RworksheEt_ESTOCE#4C

John Rick Estoce

2025-11-24

```
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)
```

1. Use the dataset mpg

a. Show your solutions on how to import a csv file into the environment.

```
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(l4)   4  11  15
## 72         dodge    ram 1500 pickup 4wd   5.2 1999   8 manual(m5)   4  11  16
## 73         dodge    ram 1500 pickup 4wd   5.7 2008   8   auto(l5)   4  13  17
## 74         dodge    ram 1500 pickup 4wd   5.9 1999   8   auto(l4)   4  11  15
```

```
## 75          ford         expedition 2wd   4.6 1999   8   auto(l4)   r  11  17
## 76          ford         expedition 2wd   5.4 1999   8   auto(l4)   r  11  17
## 77          ford         expedition 2wd   5.4 2008   8   auto(l6)   r  12  18
## 78          ford           explorer 4wd   4.0 1999   6   auto(l5)   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(l5)   4  14  17
## 81          ford           explorer 4wd   4.0 2008   6   auto(l5)   4  13  19
## 82          ford           explorer 4wd   4.6 2008   8   auto(l6)   4  13  19
## 83          ford           explorer 4wd   5.0 1999   8   auto(l4)   4  13  17
## 84          ford       f150 pickup 4wd   4.2 1999   6   auto(l4)   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(l4)   4  13  16
## 88          ford       f150 pickup 4wd   4.6 2008   8   auto(l4)   4  13  17
## 89          ford       f150 pickup 4wd   5.4 1999   8   auto(l4)   4  11  15
## 90          ford       f150 pickup 4wd   5.4 2008   8   auto(l4)   4  13  17
## 91          ford              mustang   3.8 1999   6 manual(m5)   r  18  26
## 92          ford              mustang   3.8 1999   6   auto(l4)   r  18  25
## 93          ford              mustang   4.0 2008   6 manual(m5)   r  17  26
## 94          ford              mustang   4.0 2008   6   auto(l5)   r  16  24
## 95          ford              mustang   4.6 1999   8   auto(l4)   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(l5)   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(l4)   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(l4)   f  24  32
## 105        honda                civic   1.8 2008   4 manual(m5)   f  26  34
## 106        honda                civic   1.8 2008   4   auto(l5)   f  25  36
## 107        honda                civic   1.8 2008   4   auto(l5)   f  24  36
## 108        honda                civic   2.0 2008   4 manual(m6)   f  21  29
## 109      hyundai               sonata   2.4 1999   4   auto(l4)   f  18  26
## 110      hyundai               sonata   2.4 1999   4 manual(m5)   f  18  27
## 111      hyundai               sonata   2.4 2008   4   auto(l4)   f  21  30
## 112      hyundai               sonata   2.4 2008   4 manual(m5)   f  21  31
## 113      hyundai               sonata   2.5 1999   6   auto(l4)   f  18  26
## 114      hyundai               sonata   2.5 1999   6 manual(m5)   f  18  26
## 115      hyundai               sonata   3.3 2008   6   auto(l5)   f  19  28
## 116      hyundai              tiburon   2.0 1999   4   auto(l4)   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(l4)   f  20  27
## 120      hyundai              tiburon   2.7 2008   6   auto(l4)   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(l5)   4  17  22
## 124         jeep grand cherokee 4wd   3.7 2008   6   auto(l5)   4  15  19
## 125         jeep grand cherokee 4wd   4.0 1999   6   auto(l4)   4  15  20
## 126         jeep grand cherokee 4wd   4.7 1999   8   auto(l4)   4  14  17
## 127         jeep grand cherokee 4wd   4.7 2008   8   auto(l5)   4   9  12
## 128         jeep grand cherokee 4wd   4.7 2008   8   auto(l5)   4  14  19
```

```
## 129         jeep     grand cherokee 4wd   5.7 2008   8   auto(l5)   4  13  18
## 130         jeep     grand cherokee 4wd   6.1 2008   8   auto(l5)   4  11  14
## 131   land rover            range rover   4.0 1999   8   auto(l4)   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(l4)   4  11  15
## 135      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11  17
## 136      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11  16
## 137      lincoln          navigator 2wd   5.4 2008   8   auto(l6)   r  12  18
## 138      mercury        mountaineer 4wd   4.0 1999   6   auto(l5)   4  14  17
## 139      mercury        mountaineer 4wd   4.0 2008   6   auto(l5)   4  13  19
## 140      mercury        mountaineer 4wd   4.6 2008   8   auto(l6)   4  13  19
## 141      mercury        mountaineer 4wd   5.0 1999   8   auto(l4)   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
```

```
data(MPG)
```

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

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

b. Identify categorical 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 characters and factors are categorical
```

c. 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" ...
```

