

RWorksheet_Hallares#4c

Marc Christian P. Hallares

2025-12-16

```
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)
```

```
# 1A. Import CSV file into the environment
# Import the mpg dataset from CSV
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(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
```

```
# 1B. Identify categorical variables
data(MPG)
```

```
## Warning in data(MPG): data set 'MPG' not found
```

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

```
# 1C. Identify continuous variables
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" ...
```

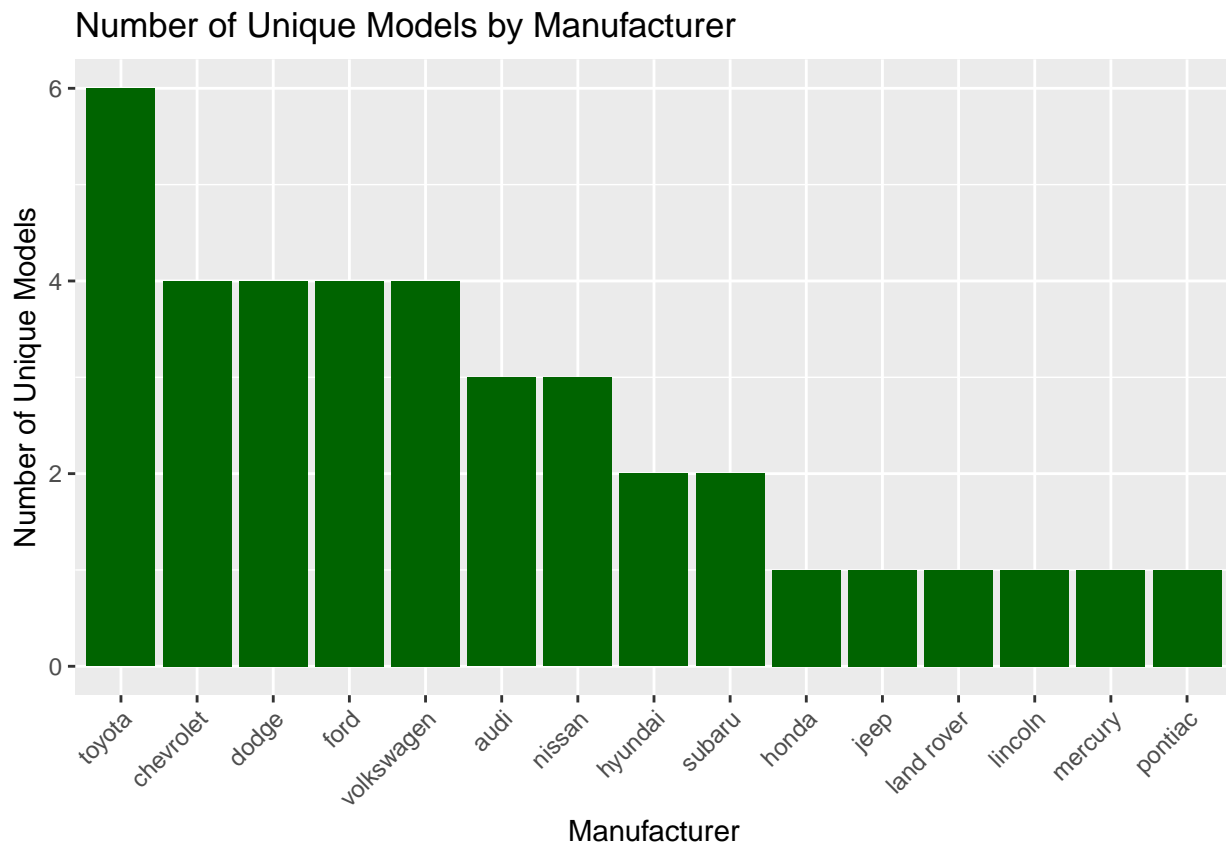
```
# All numeric are continuous
```

```
# 2A. Count how many unique models each manufacturer has
unique_models <- MPG %>%
  group_by(manufacturer) %>%
  summarise(unique_models = n_distinct(model)) %>%
  arrange(desc(unique_models))
```

