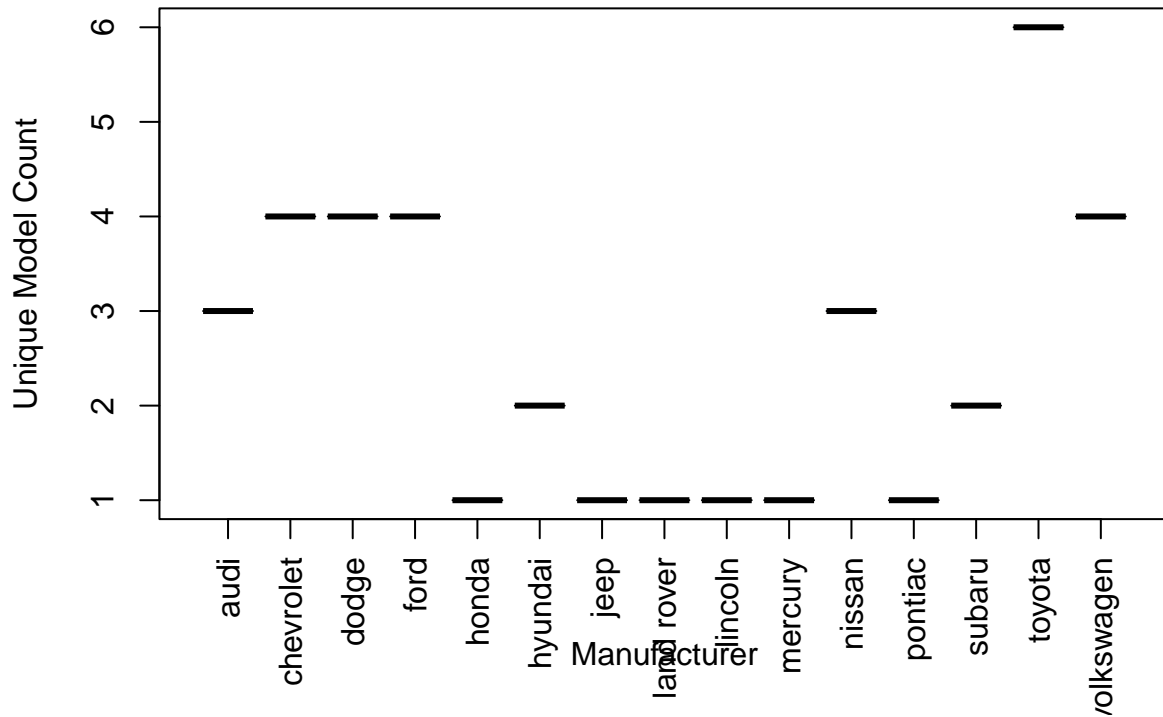
#2b
library(ggplot2)
unique_model$manufacturer <- as.factor(unique_model$manufacturer)
unique_model$models <- as.numeric(unique_model$models)

plot(unique_model$manufacturer, unique_model$models,
      type = "p",
      col = "blue",