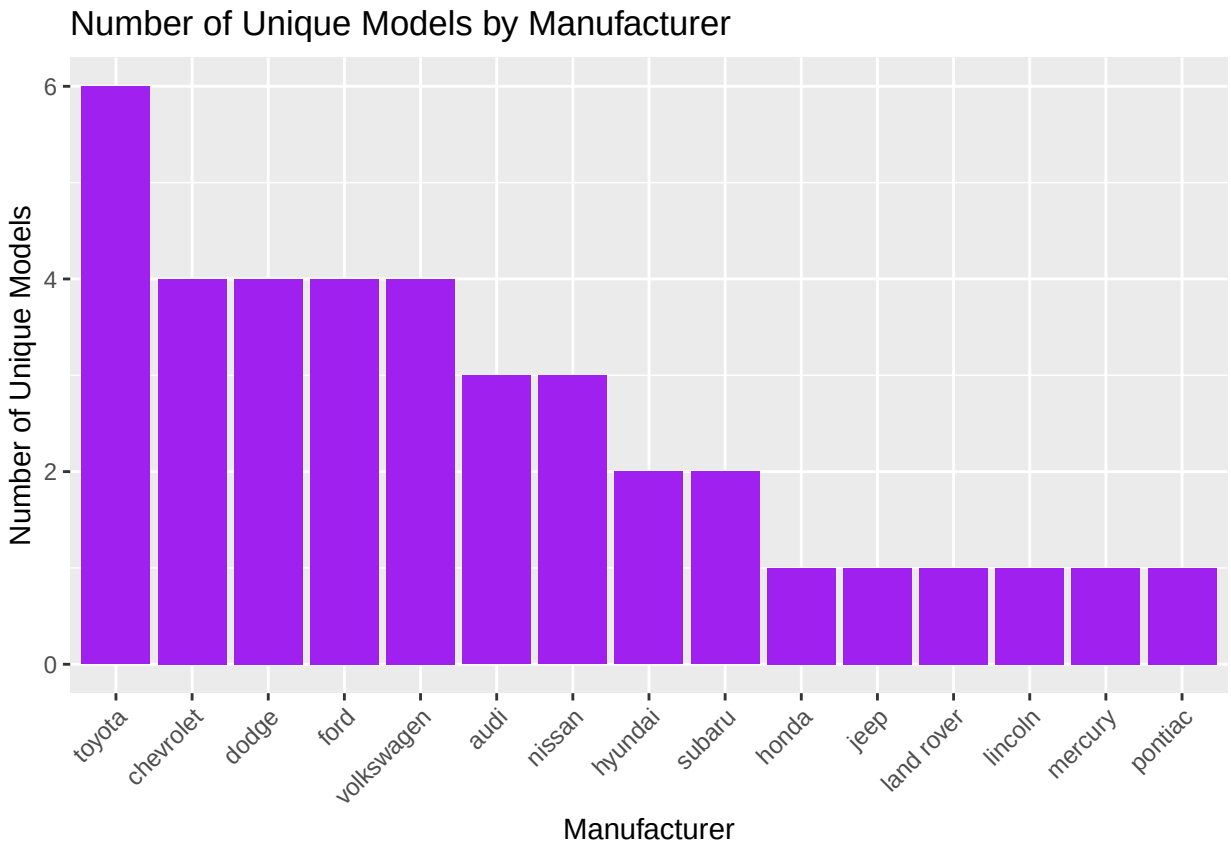
```
##  $ class       : chr  "compact" "compact" "compact" "compact" ...
```

```
#All numeric are continous
```