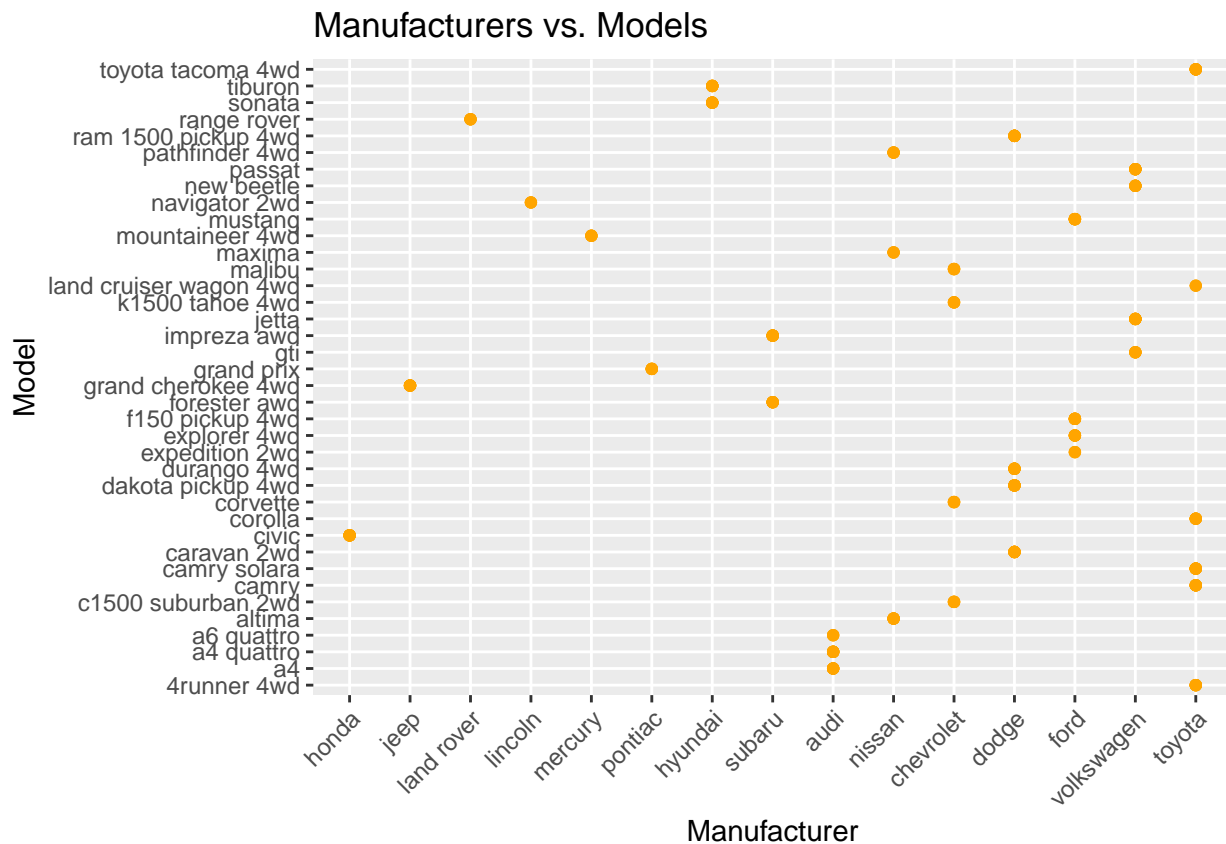
```
unique_models
```

```
## # 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
```

```
# 2B. Barplot of number of unique models per manufacturer
ggplot(unique_models, aes(x = reorder(manufacturer, -unique_models),
                               y = unique_models)) +
  geom_bar(stat = "identity", fill = "darkgreen") +
  xlab("Manufacturer") +
  ylab("Number of Unique Models") +
  ggtitle("Number of Unique Models by Manufacturer") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



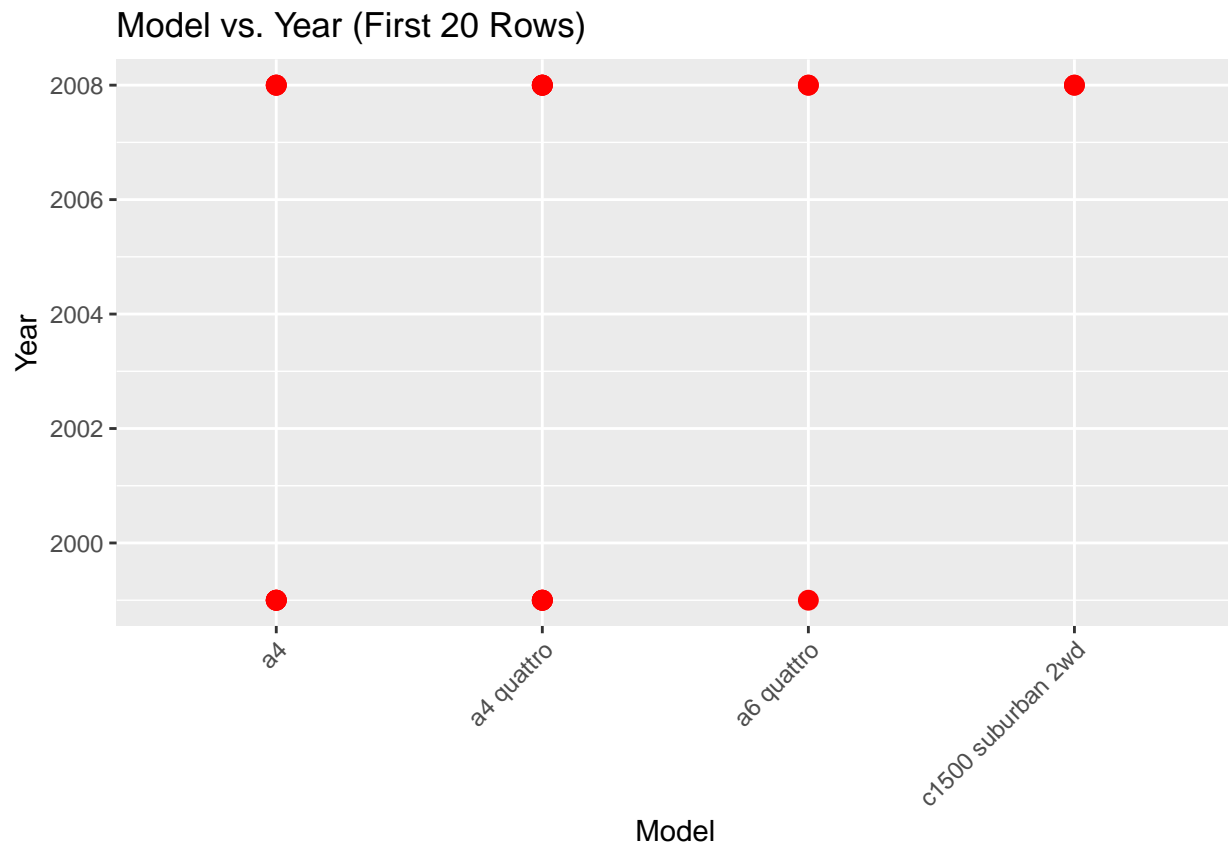
```
# 2A (alternative visualization). Scatter plot of manufacturers vs. their models
ggplot(MPG, aes(x = reorder(manufacturer, model, function(x) length(unique(x))),
                    y = model)) +
  geom_point(color = "orange") +
  xlab("Manufacturer") +
  ylab("Model") +
  ggtitle("Manufacturers vs. Models") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



```
# 2B
# The barplot is more effective because it clearly displays the exact count for each manufacturer, making it easier to compare the number of models per manufacturer.
```

```
# 3. Scatter plot of the first 20 rows showing model vs. year
top_20 <- head(MPG, 20)

ggplot(top_20, aes(x = model, y = year)) +
  geom_point(color = "red", size = 3) +
  xlab("Model") +
  ylab("Year") +
  ggtitle("Model vs. Year (First 20 Rows)") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



4. Count how many entries each car model has

