

RWorksheet4c in R

2025-12-10

```
library(ggplot2)
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(RColorBrewer)
library(readxl)
library(writexl)
```

1. MPG Dataset

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

mpg <- read.csv("mpg.csv", stringsAsFactors = FALSE)
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(14)	r	11	15
## 21	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(14)	r	14	20
## 22	chevrolet	c1500 suburban 2wd	5.7	1999	8	auto(14)	r	13	17
## 23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(14)	r	12	17
## 24	chevrolet	corvette	5.7	1999	8	manual(m6)	r	16	26
## 25	chevrolet	corvette	5.7	1999	8	auto(14)	r	15	23
## 26	chevrolet	corvette	6.2	2008	8	manual(m6)	r	16	26
## 27	chevrolet	corvette	6.2	2008	8	auto(s6)	r	15	25
## 28	chevrolet	corvette	7.0	2008	8	manual(m6)	r	15	24
## 29	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(14)	4	14	19
## 30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(14)	4	11	14
## 31	chevrolet	k1500 tahoe 4wd	5.7	1999	8	auto(14)	4	11	15
## 32	chevrolet	k1500 tahoe 4wd	6.5	1999	8	auto(14)	4	14	17
## 33	chevrolet	malibu	2.4	1999	4	auto(14)	f	19	27
## 34	chevrolet	malibu	2.4	2008	4	auto(14)	f	22	30
## 35	chevrolet	malibu	3.1	1999	6	auto(14)	f	18	26
## 36	chevrolet	malibu	3.5	2008	6	auto(14)	f	18	29
## 37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17	26
## 38	dodge	caravan 2wd	2.4	1999	4	auto(13)	f	18	24
## 39	dodge	caravan 2wd	3.0	1999	6	auto(14)	f	17	24
## 40	dodge	caravan 2wd	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(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
```

```
str(mpg)
```

```
## 'data.frame': 234 obs. of 11 variables:
## $ manufacturer: chr "audi" "audi" "audi" "audi" ...
## $ model : chr "a4" "a4" "a4" "a4" ...
## $ displ : num 1.8 1.8 2 2 2.8 2.8 3.1 1.8 1.8 2 ...
## $ year : int 1999 1999 2008 2008 1999 1999 2008 1999 1999 2008 ...
## $ cyl : int 4 4 4 4 6 6 6 4 4 4 ...
## $ trans : chr "auto(l5)" "manual(m5)" "manual(m6)" "auto(av)" ...
## $ drv : chr "f" "f" "f" "f" ...
## $ cty : int 18 21 20 21 16 18 18 18 16 20 ...
## $ hwy : int 29 29 31 30 26 26 27 26 25 28 ...
## $ fl : chr "p" "p" "p" "p" ...
## $ class : chr "compact" "compact" "compact" "compact" ...
```

2. Models by Manufacturer

```
mpg %>%
  group_by(manufacturer) %>%
  summarise(models = n_distinct(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
```

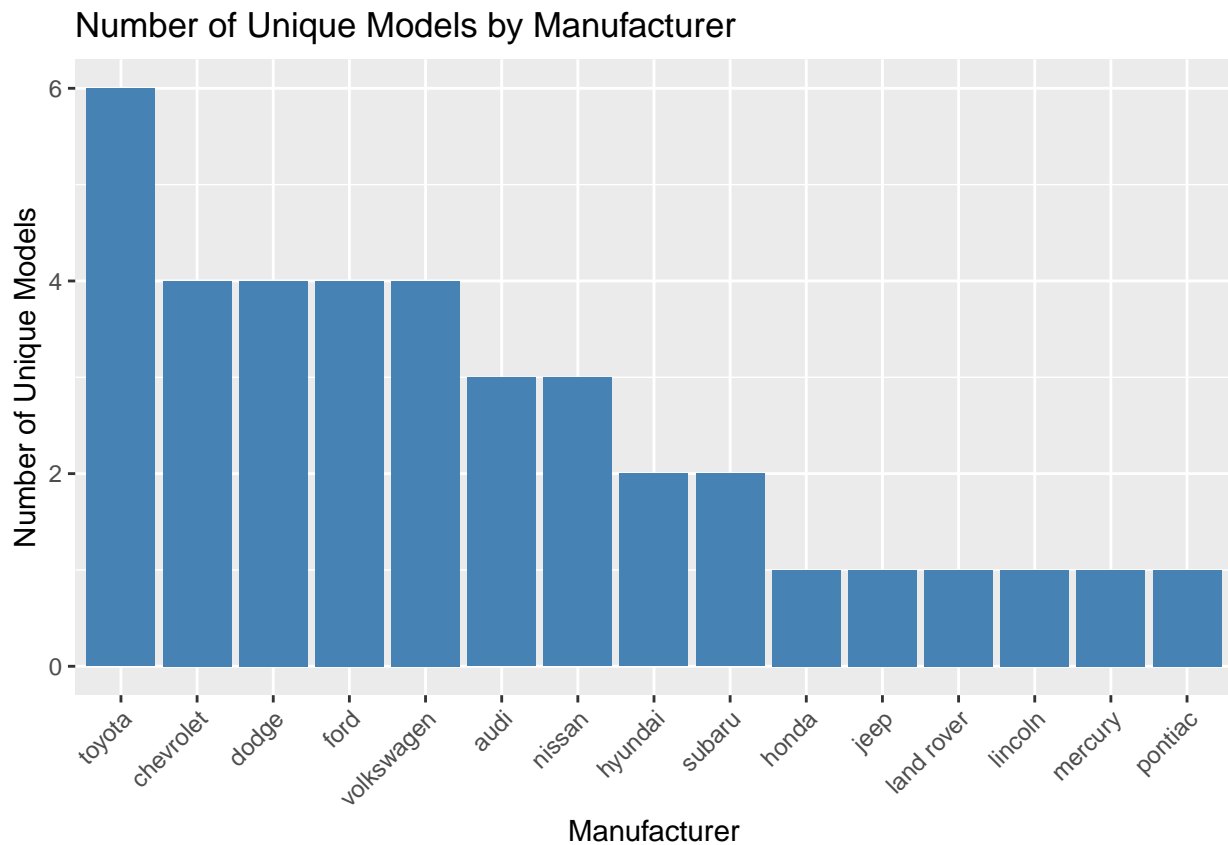
```
## 13 subaru          2
## 14 toyota          6
## 15 volkswagen      4
```