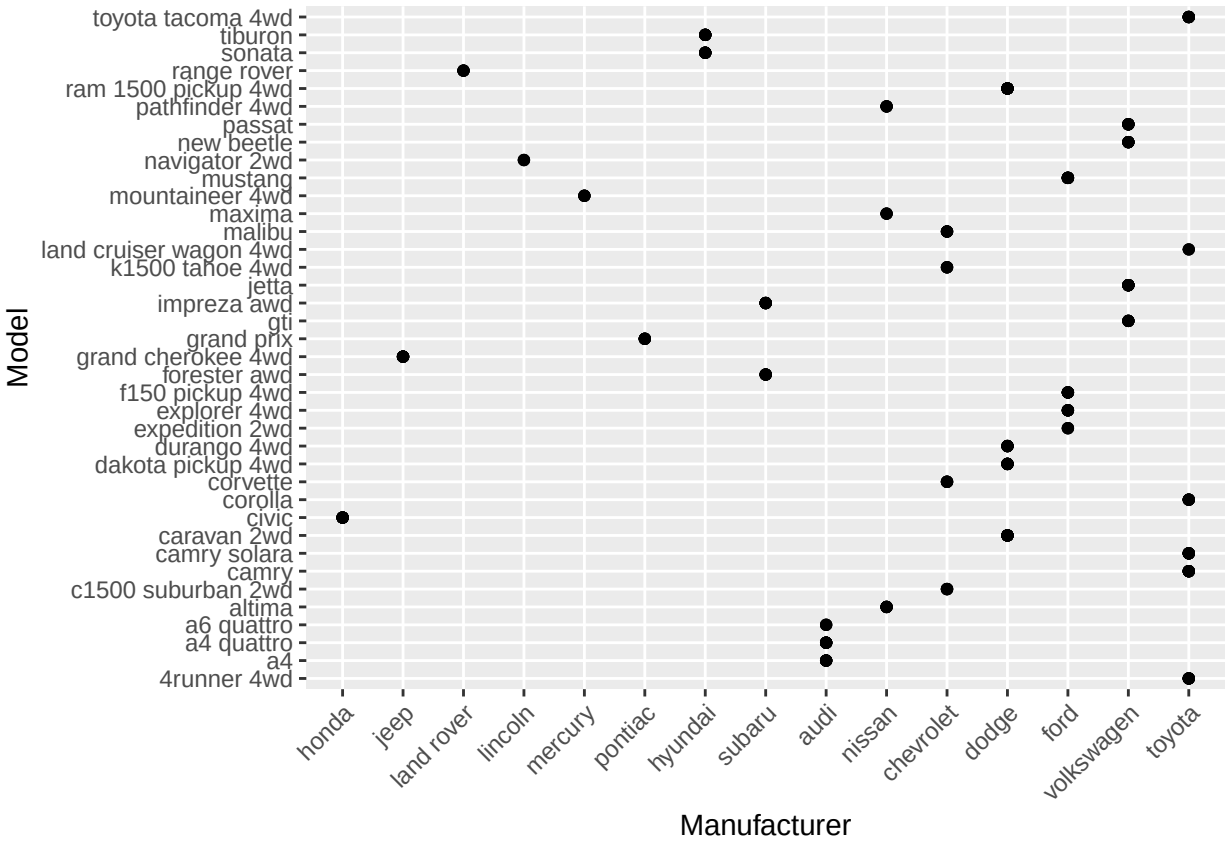
```
# 2A. Count how many unique models each manufacturer has
unique_models <- MPG %>%
  group_by(manufacturer) %>%
  summarise(unique_models = n_distinct(model)) %>%
  arrange(desc(unique_models))

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 = "purple") +
  xlab("Manufacturer") +
  ylab("Number of Unique Models") +
  ggtitle("Number of Unique Models by Manufacturer") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

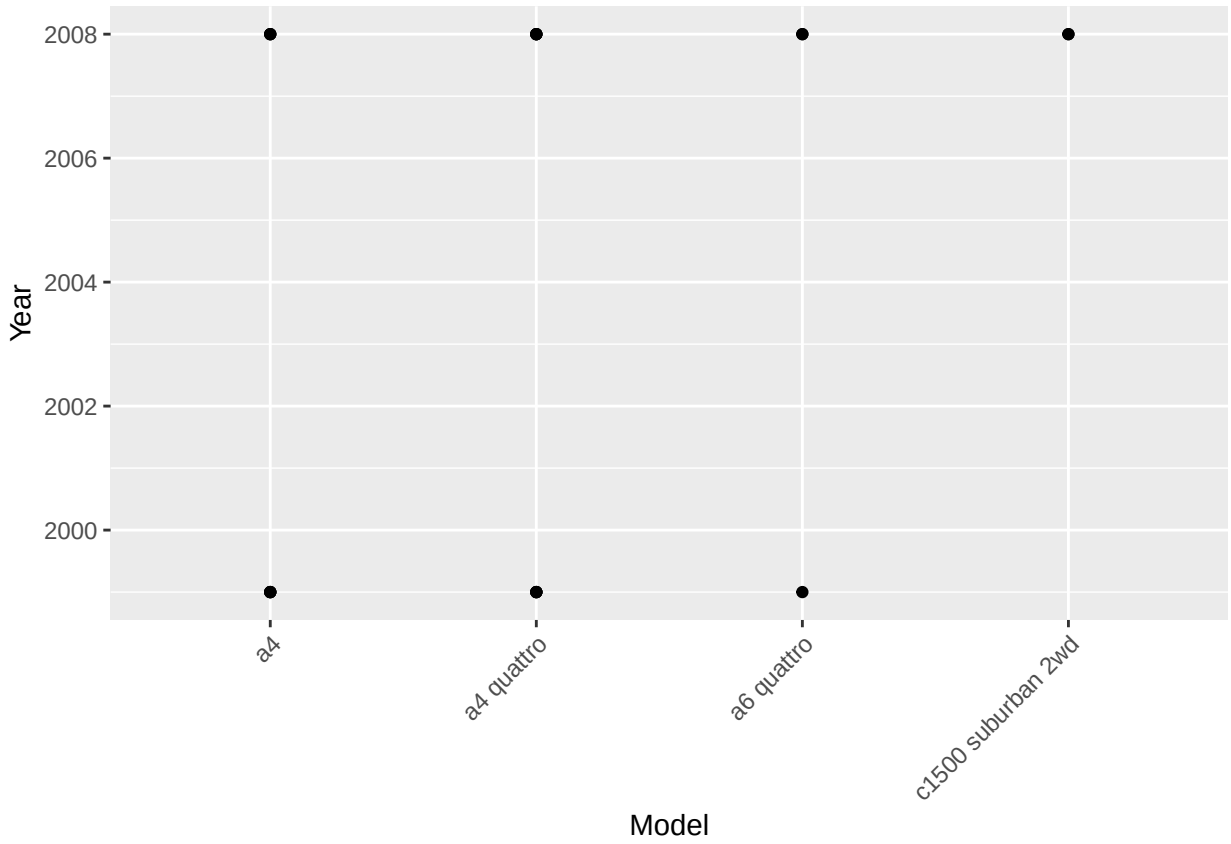