```
model_counts <- MPG %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count))
```

```
model_counts
```

```
## # 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
```

4A. Top 20 car models with the highest number of entries

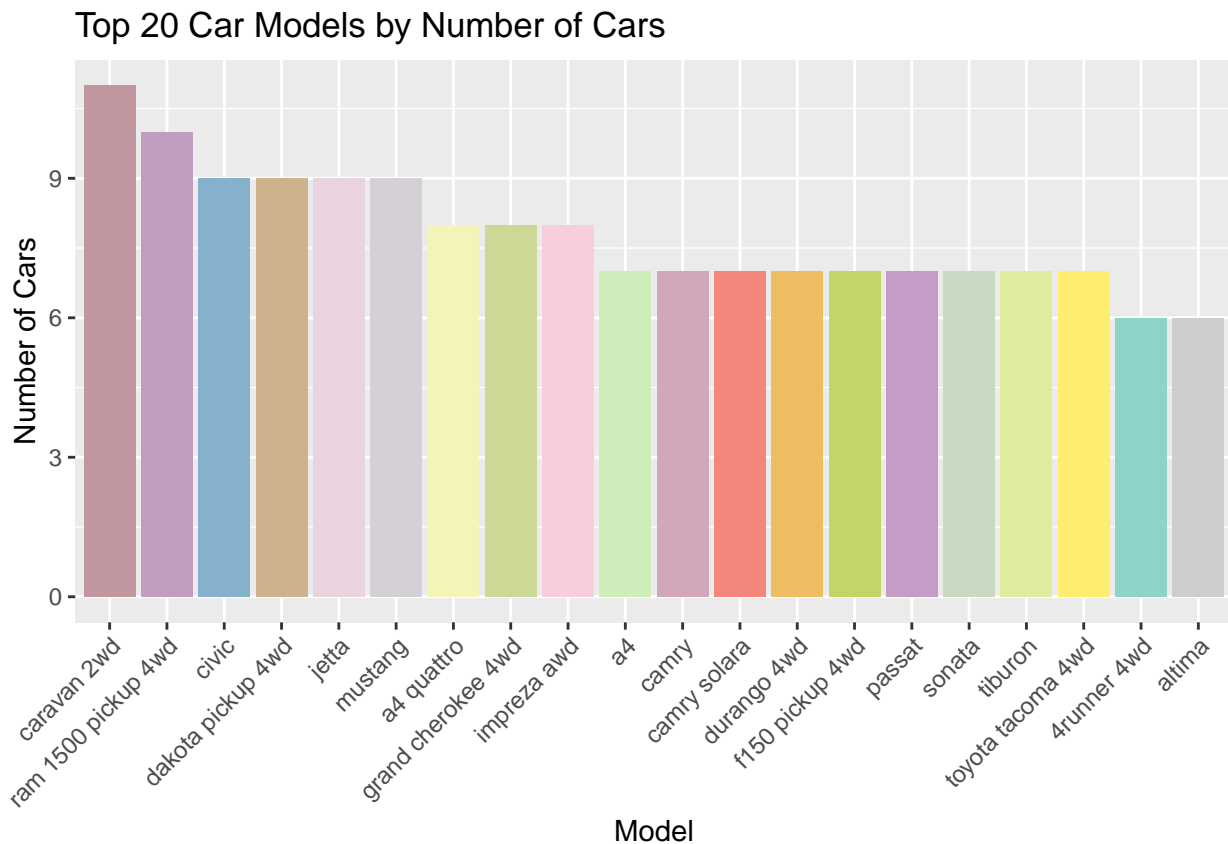
```
top_20_models <- MPG %>%
  group_by(model) %>%
```

```

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))