```
unique_models <- mpg %>%
  group_by(manufacturer) %>%
  summarise(unique_models = n_distinct(model)) %>%
  arrange(desc(unique_models))
```

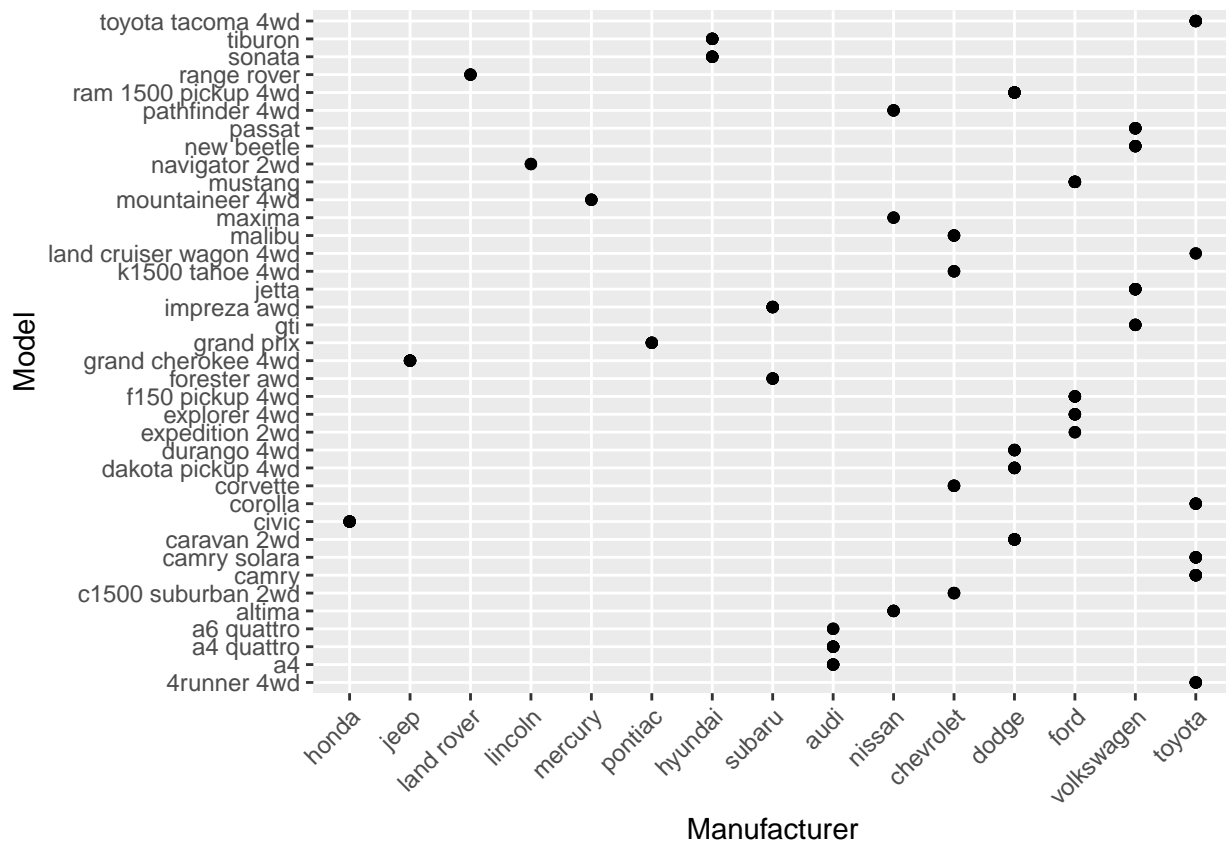
```
unique_models
```

```
## # A tibble: 15 x 2
##   manufacturer unique_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
```

```
ggplot(unique_models, aes(x = reorder(manufacturer, -unique_models), y = unique_models)) +
  geom_bar(stat = "identity", fill = "steelblue") +
  xlab("Manufacturer") +
  ylab("Number of Unique Models") +
  ggtitle("Number of Unique Models by Manufacturer") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