```
# 2A (alternative visualization). Scatter plot of manufacturers vs. their models
ggplot(MPG, aes(x = reorder(manufacturer, model, function(x) length(unique(x))),
                y = model)) +
  geom_point() +
  xlab("Manufacturer") +
  ylab("Model") +
  theme(axis.text.x = element_text(angle = 45,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




```
# 2B
# For me, the barplot is easier to interpret because it clearly shows the number of models per manufact
```

```
# 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() +
  xlab("Model") +
  ylab("Year") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

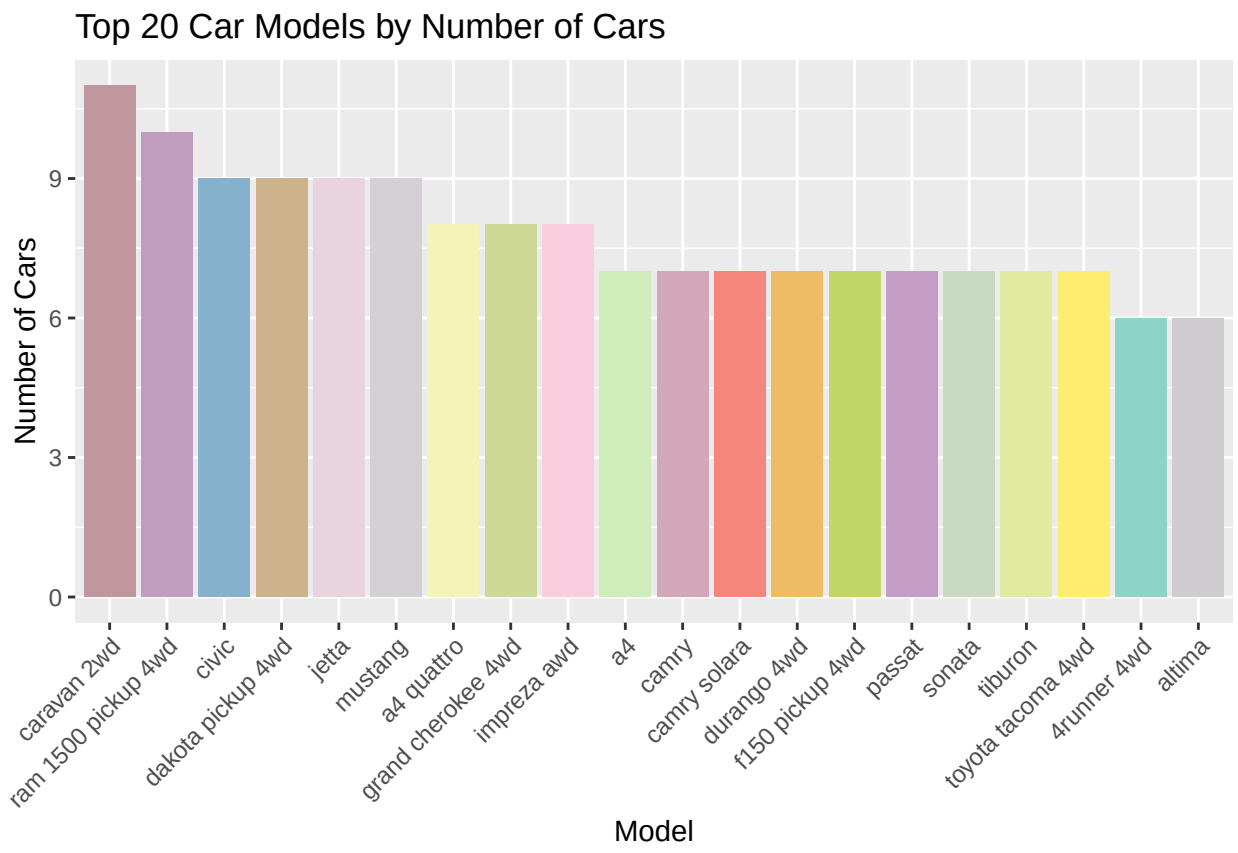



```
# 4. Count how many entries each car model has
MPG %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count))
```

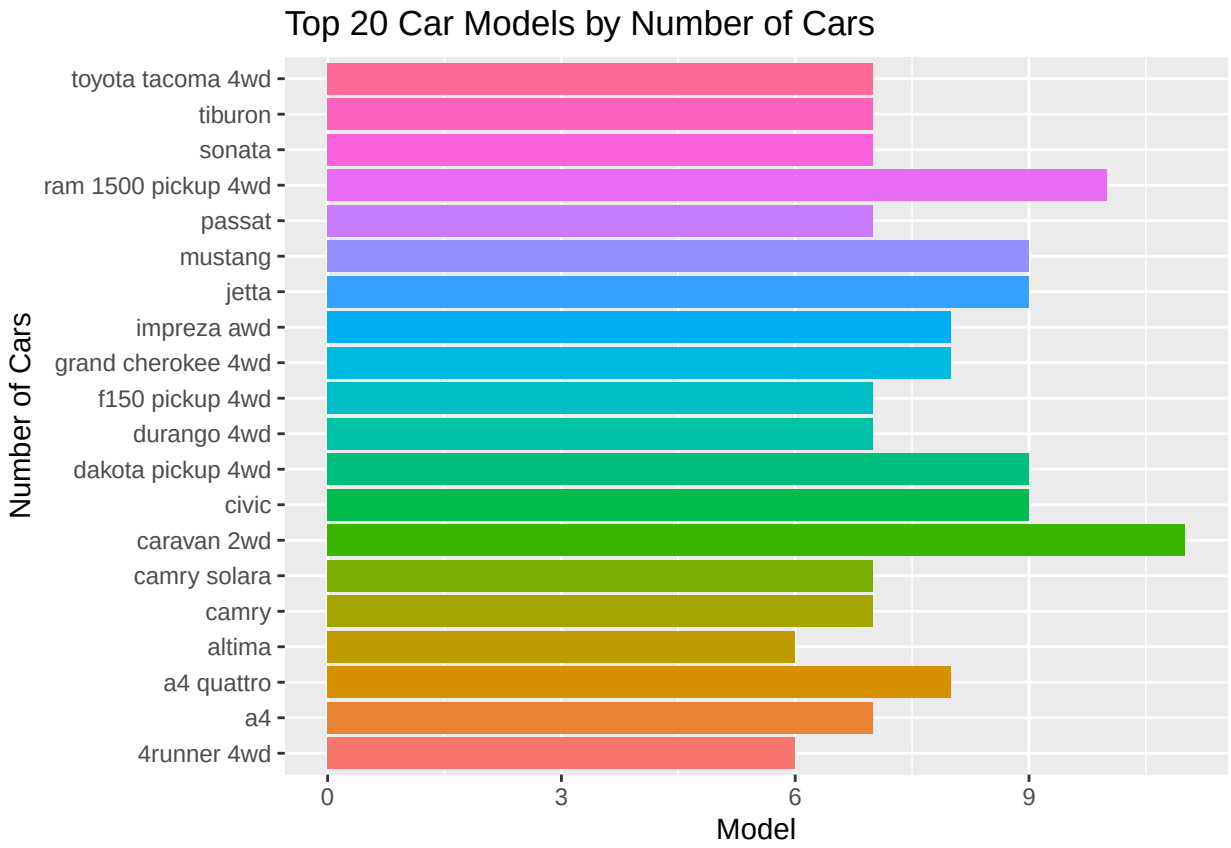
```
## # A tibble: 38 x 2
##    model               count
##    <chr>               <int>
##  1 caravan 2wd            11
##  2 ram 1500 pickup 4wd    10
##  3 civic                   9
##  4 dakota pickup 4wd       9
##  5 jetta                   9
##  6 mustang                 9
##  7 a4 quattro  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

```
# 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)
```