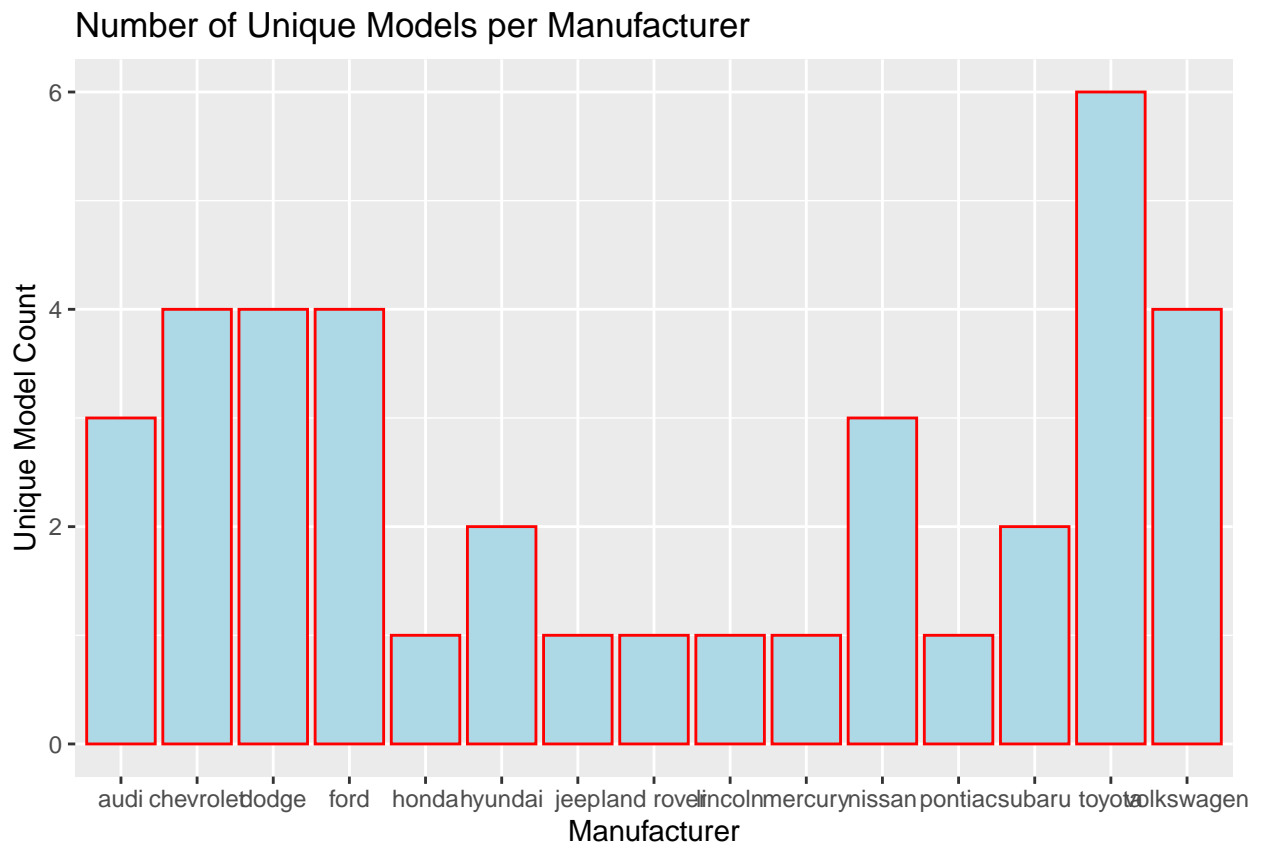
```

```
main = "Number of Unique Models per Manufacturer",
xlab = "Manufacturer",
ylab = "Unique Model Count",
las = 3)
```

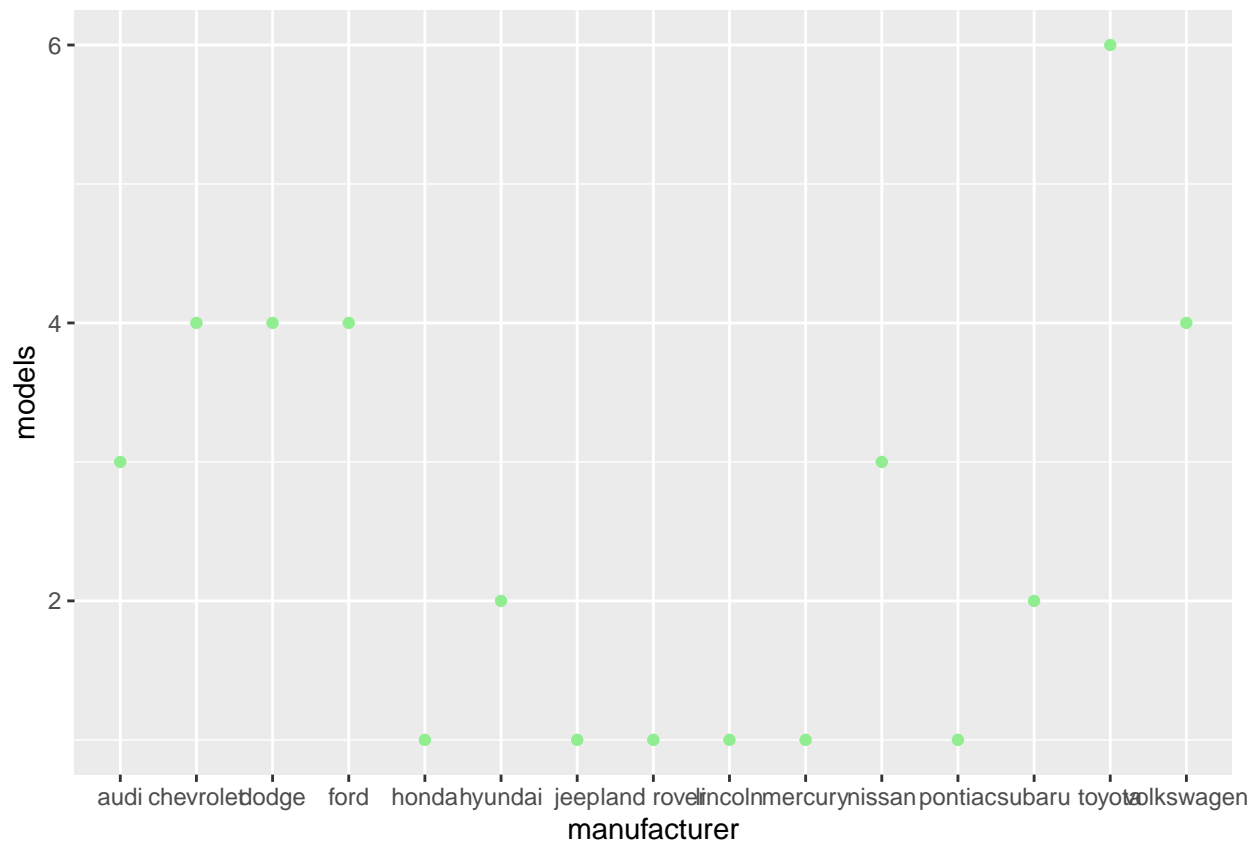
## Number of Unique Models per Manufacturer



