RWorksheet_Laurente#4C

Karl

2024-11-10

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

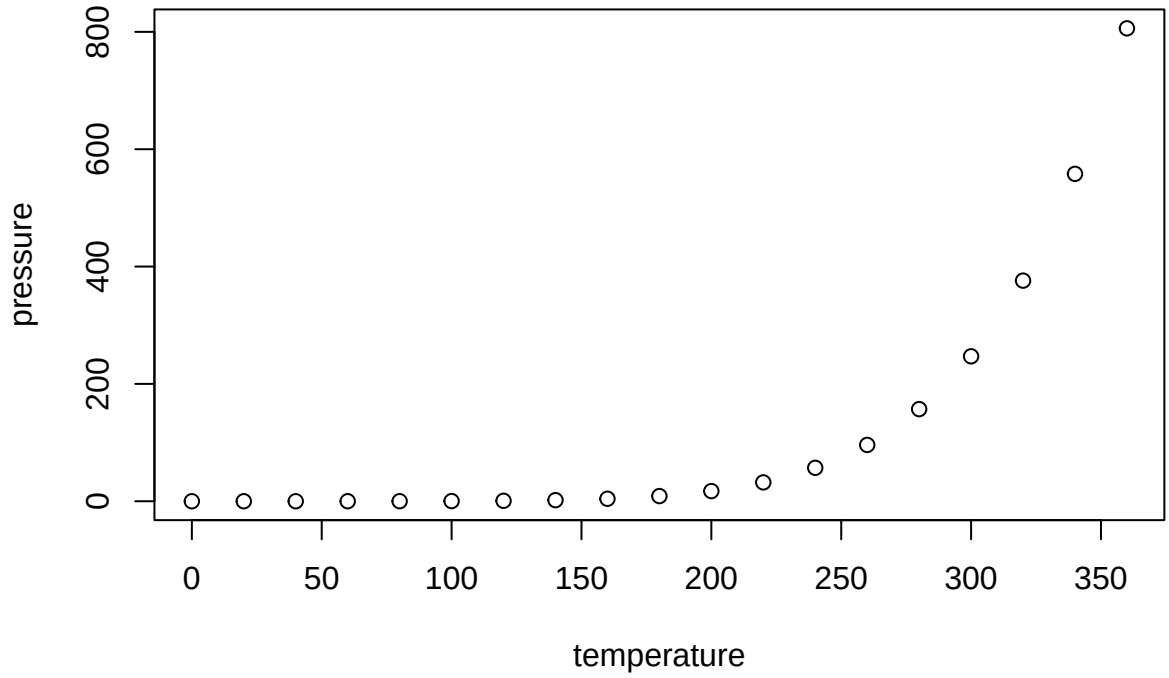
When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist       
##  Min.   : 4.0   Min.   :  2.00  
##  1st Qu.:12.0   1st Qu.: 26.00  
##  Median :15.0   Median : 36.00  
##  Mean   :15.4   Mean   : 42.98  
##  3rd Qu.:19.0   3rd Qu.: 56.00  
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

```
#1.)
library(readxl)
#a.)
mpg <- read.csv("mpg.csv")
mpg
```

```
##        X manufacturer                model displ year cyl      trans drv cty
## 1      1         audi                   a4   1.8 1999   4   auto(l5)   f  18
## 2      2         audi                   a4   1.8 1999   4 manual(m5)   f  21
## 3      3         audi                   a4   2.0 2008   4 manual(m6)   f  20
## 4      4         audi                   a4   2.0 2008   4   auto(av)   f  21
## 5      5         audi                   a4   2.8 1999   6   auto(l5)   f  16
## 6      6         audi                   a4   2.8 1999   6 manual(m5)   f  18
## 7      7         audi                   a4   3.1 2008   6   auto(av)   f  18
## 8      8         audi           a4 quattro   1.8 1999   4 manual(m5)   4  18
## 9      9         audi           a4 quattro   1.8 1999   4   auto(l5)   4  16
## 10    10         audi           a4 quattro   2.0 2008   4 manual(m6)   4  20
## 11    11         audi           a4 quattro   2.0 2008   4   auto(s6)   4  19
## 12    12         audi           a4 quattro   2.8 1999   6   auto(l5)   4  15
## 13    13         audi           a4 quattro   2.8 1999   6 manual(m5)   4  17
## 14    14         audi           a4 quattro   3.1 2008   6   auto(s6)   4  17
## 15    15         audi           a4 quattro   3.1 2008   6 manual(m6)   4  15
## 16    16         audi           a6 quattro   2.8 1999   6   auto(l5)   4  15
```

```
## 17   17         audi             a6 quattro   3.1 2008   6   auto(s6)   4  17
## 18   18         audi             a6 quattro   4.2 2008   8   auto(s6)   4  16
## 19   19    chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14
## 20   20    chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  11
## 21   21    chevrolet     c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14
## 22   22    chevrolet     c1500 suburban 2wd   5.7 1999   8   auto(l4)   r  13
## 23   23    chevrolet     c1500 suburban 2wd   6.0 2008   8   auto(l4)   r  12
## 24   24    chevrolet               corvette   5.7 1999   8 manual(m6)   r  16
## 25   25    chevrolet               corvette   5.7 1999   8   auto(l4)   r  15
## 26   26    chevrolet               corvette   6.2 2008   8 manual(m6)   r  16
## 27   27    chevrolet               corvette   6.2 2008   8   auto(s6)   r  15
## 28   28    chevrolet               corvette   7.0 2008   8 manual(m6)   r  15
## 29   29    chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  14
## 30   30    chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  11
## 31   31    chevrolet        k1500 tahoe 4wd   5.7 1999   8   auto(l4)   4  11
## 32   32    chevrolet        k1500 tahoe 4wd   6.5 1999   8   auto(l4)   4  14
## 33   33    chevrolet                 malibu   2.4 1999   4   auto(l4)   f  19
## 34   34    chevrolet                 malibu   2.4 2008   4   auto(l4)   f  22
## 35   35    chevrolet                 malibu   3.1 1999   6   auto(l4)   f  18
## 36   36    chevrolet                 malibu   3.5 2008   6   auto(l4)   f  18
## 37   37    chevrolet                 malibu   3.6 2008   6   auto(s6)   f  17
## 38   38        dodge            caravan 2wd   2.4 