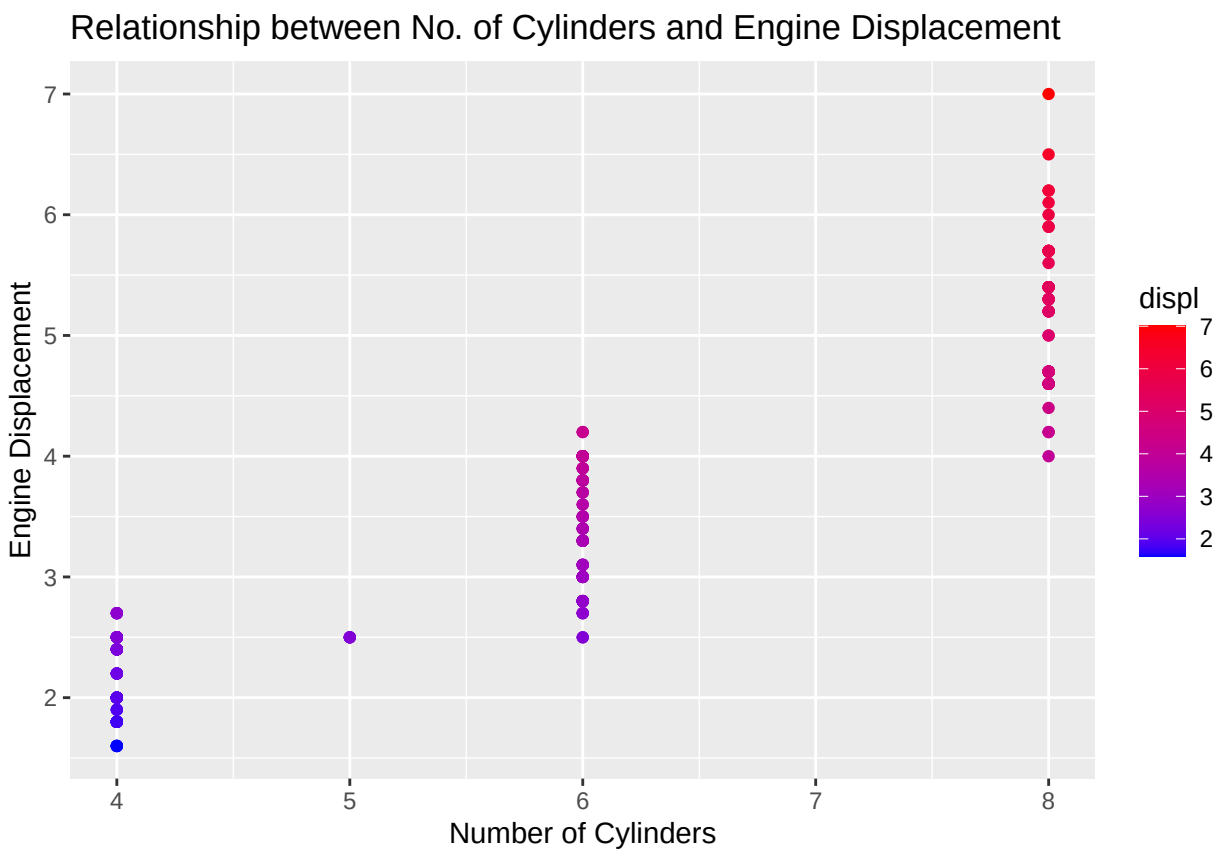
```
ggplot(top_20_models, aes(x = reorder(model, -count), y = count, fill = model)) +
  geom_bar(stat = "identity") +
  xlab("Model") +
  ylab("Number of Cars") +
  ggtitle("Top 20 Car Models by Number of Cars") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1),
        legend.position = "none")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