```
ggplot(unique_model, aes(manufacturer, models), y = models) +
  geom_bar(stat = "identity", fill = "lightblue", color = "red") +
  labs(title = "Number of Unique Models per Manufacturer", x = "Manufacturer", y = "Unique Model Count")
```



```
#2.2a
#The data was presented using points
library(ggplot2)
ggplot(unique_model, aes(manufacturer, models), y = models) +
  geom_point( color = "lightgreen")
```



### #2.2b

*#It is very useful as it can make the data easier to read and make it clearer to analyze it if there's*

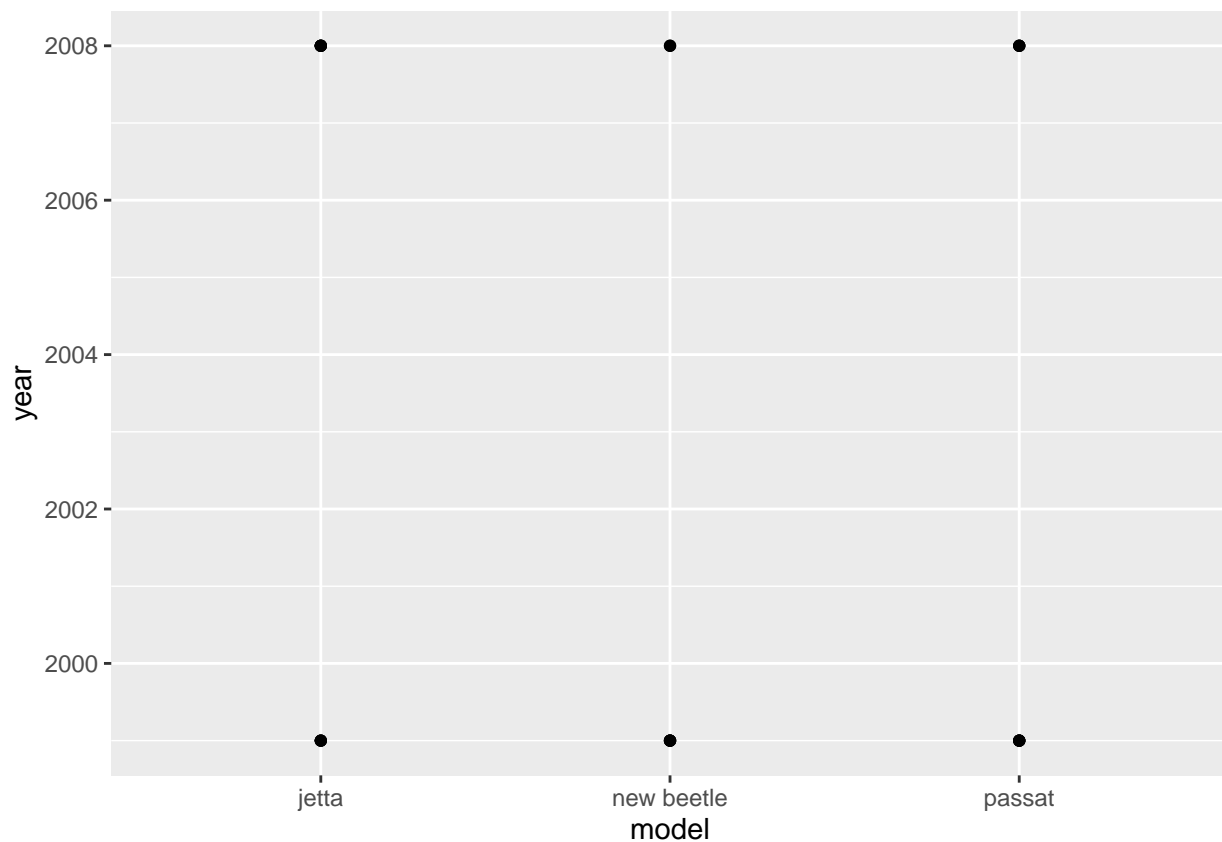
### #3