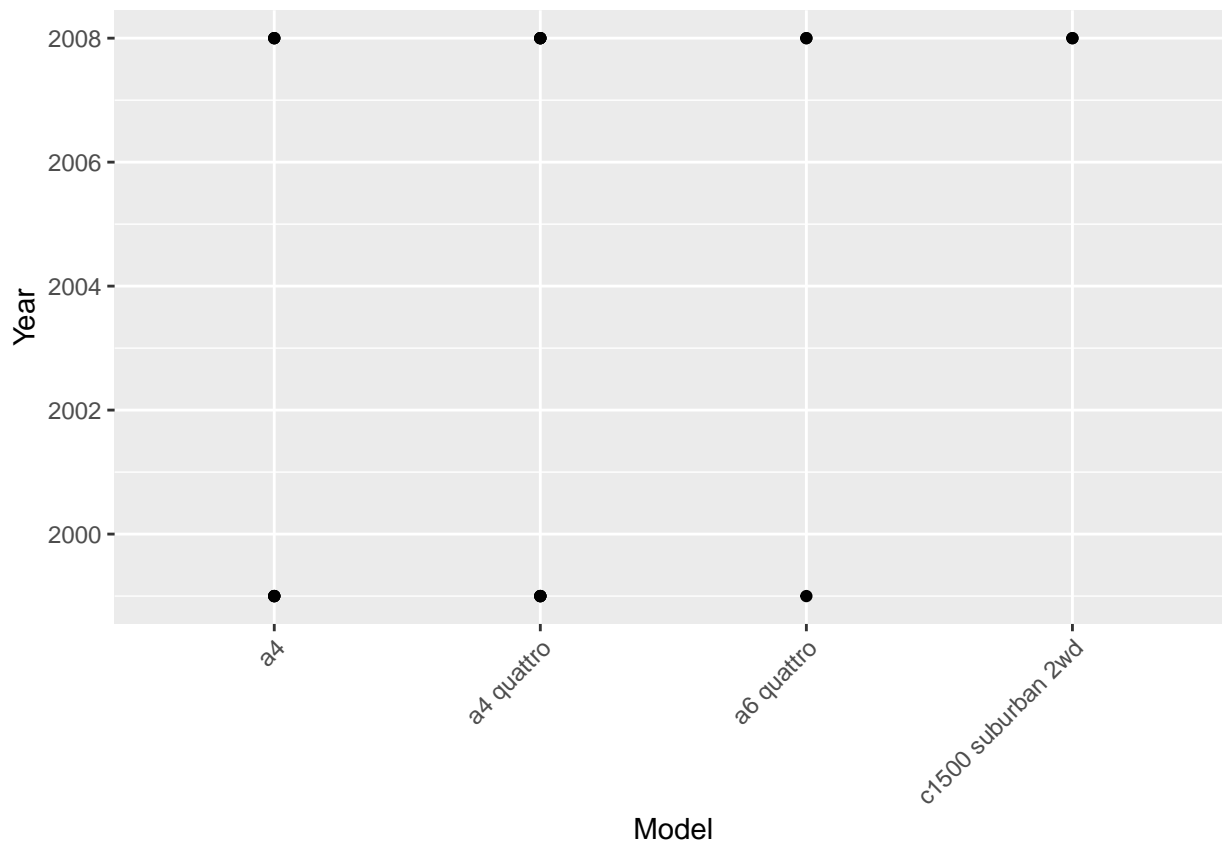
```
ggplot(mpg, aes(x = reorder(manufacturer, model, function(x) length(unique(x))), y = model)) +  
  geom_point() +  
  xlab("Manufacturer") +  
  ylab("Model") +  
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



3. Top 20 Models

```
top_20 <- head(mpg, 20)

ggplot(top_20, aes(x = model, y = year)) +
  geom_point() +
  xlab("Model") +
  ylab("Year") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



4. Car Model Frequency

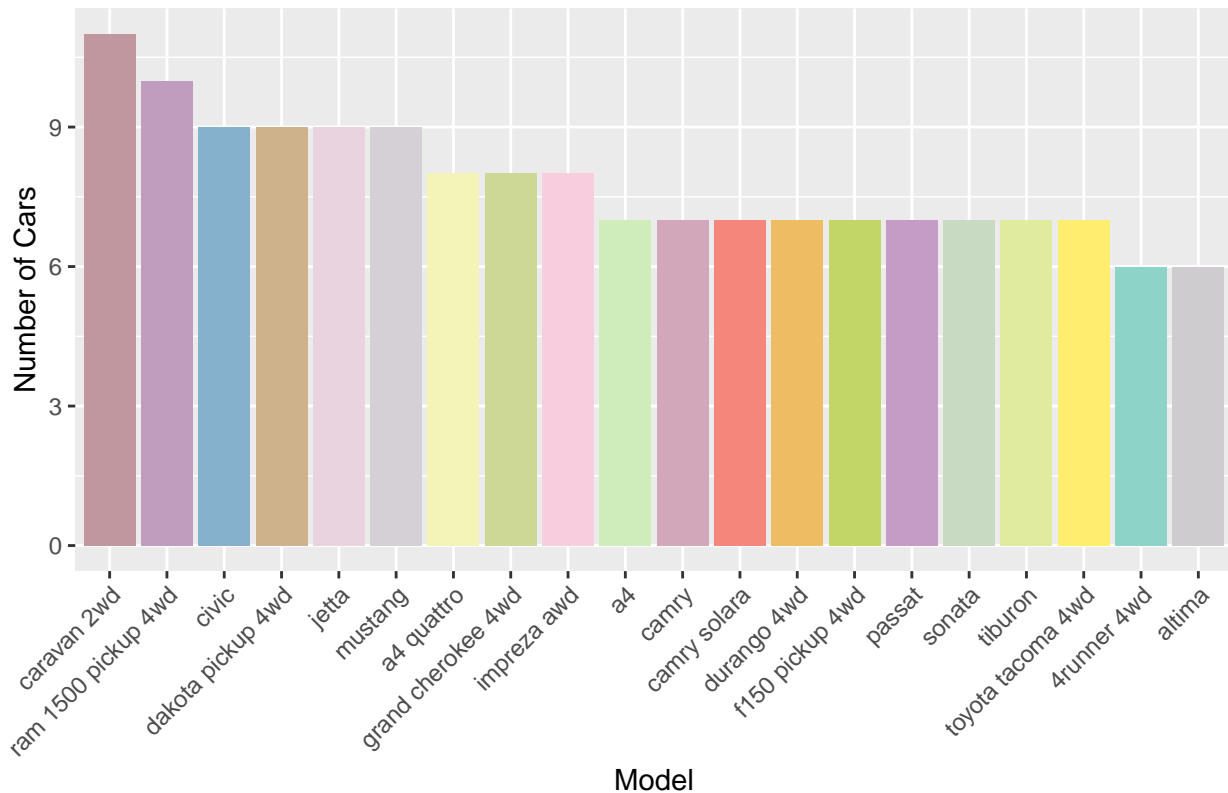
```
mpg %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count))
```

```
## # A tibble: 38 x 2
##   model                count
##   <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
```