```
# 4B. Horizontal version of the Top 20 models barplot
top_20_models <- MPG %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count)) %>%
  head(20)

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

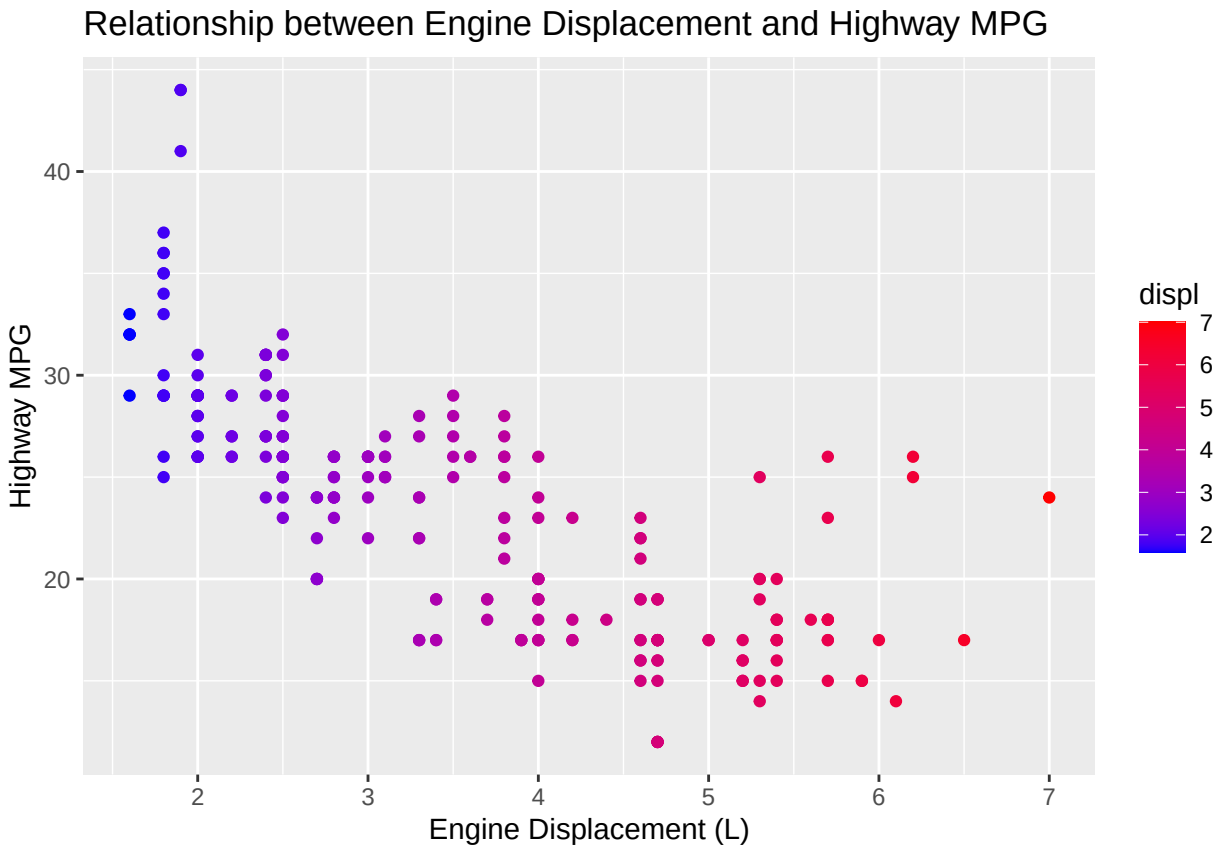



```
# 5. Relationship between number of cylinders and engine displacement
ggplot(MPG, aes(x = cyl, y = displ, color = displ)) +
  geom_point() +
  ggtitle("Relationship between No. of Cylinders and Engine Displacement") +
  xlab("Number of Cylinders") +
  ylab("Engine Displacement") +
  scale_color_gradient(low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




```
# 5A
# The relationship is strong and positive: cars with more cylinders usually have larger engine displace
```

```
# 6. Scatter plot: Engine 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")
```




```
# 6.
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)
```

```
# 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  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
```

```
# 6B. Separating traffic data by location
intersection_a <- traffic[traffic$Location == "Intersection A", ]
intersection_b <- traffic[traffic$Location == "Intersection B", ]