```
top_MPG <- MPG %>%
  arrange(desc(MPG)) %>%
  head(20)
top_MPG
```

##	X	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy	fl
## 1	234	volkswagen	passat	3.6	2008	6	auto(s6)	f	17	26	p
## 2	233	volkswagen	passat	2.8	1999	6	manual(m5)	f	18	26	p
## 3	232	volkswagen	passat	2.8	1999	6	auto(l15)	f	16	26	p
## 4	231	volkswagen	passat	2.0	2008	4	manual(m6)	f	21	29	p
## 5	230	volkswagen	passat	2.0	2008	4	auto(s6)	f	19	28	p
## 6	229	volkswagen	passat	1.8	1999	4	auto(l15)	f	18	29	p
## 7	228	volkswagen	passat	1.8	1999	4	manual(m5)	f	21	29	p
## 8	227	volkswagen	new beetle	2.5	2008	5	auto(s6)	f	20	29	r
## 9	226	volkswagen	new beetle	2.5	2008	5	manual(m5)	f	20	28	r
## 10	225	volkswagen	new beetle	2.0	1999	4	auto(l14)	f	19	26	r
## 11	224	volkswagen	new beetle	2.0	1999	4	manual(m5)	f	21	29	r
## 12	223	volkswagen	new beetle	1.9	1999	4	auto(l14)	f	29	41	d
## 13	222	volkswagen	new beetle	1.9	1999	4	manual(m5)	f	35	44	d
## 14	221	volkswagen	jetta	2.8	1999	6	manual(m5)	f	17	24	r
## 15	220	volkswagen	jetta	2.8	1999	6	auto(l14)	f	16	23	r
## 16	219	volkswagen	jetta	2.5	2008	5	manual(m5)	f	21	29	r
## 17	218	volkswagen	jetta	2.5	2008	5	auto(s6)	f	21	29	r
## 18	217	volkswagen	jetta	2.0	2008	4	manual(m6)	f	21	29	p

```
## 19 216 volkswagen jetta 2.0 2008 4 auto(s6) f 22 29 p
## 20 215 volkswagen jetta 2.0 1999 4 auto(l4) f 19 26 r
##      class
## 1      midsize
## 2      midsize
## 3      midsize
## 4      midsize
## 5      midsize
## 6      midsize
## 7      midsize
## 8 subcompact
## 9 subcompact
## 10 subcompact
## 11 subcompact
## 12 subcompact
## 13 subcompact
## 14 compact
## 15 compact
## 16 compact
## 17 compact
## 18 compact
## 19 compact
## 20 compact
```

```
ggplot(top_MPG, aes(model,year)) + geom_point()
```



```
#4
car_Models <- MPG %>%
```

```
car_Models
```

```
## # i 28 more rows
```

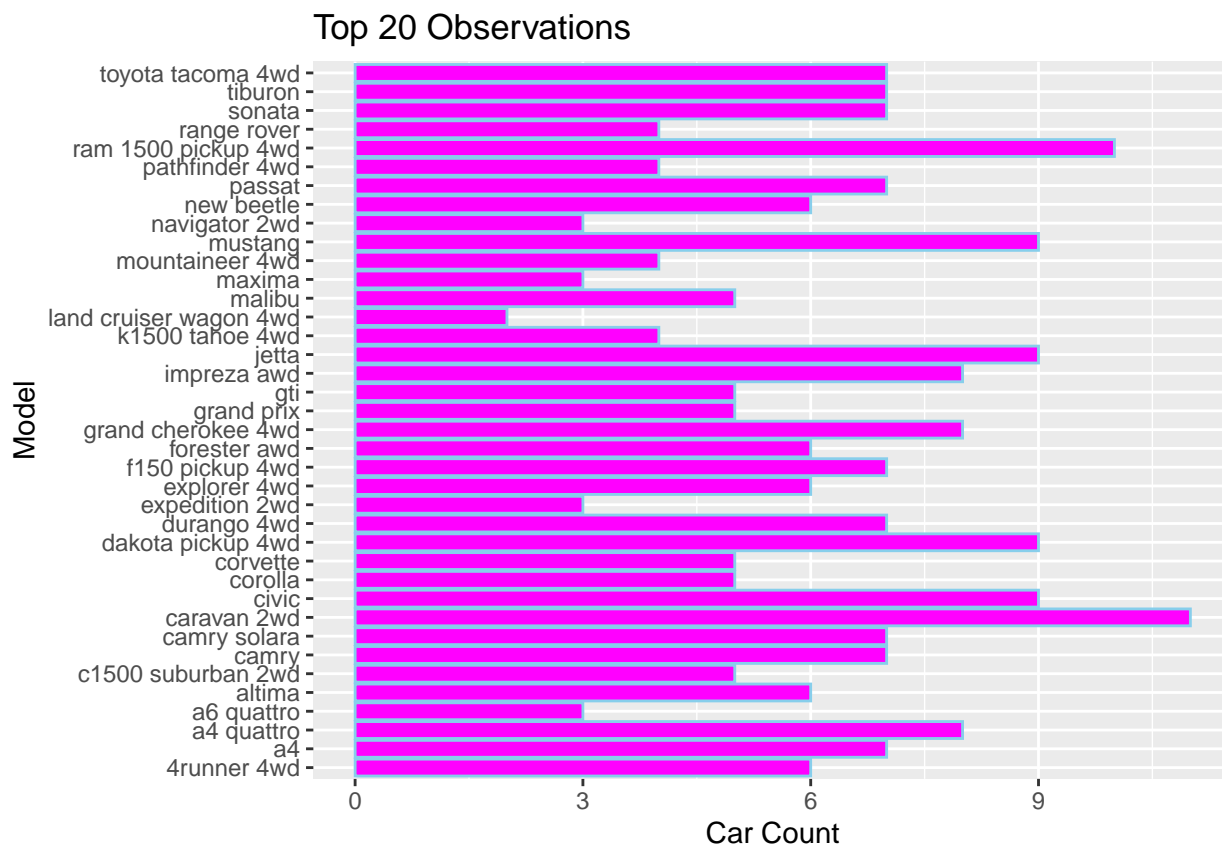
#4a

## Top 20 Observations



## #4b