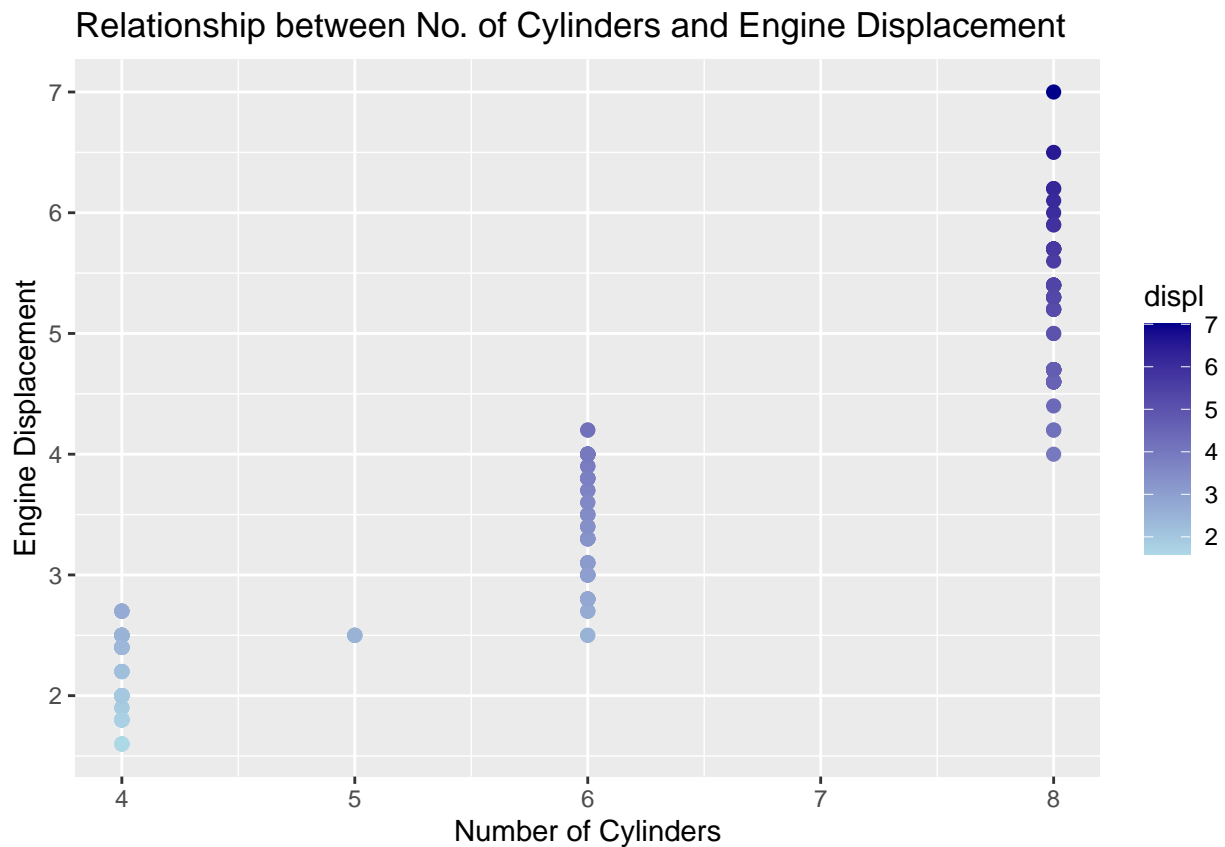
```



```

# 5. Relationship between number of cylinders and engine displacement
ggplot(MPG, aes(x = cyl, y = displ, color = displ)) +
  geom_point(size = 2) +
  ggtitle("Relationship between No. of Cylinders and Engine Displacement") +
  xlab("Number of Cylinders") +
  ylab("Engine Displacement") +
  scale_color_gradient(low = "lightblue", high = "darkblue")

```



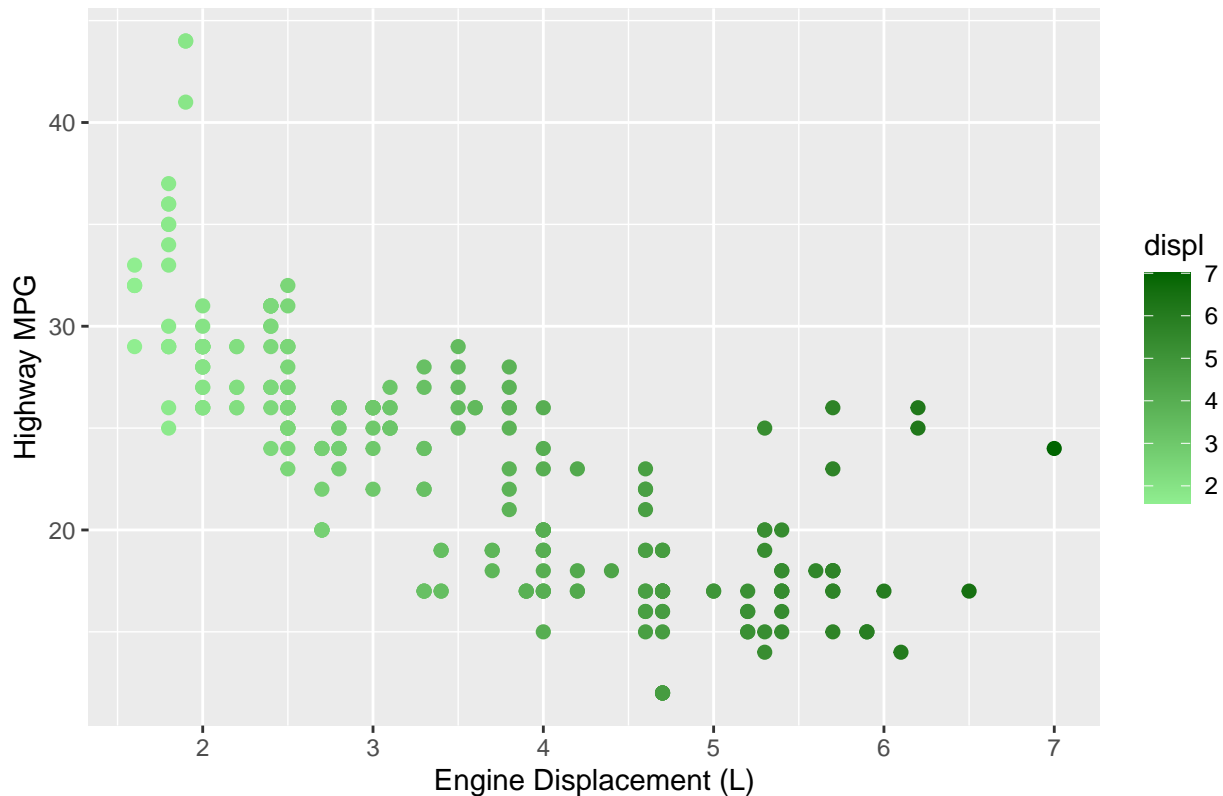
5A

There is a positive relationship: as the number of cylinders increases, the engine displacement also

6. Scatter plot: Engine displacement vs. Highway MPG