print(intersection_a)
```

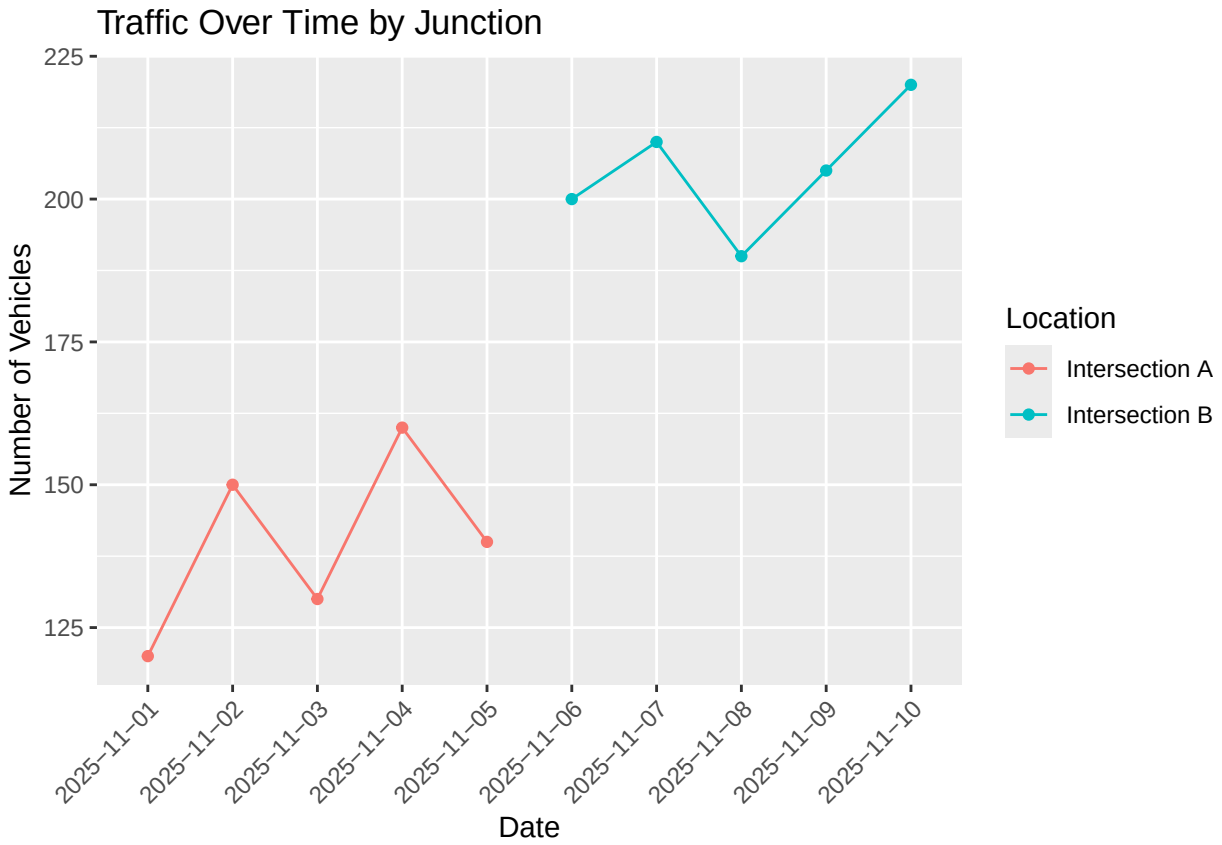
```
##         Date       Location Vehicles Average_Speed
```

```
## 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
```

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




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

Alexa <- read_excel("alexa_file.xlsx")
```

```r
# Number of observations (rows)
nrow(Alexa)
```

```
## [1] 3150
```