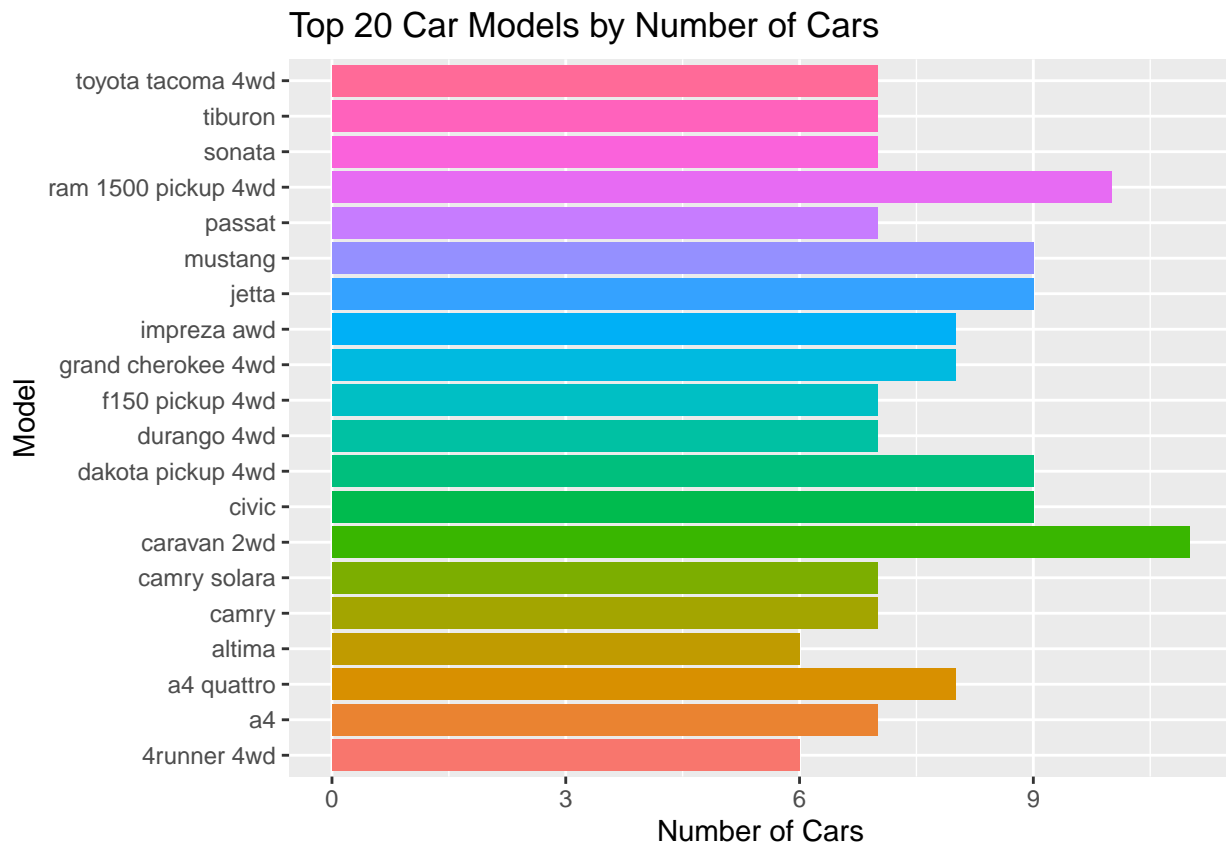
```
top_20_models <- mpg %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count)) %>%
  head(20)
```

```
ggplot(top_20_models, aes(x = reorder(model, -count), y = count, fill = model)) +
  geom_bar(stat = "identity") +
  xlab("Model") +
  ylab("Number of Cars") +
  ggtitle("Top 20 Car Models by Number of Cars") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1), legend.position = "none") +
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(20))
```