```
ggplot(MPG, aes(x = displ, y = hwy, color = displ)) +
  geom_point(size = 2) +
  ggtitle("Relationship between Engine Displacement and Highway MPG") +
  xlab("Engine Displacement (L)") +
  ylab("Highway MPG") +
  scale_color_gradient(low = "lightgreen", high = "darkgreen")
```

Relationship between Engine Displacement and Highway MPG



```
# 6. Create traffic dataset
traffic_data <- data.frame(
  Date = as.Date('2025-11-01') + 0:9,
  Location = rep(c("Intersection A", "Intersection B"), each = 5),
  Vehicles = c(125, 148, 132, 157, 142, 198, 208, 195, 212, 218),
  Average_Speed = c(34.8, 33.9, 35.2, 33.5, 34.1, 31.8, 31.2, 32.5, 30.9, 29.8)
)
```

```
write.csv(traffic_data, "traffic.csv", row.names = FALSE)
```

```
traffic <- read.csv("traffic.csv", stringsAsFactors = FALSE)
```

```
# 6A. Structure of the traffic dataset
```

```
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   125 148 132 157 142 198 208 195 212 218
## $ Average_Speed  : num   34.8 33.9 35.2 33.5 34.1 31.8 31.2 32.5 30.9 29.8
```

```
# 6B. Separating traffic data by location
```

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

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

```
print("Intersection A Data:")
```



```
## [1] "Intersection A Data:"
```

```
print(intersection_a)
```

```
##           Date      Location Vehicles Average_Speed
## 1 2025-11-01 Intersection A      125          34.8
## 2 2025-11-02 Intersection A      148          33.9
## 3 2025-11-03 Intersection A      132          35.2
## 4 2025-11-04 Intersection A      157          33.5
## 5 2025-11-05 Intersection A      142          34.1
```

```
print("Intersection B Data:")
```

```
## [1] "Intersection B Data:"
```

```
print(intersection_b)
```

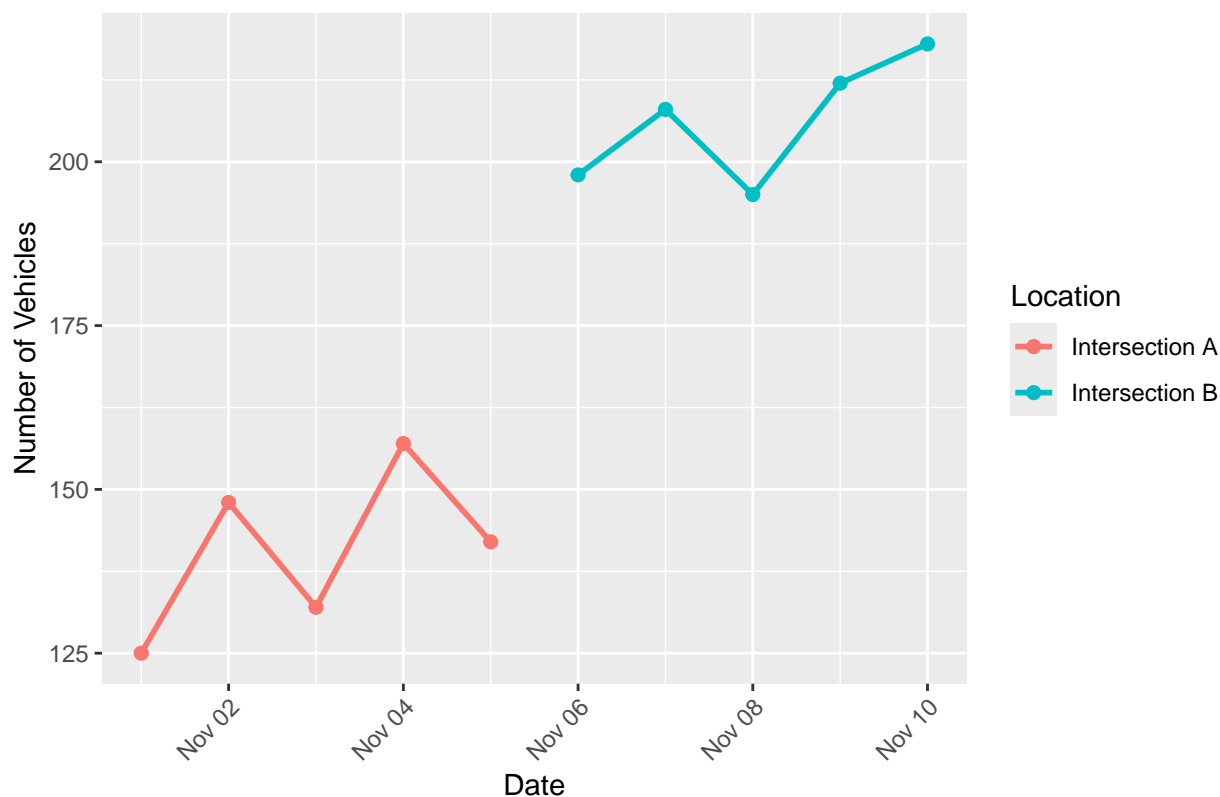
```
##           Date      Location Vehicles Average_Speed
## 6 2025-11-06 Intersection B      198          31.8
## 7 2025-11-07 Intersection B      208          31.2
## 8 2025-11-08 Intersection B      195          32.5
## 9 2025-11-09 Intersection B      212          30.9
## 10 2025-11-10 Intersection B      218          29.8
```