```
labs(title = "Top 20 Observations", x = "Model", y = "Car Count") +  
coord_flip()
```



```
#5  
ggplot(MPG, aes(x = displ, y = cyl, color = displ)) + geom_point(size = 3) + labs(title = "Relationship")
```

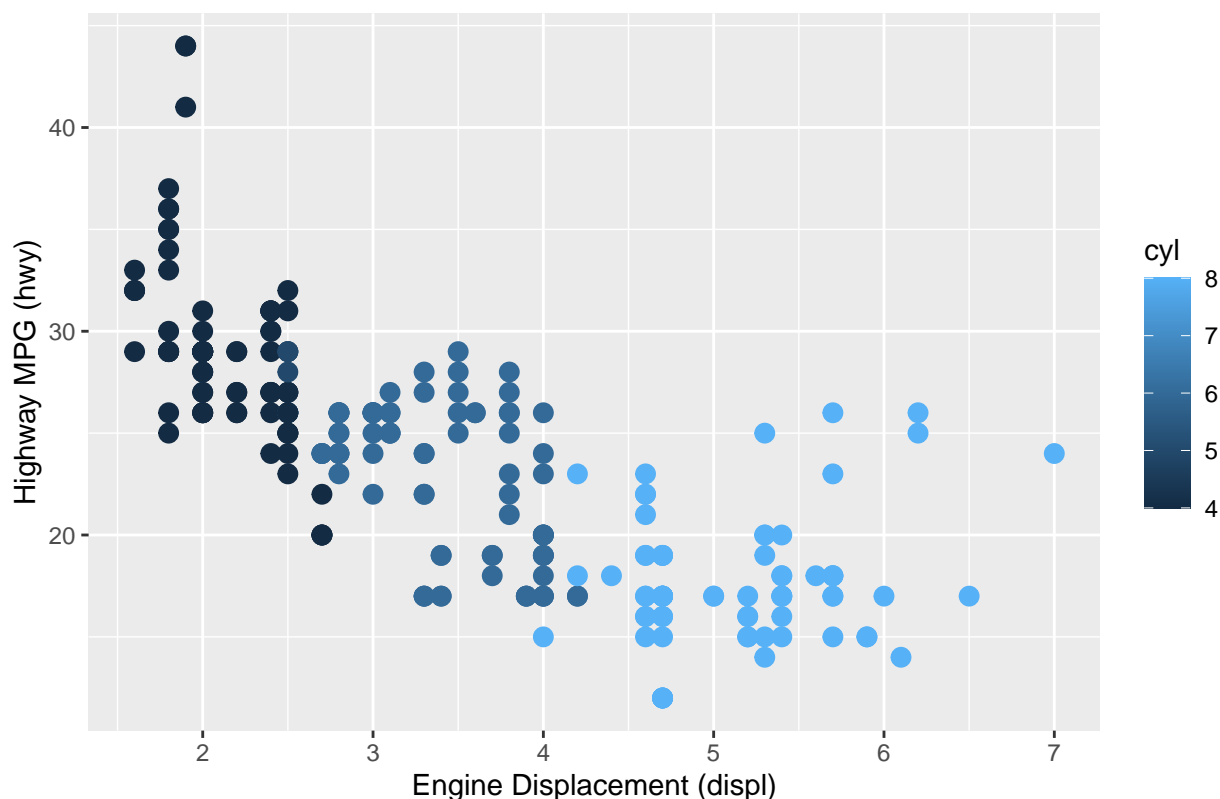


A scatter plot showing the relationship between the Number of Cylinders (cyl) on the x-axis and Engine Displacement (displ) on the y-axis. The x-axis ranges from 1 to 7, and the y-axis ranges from 4 to 8. The plot features a light gray background with white grid lines. Data points are colored according to their displacement value, with a color scale on the right ranging from dark blue (low displacement) to light blue (high displacement). The data points are clustered into three main horizontal bands: one at a displacement of 4 for 1 to 3 cylinders, one at a displacement of 6 for 2 to 4 cylinders, and one at a displacement of 8 for 4 to 7 cylinders. There is a single outlier at (2.6, 5.0).

Number of Cylinders (cyl)	Engine Displacement (displ)
1.6	4.0
1.8	4.0
1.8	4.0
1.8	4.0
2.0	4.0
2.0	4.0
2.4	4.0
2.6	5.0
2.6	4.0
2.6	6.0
2.8	4.0
2.8	6.0
3.0	6.0
3.0	6.0
3.2	6.0
3.4	6.0
3.4	6.0
3.6	6.0
3.6	6.0
3.8	6.0
3.8	6.0
4.0	6.0
4.0	8.0
4.2	6.0
4.2	8.0
4.4	8.0
4.6	8.0
4.6	8.0
4.6	8.0
4.8	8.0
5.0	8.0
5.2	8.0
5.2	8.0
5.4	8.0
5.4	8.0
5.6	8.0
5.6	8.0
5.8	8.0
5.8	8.0
6.0	8.0
6.0	8.0
6.2	8.0
6.2	8.0
6.6	8.0
7.0	8.0