Top 20 Car Models by Number of Cars

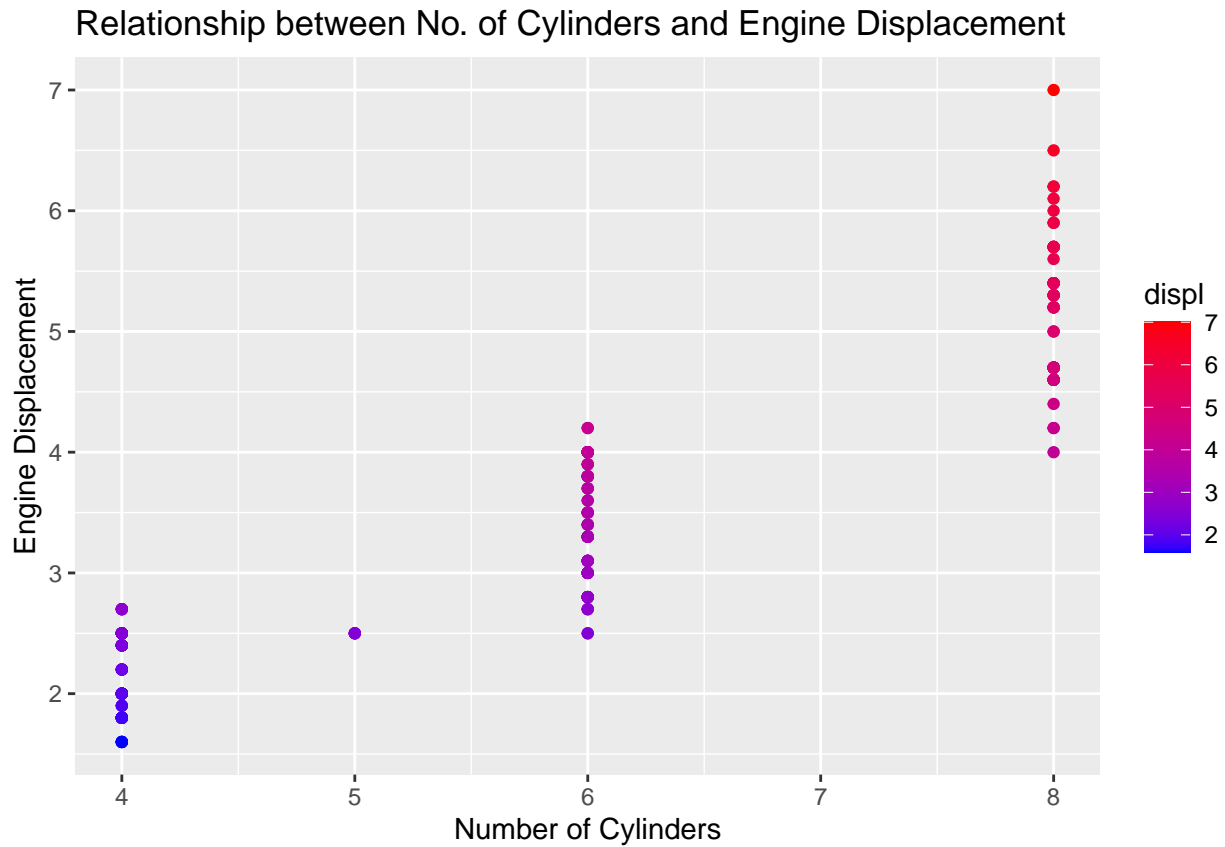


```
ggplot(top_20_models, aes(x = model, y = count, fill = model)) +
  geom_bar(stat = "identity") +
  coord_flip() +
  xlab("Model") +
  ylab("Number of Cars") +
  ggtitle("Top 20 Car Models by Number of Cars") +
  theme(axis.text.y = element_text(size = 9), legend.position = "none")
```



5. Cylinders vs Displacement

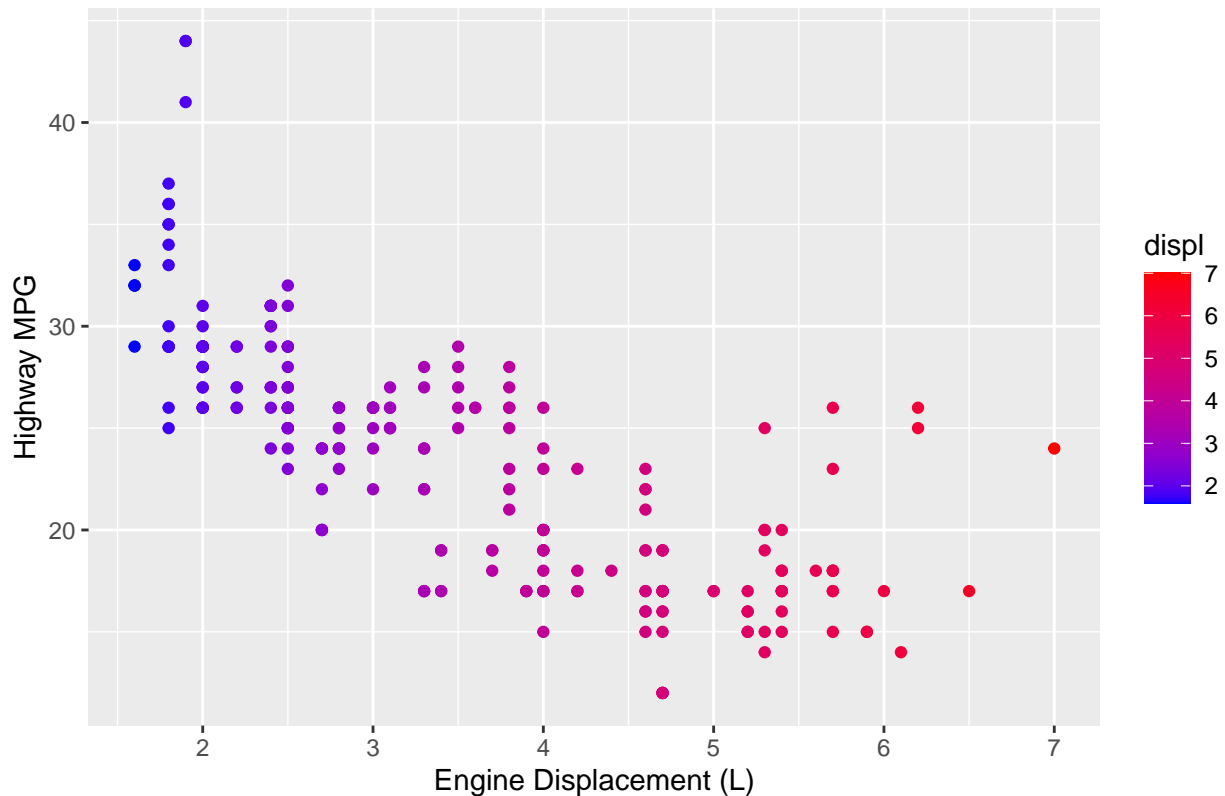
```
ggplot(mpg, aes(x = cyl, y = displ, color = displ)) +
  geom_point() +
  ggtitle("Relationship between No. of Cylinders and Engine Displacement") +
  xlab("Number of Cylinders") +
  ylab("Engine Displacement") +
  scale_color_gradient(low = "blue", high = "red")
```