```
# 6C. Line graph showing number of vehicles over time by intersection
```

```
ggplot(traffic, aes(x = as.Date(Date), y = Vehicles, color = Location, group = Location)) +  
  geom_line(size = 1) +  
  geom_point(size = 2) +  
  xlab("Date") +  
  ylab("Number of Vehicles") +  
  ggtitle("Traffic Over Time by Intersection") +  
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

```
## Warning: Using 'size' aesthetic for lines was deprecated in ggplot2 3.4.0.  
## i Please use 'linewidth' instead.  
## This warning is displayed once every 8 hours.  
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was  
## generated.
```

Traffic Over Time by Intersection



```
#7A. Import and count rows & columns
library(readxl)

Alexa <- read_excel("alexa_file.xlsx")

# Number of observations (rows)
cat("Number of rows:", nrow(Alexa), "\n")
```

```
## Number of rows: 3150
```

```
# Number of columns
cat("Number of columns:", ncol(Alexa))
```

```
## Number of columns: 5
```

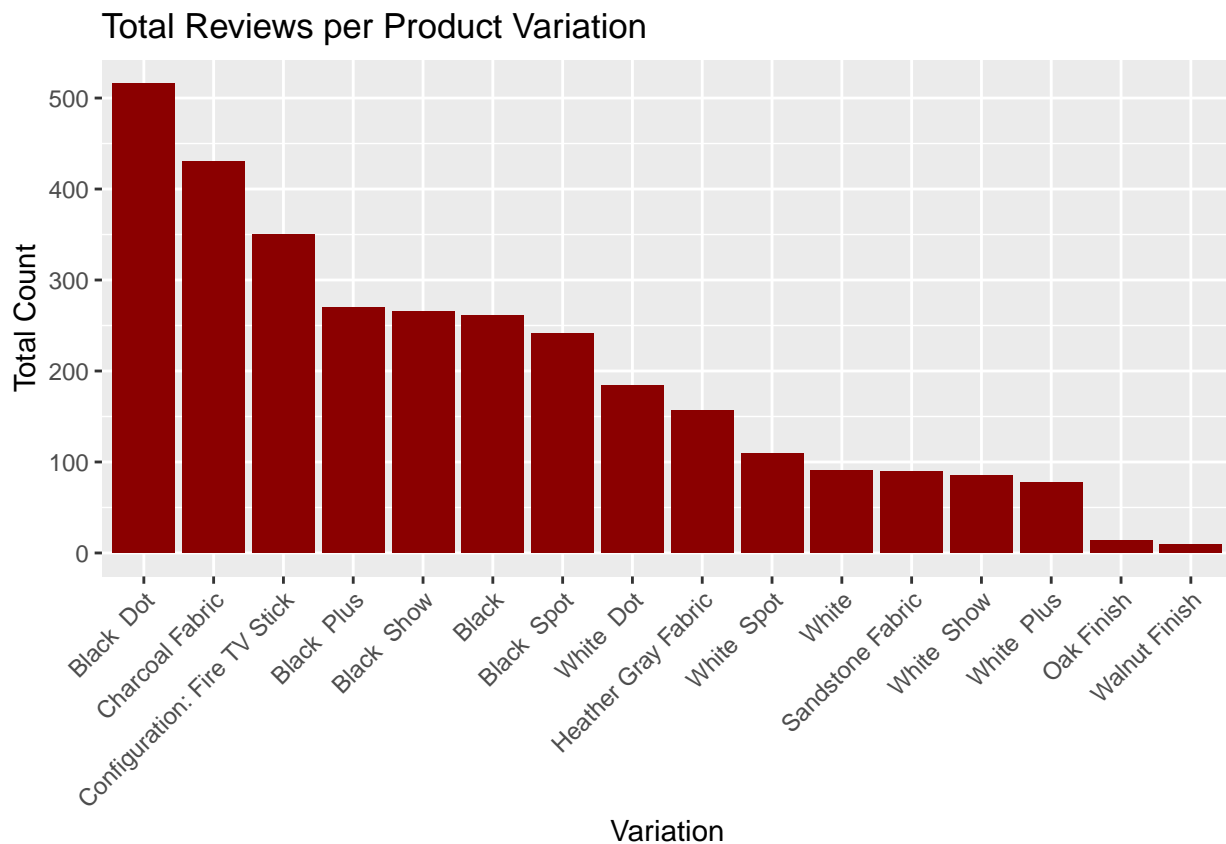
```
#7B. Plot variations using ggplot()
variation_totals <- Alexa %>%
  group_by(variation) %>%
  summarise(total = n()) %>%
  arrange(desc(total))

variation_totals
```

```
## # A tibble: 16 x 2
##   variation          total
```

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

```
#7C. Plot variations using ggplot()
ggplot(variation_totals, aes(x = reorder(variation, -total), y = total)) +
  geom_bar(stat = "identity", fill = "darkred") +
  xlab("Variation") +
  ylab("Total Count") +
  ggtitle("Total Reviews per Product Variation") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



```
#7D. Line graph: Date vs Number of Verified Reviews
ggplot(Alexa, aes(x = date, y = verified_reviews)) +
  geom_line(color = "purple", size = 1) +
  xlab("Date") +
  ylab("Verified Reviews") +
  ggtitle("Trend of Verified Reviews Over Time")