```
#6
ggplot(MPG, aes(x = displ, y = hwy, color = cyl)) +
  geom_point(size = 3) +
  labs(title = "Relationship between Engine Displacement and Highway MPG",
       x = "Engine Displacement (displ)",
       y = "Highway MPG (hwy)")
```

Relationship between Engine Displacement and Highway MPG



*#The plot shows that as the engine displacement increases the highway miles per gallon generally decrease.*

*#6.2*

```
traffic <- read.csv("/cloud/project/worksheet#4/traffic.csv")
```

*#6.2a*

```
str(traffic)
```

```
## 'data.frame': 48120 obs. of 4 variables:
## $ DateTime: chr "2015-11-01 00:00:00" "2015-11-01 01:00:00" "2015-11-01 02:00:00" "2015-11-01 03:00:00" ...
## $ Junction: int 1 1 1 1 1 1 1 1 1 1 ...
## $ Vehicles: int 15 13 10 7 9 6 9 8 11 12 ...
## $ ID : num 2.02e+10 2.02e+10 2.02e+10 2.02e+10 2.02e+10 ...
```

*# There are 48120 observations and 4 variables called DateTime, Junction, Vehicles, and ID*

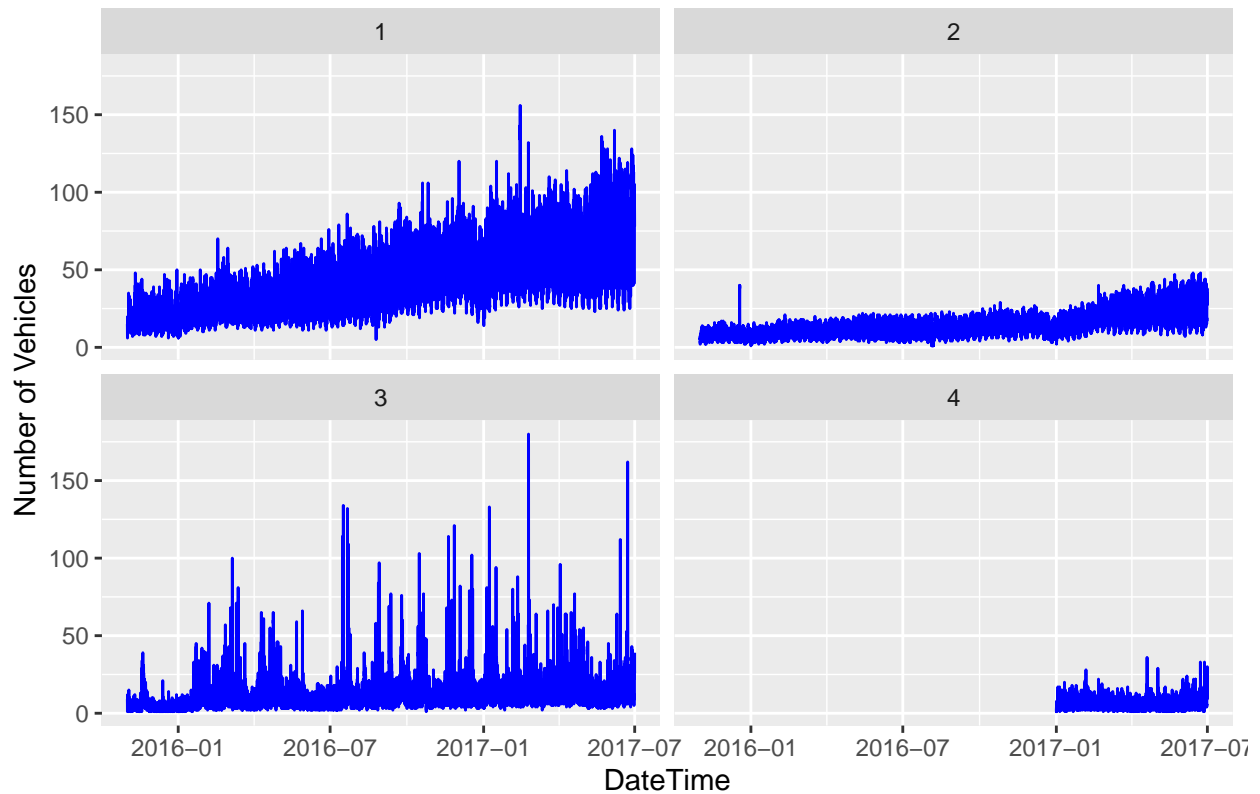
*#6.2b*