6. Displacement vs Highway MPG

```
ggplot(mpg, aes(x = displ, y = hwy, color = displ)) +
  geom_point() +
  ggtitle("Relationship between Engine Displacement and Highway MPG") +
  xlab("Engine Displacement (L)") +
  ylab("Highway MPG") +
  scale_color_gradient(low = "blue", high = "red")
```

Relationship between Engine Displacement and Highway MPG



7. Traffic Data

```
traffic_data <- data.frame(
  Date = as.Date('2025-11-01') + 0:9,
  Location = rep(c("Intersection A", "Intersection B"), each = 5),
  Vehicles = c(120, 150, 130, 160, 140, 200, 210, 190, 205, 220),
  Average_Speed = c(35.5, 34.2, 36.0, 33.8, 34.5, 32.0, 31.5, 33.0, 30.8, 29.5)
)

write.csv(traffic_data, "traffic.csv", row.names = FALSE)
traffic <- read.csv("traffic.csv", stringsAsFactors = FALSE)

str(traffic)

## 'data.frame': 10 obs. of 4 variables:
## $ Date : chr "2025-11-01" "2025-11-02" "2025-11-03" "2025-11-04" ...
## $ Location : chr "Intersection A" "Intersection A" "Intersection A" "Intersection A" ...
## $ Vehicles : int 120 150 130 160 140 200 210 190 205 220
## $ Average_Speed: num 35.5 34.2 36 33.8 34.5 32 31.5 33 30.8 29.5

intersection_a <- traffic[traffic$Location == "Intersection A", ]
intersection_b <- traffic[traffic$Location == "Intersection B", ]

print(intersection_a)

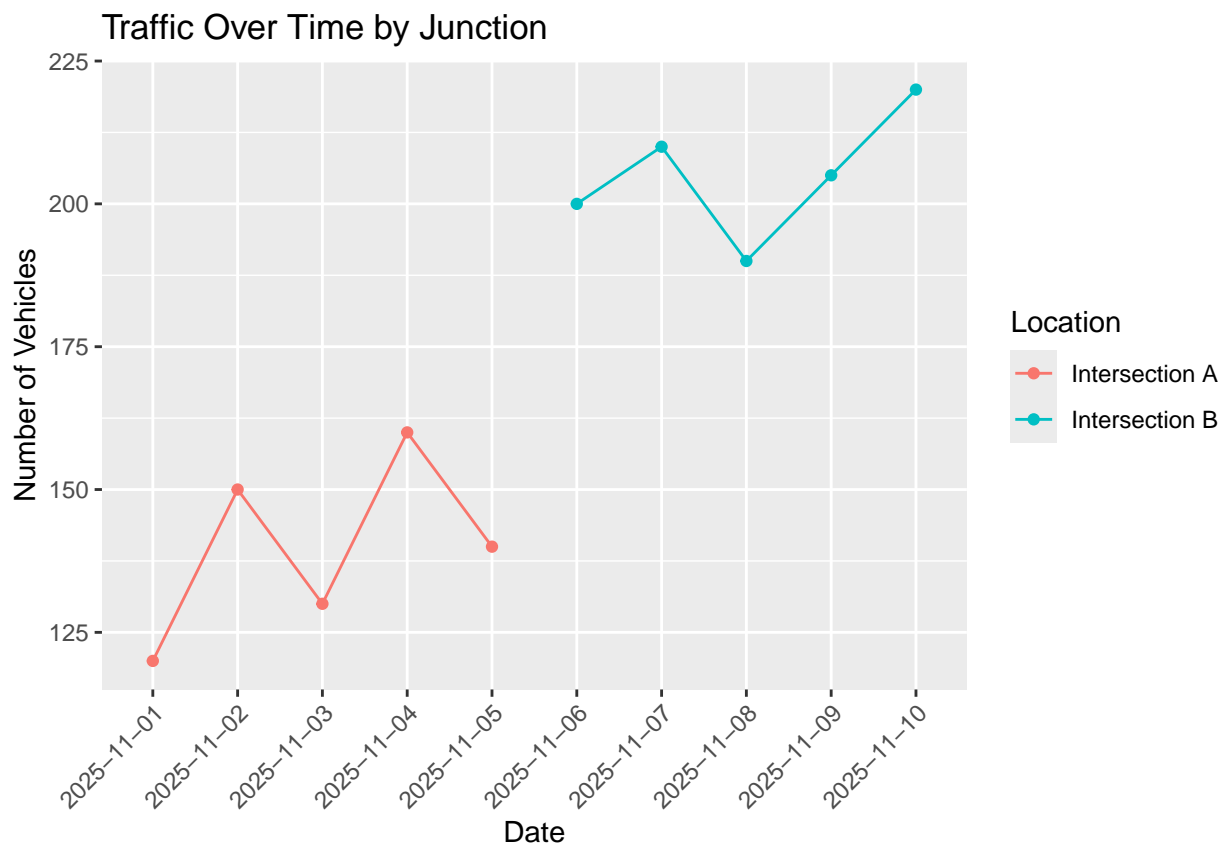
## Date Location Vehicles Average_Speed
## 1 2025-11-01 Intersection A 120 35.5
```

```
## 2 2025-11-02 Intersection A      150      34.2
## 3 2025-11-03 Intersection A      130      36.0
## 4 2025-11-04 Intersection A      160      33.8
## 5 2025-11-05 Intersection A      140      34.5
```

```
print(intersection_b)
```

```
##      Date      Location Vehicles Average_Speed
## 6 2025-11-06 Intersection B      200      32.0
## 7 2025-11-07 Intersection B      210      31.5
## 8 2025-11-08 Intersection B      190      33.0
## 9 2025-11-09 Intersection B      205      30.8
## 10 2025-11-10 Intersection B      220      29.5
```

```
ggplot(traffic, aes(x = Date, y = Vehicles, color = Location, group = Location)) +
  geom_line() +
  geom_point() +
  xlab("Date") +
  ylab("Number of Vehicles") +
  ggtitle("Traffic Over Time by Junction") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



8. Alexa Dataset