```

are some serious flaws, particularly if you are the last one to bed or the first to wake. It doesn't seem like the engineer

expensive alternative option to fill the gap. Ordered the Amazon Fire Stick from Best Buy. Instructions were short and

one of the lights by saying "Alexa, turn off the second light". In the Alexa app, I created a 'Group' with " , but lately I've been getting terrible support. The guy that took my call just rambled off a (completely unhelpful) script a

noting to add this bulb to my Alexa Echo Plus. Everything tried ended in a "Discovery Failed" message. I tried to set up multiple pages. The one thing that I am not a fan of is the home screen cards do not really rotate that much — they

```
#7E. Relationship between variation and rating
```

```
# Variation
variation_rating <- Alexa %>%
  group_by(variation) %>%
  summarise(avg_rating = mean(rating, na.rm = TRUE)) %>%
  arrange(desc(avg_rating))

variation_rating
```

```
## # A tibble: 16 x 2
##   variation          avg_rating
##   <chr>             <dbl>
## 1 Walnut Finish      4.89
## 2 Oak Finish         4.86
## 3 Charcoal Fabric    4.73
## 4 Heather Gray Fabric 4.69
## 5 Configuration: Fire TV Stick 4.59
## 6 Black Show         4.49
## 7 Black Dot          4.45
## 8 White Dot          4.42
## 9 Black Plus         4.37
## 10 White Plus        4.36
## 11 Sandstone Fabric   4.36
## 12 White Spot         4.31
## 13 Black Spot         4.31
## 14 White Show        4.28
## 15 Black             4.23
## 16 White             4.14
```

```
# Rating
ggplot(variation_rating, aes(x = reorder(variation, -avg_rating), y = avg_rating)) +
  geom_bar(stat = "identity", fill = "darkorange") +
  xlab("Variation") +
  ylab("Average Rating") +
  ggtitle("Average Rating per Product Variation") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