```
junction <- split(traffic, traffic$Junction)
```

*#6.2c*

```
traffic$DateTime <- as.POSIXct(traffic$DateTime, format = "%Y-%m-%d %H:%M:%S")
ggplot(traffic, aes(x = DateTime, y = Vehicles)) +
  geom_line(color = "blue") +
  labs(title = "Traffic Volume Over Time at Each Junction",
       x = "DateTime",
       y = "Number of Vehicles") +
  facet_wrap(~ Junction)
```

## Traffic Volume Over Time at Each Junction



```
#7
library(readxl)
alexa <- read_excel("/cloud/project/worksheet#4/alexa_file.xlsx")

#7a
str(alexa)

## tibble [3,150 x 5] (S3: tbl_df/tbl/data.frame)
##  $ rating      : num [1:3150] 5 5 4 5 5 5 3 5 5 5 ...
##  $ date        : POSIXct[1:3150], format: "2018-07-31" "2018-07-31" ...
##  $ variation    : chr [1:3150] "Charcoal Fabric" "Charcoal Fabric" "Walnut Finish" "Charcoal Fabr
##  $ verified_reviews: chr [1:3150] "Love my Echo!" "Loved it!" "Sometimes while playing a game, you c
##  $ feedback     : num [1:3150] 1 1 1 1 1 1 1 1 1 1 ...

ncol(alexa)

## [1] 5

# There are 3150 observations and 5 columns in alexa_file

#7b
library(dplyr)
print(colnames(alexa))

## [1] "rating"      "date"        "variation"    "verified_reviews"
## [5] "feedback"

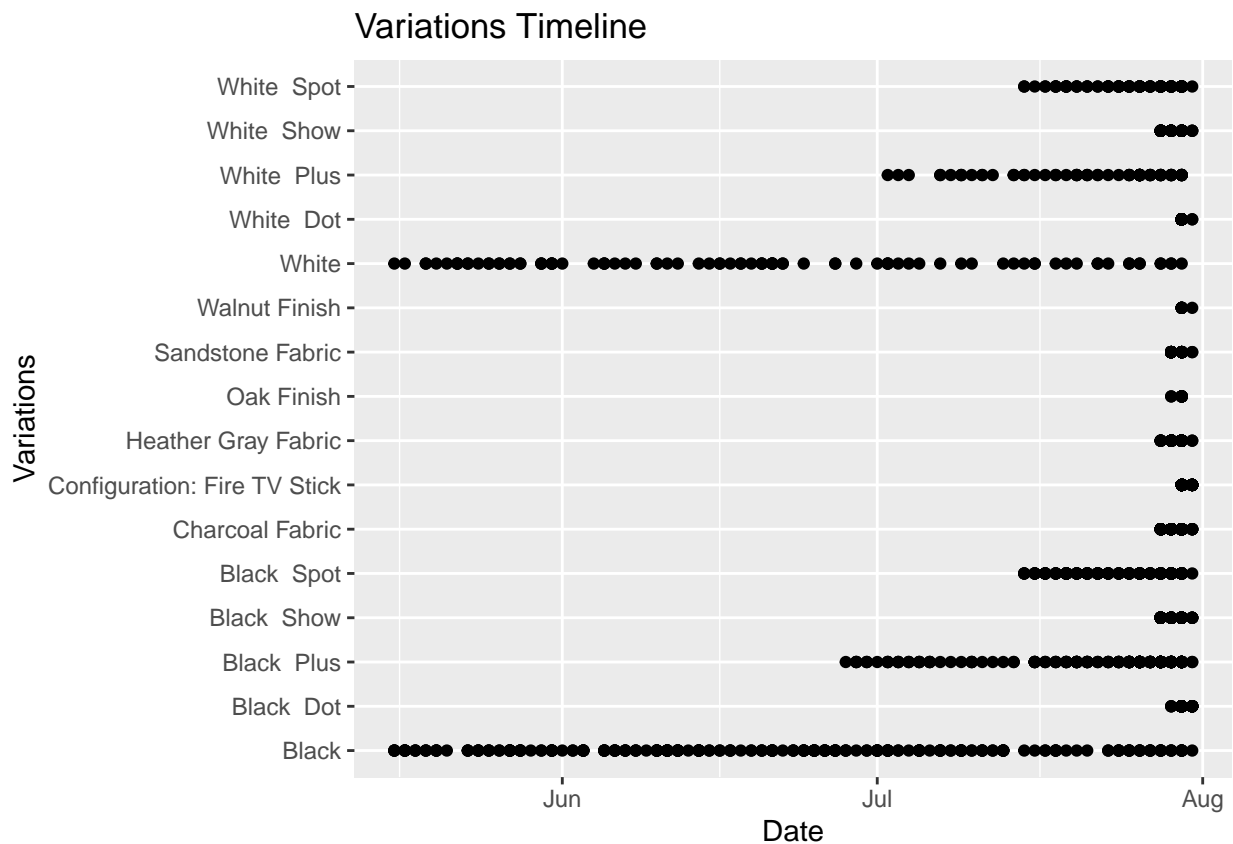
total_variation <- alexa %>%
  group_by(variation) %>%
  summarise(total = n())
```