```
alexa <- data.frame(
  rating = sample(1:5, 100, replace = TRUE),
  date = seq(as.Date("2024-01-01"), by = "day", length.out = 100),
  verified_reviews = sample(c("Great product", "Good", "Average", "Poor"), 100, replace = TRUE),
```

```

feedback = sample(0:1, 100, replace = TRUE),
variation = sample(c("Black", "White", "Charcoal Fabric", "Heather Gray Fabric"), 100, replace = TRUE)
)

write_xlsx(alexa, "alexa-file.xlsx")
alexa <- read_excel("alexa-file.xlsx")

str(alexa)

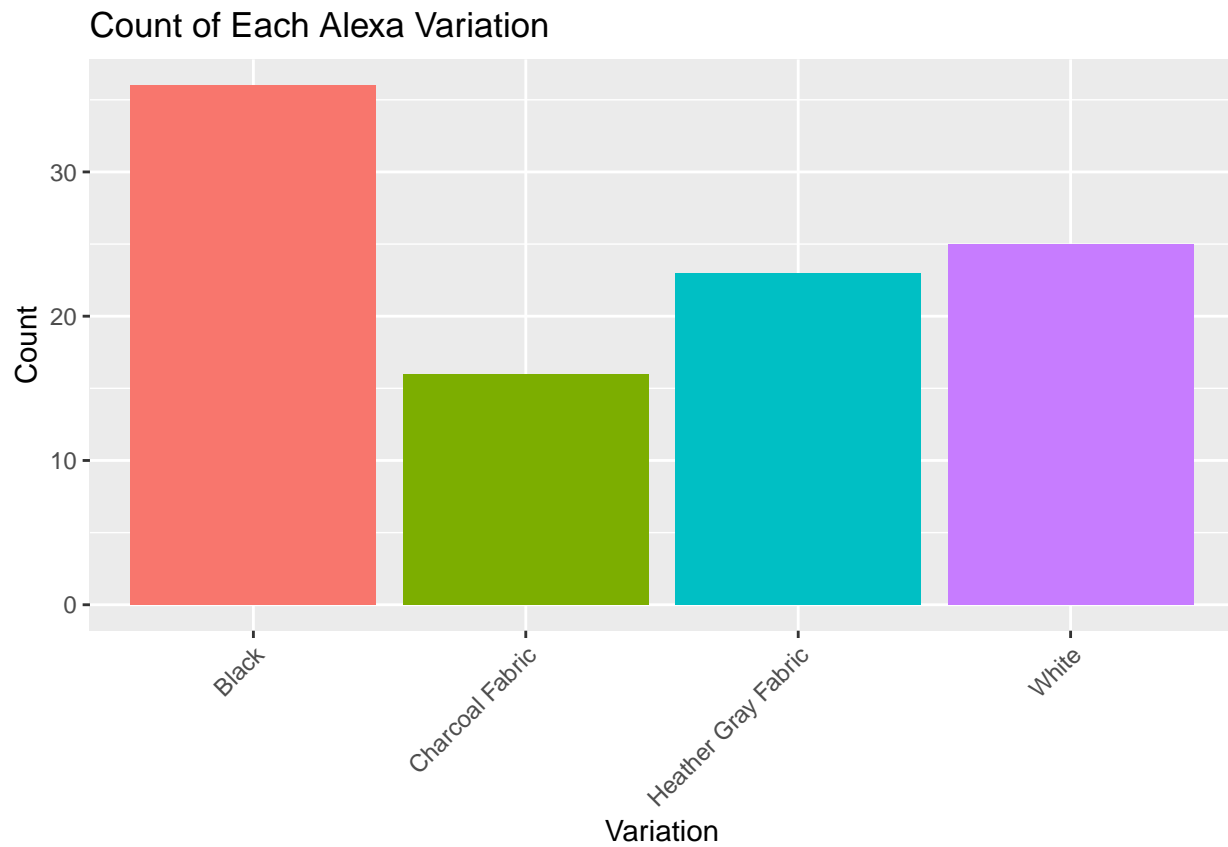
## tibble [100 x 5] (S3: tbl_df/tbl/data.frame)
##  $ rating      : num [1:100] 3 3 1 1 4 2 1 1 2 4 ...
##  $ date        : POSIXct[1:100], format: "2024-01-01" "2024-01-02" ...
##  $ verified_reviews: chr [1:100] "Good" "Good" "Average" "Poor" ...
##  $ feedback     : num [1:100] 1 0 1 0 1 1 0 0 0 0 ...
##  $ variation    : chr [1:100] "Heather Gray Fabric" "Black" "Heather Gray Fabric" "Charcoal Fabri