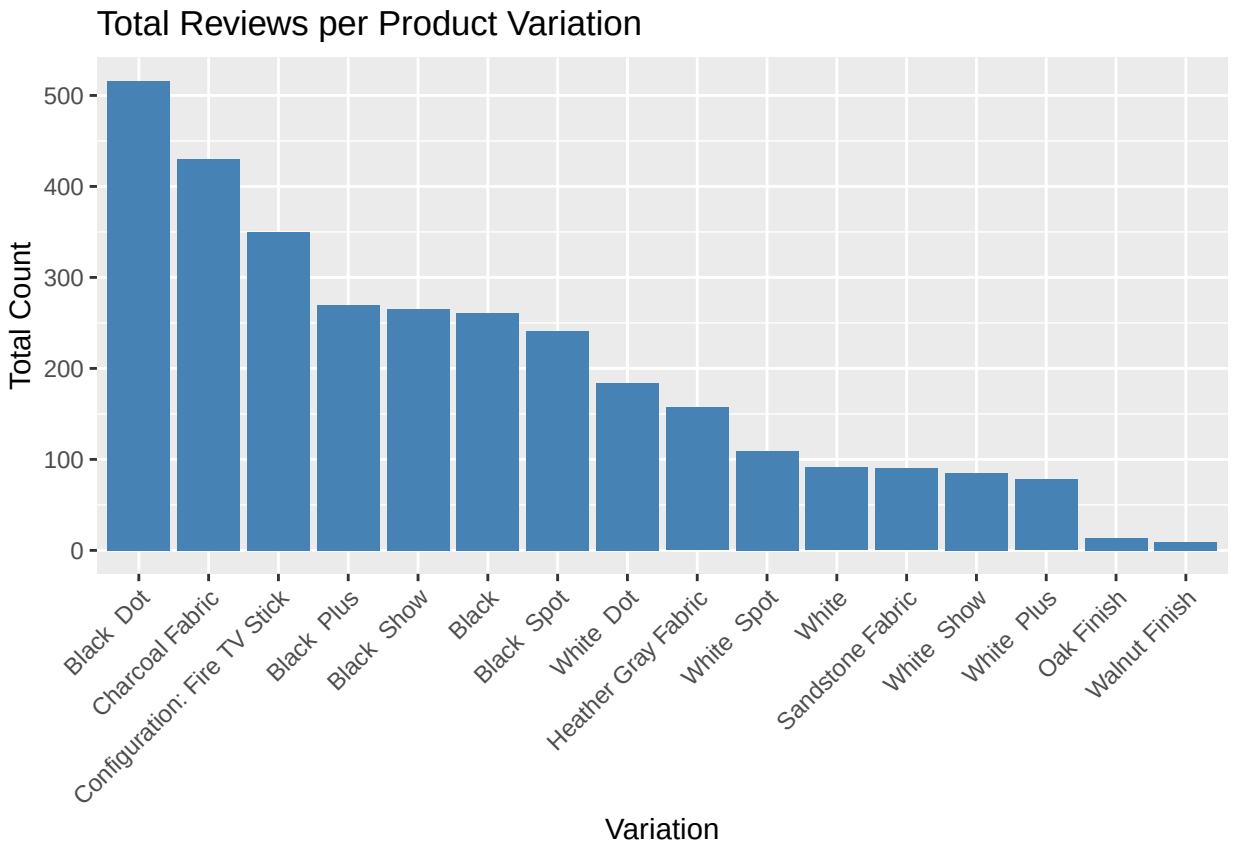
```r
# Number of columns
ncol(Alexa)
```

```
## [1] 5
```

```r
#7B. Plot variations using ggplot()
library(dplyr)

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
```

```r
#7C. Plot variations using ggplot()
library(ggplot2)

ggplot(variation_totals, aes(x = reorder(variation, -total), y = total)) +
  geom_bar(stat = "identity", fill = "steelblue") +
  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 = "blue") +
  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 &#34
, but lately I've been getting terrible support. The guy that took my call just rambled off a (completely unhelpful) script a

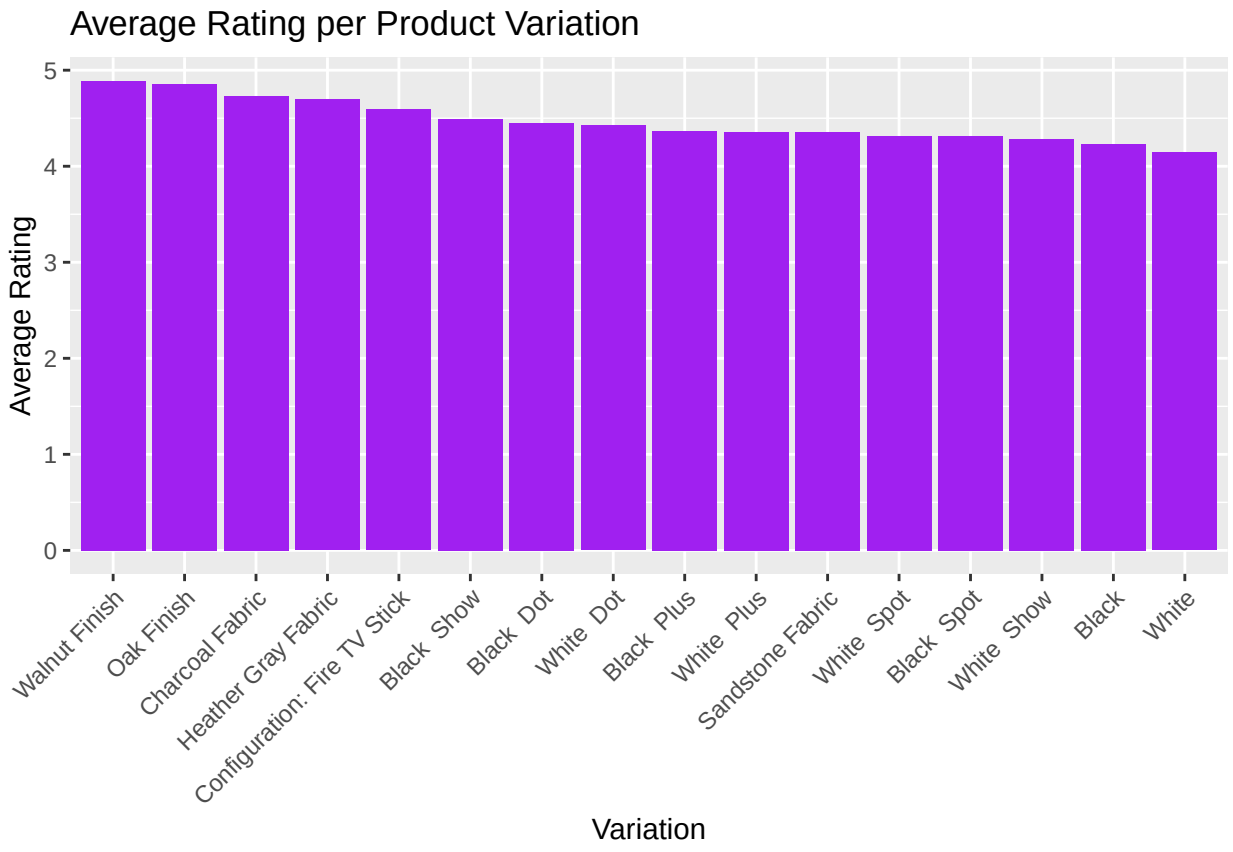
nting to add this both to my Alexa Echo Plus. Everything I tried ended in a Discovery Failed message. I tried to set
igh multiple pages. The one thing that I am not a fan of is the home screen cards do not really rotate that much - they a

```
#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 = "purple") +
  xlab("Variation") +
  ylab("Average Rating") +
  ggtitle("Average Rating per Product Variation") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```


Average Rating per Product Variation
Average Rating
5
4
3
2
1
0
Walnut Finish
Oak Finish
Charcoal Fabric
Heather Gray Fabric
Configuration: Fire TV Stick
Black Show
Black Dot
White Dot
Black Plus
White Plus
Sandstone Fabric
White Spot
Black Spot
White Show
Black
White
Variation