```
total_variation
```

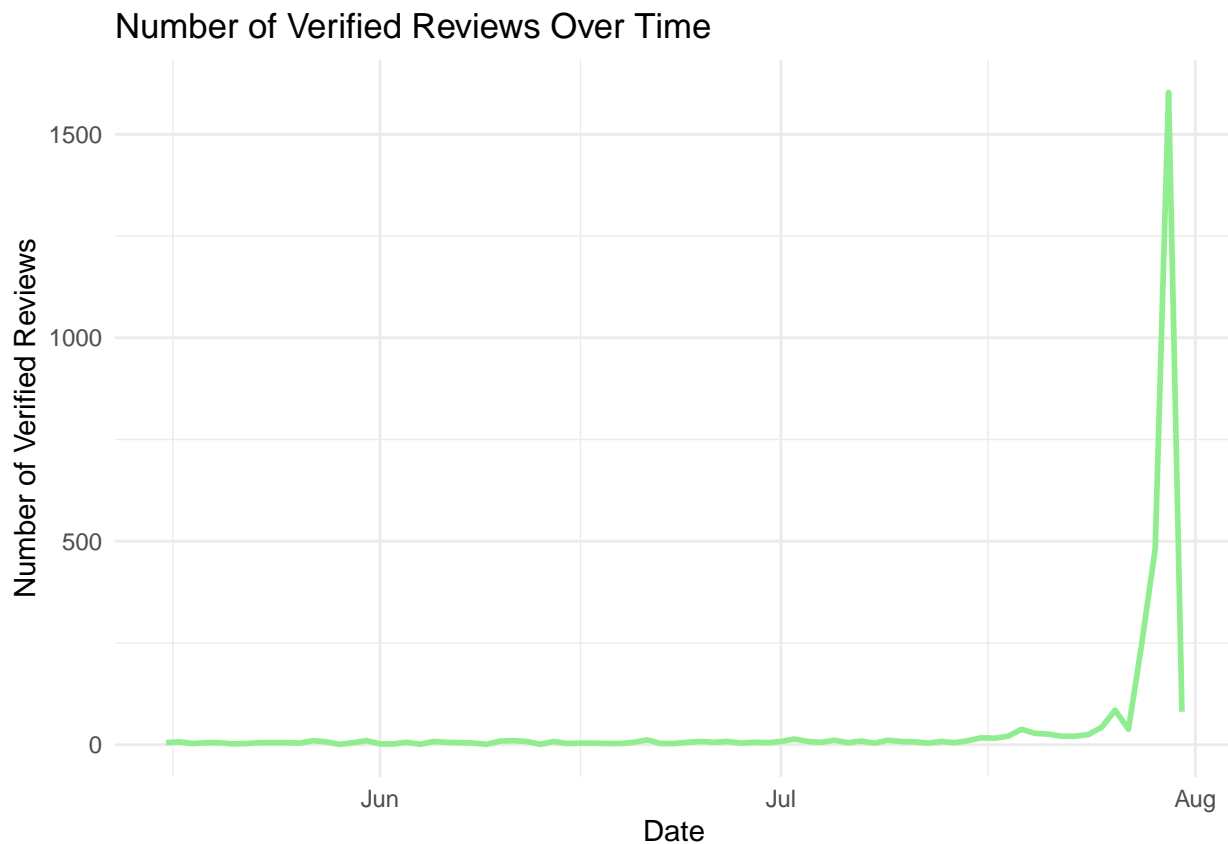
```
## # A tibble: 16 x 2
##   variation      total
##   <chr>        <int>
## 1 Black        261
## 2 Black Dot    516
## 3 Black Plus   270
## 4 Black Show   265
## 5 Black Spot   241
## 6 Charcoal Fabric 430
## 7 Configuration: Fire TV Stick 350
## 8 Heather Gray Fabric 157
## 9 Oak Finish    14
## 10 Sandstone Fabric 90
## 11 Walnut Finish 9
## 12 White        91
## 13 White Dot    184
## 14 White Plus    78
## 15 White Show    85
## 16 White Spot   109
```

```
#7c
```

```
library("ggplot2")
ggplot(alexa, aes(x = date, y = variation)) +
  geom_point() + labs(title = "Variations Timeline", x = "Date", y = "Variations", color = "Verified")
```



```
#7d
alexa$date <- as.Date(alexa$date, format = "%d-%b-%y")
review_count <- alexa %>%
  group_by(date) %>%
  summarise(review_count = n())
ggplot(data = review_count, aes(x = date, y = review_count)) +
  geom_line(color = "lightgreen", linewidth = 1) +
  labs(title = "Number of Verified Reviews Over Time", x = "Date", y = "Number of Verified Reviews") +
  theme_minimal()
```



```
#7e
variation_rates <- alexa %>%
  group_by(variation) %>%
  summarise(average_ratings = mean(rating, na.rm = TRUE)) %>%
  arrange(desc(average_ratings))

ggplot(variation_rates, aes(x = reorder(variation, -average_ratings), y = average_ratings)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  coord_flip() + # Flip coordinates for better readability
labs(title = "Average Product Variation Ratings", x = "Variations", y = "Average Rating") +
  theme_minimal()
```