alexa %>%
  group_by(variation) %>%
  summarise(total = n())

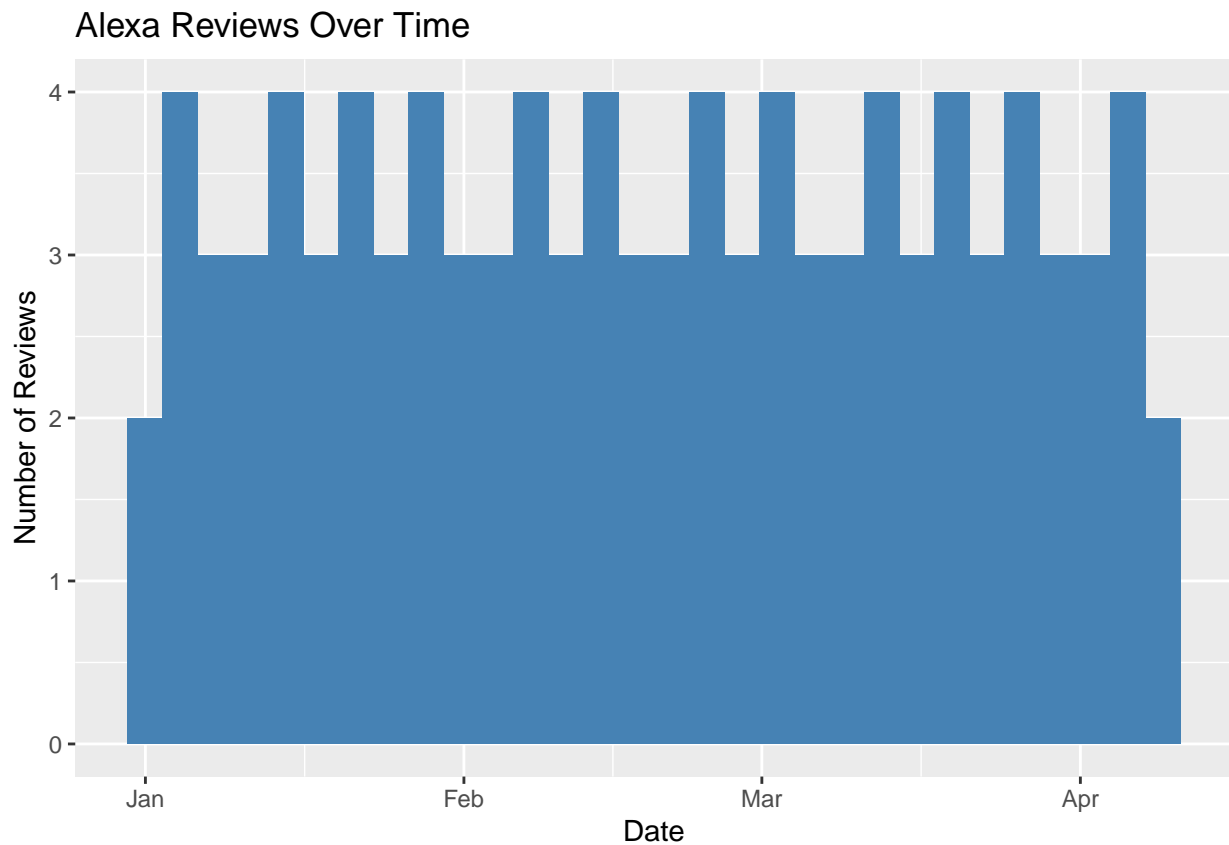
## # A tibble: 4 x 2
##   variation      total
##   <chr>          <int>
## 1 Black           36
## 2 Charcoal Fabric  16
## 3 Heather Gray Fabric  23
## 4 White           25

ggplot(alexa, aes(x = variation, fill = variation)) +
  geom_bar() +
  xlab("Variation") +
  ylab("Count") +
  ggtitle("Count of Each Alexa Variation") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1), legend.position = "none")

```



```
ggplot(alexa, aes(x = date)) +  
  geom_histogram(bins = 30, fill = "steelblue") +  
  xlab("Date") +  
  ylab("Number of Reviews") +  
  ggtitle("Alexa Reviews Over Time")
```



```
ggplot(alexa, aes(x = factor(rating), fill = factor(rating))) +  
  geom_bar() +  
  xlab("Rating") +  
  ylab("Count") +  
  ggtitle("Distribution of Alexa Ratings") +  
  scale_fill_brewer(palette = "Set3") +  
  theme(legend.position = "none")
```