1999   4   auto(l3)   f  18
## 39   39        dodge            caravan 2wd   3.0 1999   6   auto(l4)   f  17
## 40   40        dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16
## 41   41        dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16
## 42   42        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17
## 43   43        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17
## 44   44        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  11
## 45   45        dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15
## 46   46        dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15
## 47   47        dodge            caravan 2wd   3.8 2008   6   auto(l6)   f  16
## 48   48        dodge            caravan 2wd   4.0 2008   6   auto(l6)   f  16
## 49   49        dodge      dakota pickup 4wd   3.7 2008   6 manual(m6)   4  15
## 50   50        dodge      dakota pickup 4wd   3.7 2008   6   auto(l4)   4  14
## 51   51        dodge      dakota pickup 4wd   3.9 1999   6   auto(l4)   4  13
## 52   52        dodge      dakota pickup 4wd   3.9 1999   6 manual(m5)   4  14
## 53   53        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14
## 54   54        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14
## 55   55        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4   9
## 56   56        dodge      dakota pickup 4wd   5.2 1999   8 manual(m5)   4  11
## 57   57        dodge      dakota pickup 4wd   5.2 1999   8   auto(l4)   4  11
## 58   58        dodge            durango 4wd   3.9 1999   6   auto(l4)   4  13
## 59   59        dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13
## 60   60        dodge            durango 4wd   4.7 2008   8   auto(l5)   4   9
## 61   61        dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13
## 62   62        dodge            durango 4wd   5.2 1999   8   auto(l4)   4  11
## 63   63        dodge            durango 4wd   5.7 2008   8   auto(l5)   4  13
## 64   64        dodge            durango 4wd   5.9 1999   8   auto(l4)   4  11
## 65   65        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12
## 66   66        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4   9
## 67   67        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13
## 68   68        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13
## 69   69        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12
## 70   70        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4   9
```

```
## 71   71        dodge    ram 1500 pickup 4wd   5.2 1999   8   auto(l4)   4  11
## 72   72        dodge    ram 1500 pickup 4wd   5.2 1999   8 manual(m5)   4  11
## 73   73        dodge    ram 1500 pickup 4wd   5.7 2008   8   auto(l5)   4  13
## 74   74        dodge    ram 1500 pickup 4wd   5.9 1999   8   auto(l4)   4  11
## 75   75         ford         expedition 2wd   4.6 1999   8   auto(l4)   r  11
## 76   76         ford         expedition 2wd   5.4 1999   8   auto(l4)   r  11
## 77   77         ford         expedition 2wd   5.4 2008   8   auto(l6)   r  12
## 78   78         ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14
## 79   79         ford           explorer 4wd   4.0 1999   6 manual(m5)   4  15
## 80   80         ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14
## 81   81         ford           explorer 4wd   4.0 2008   6   auto(l5)   4  13
## 82   82         ford           explorer 4wd   4.6 2008   8   auto(l6)   4  13
## 83   83         ford           explorer 4wd   5.0 1999   8   auto(l4)   4  13
## 84   84         ford        f150 pickup 4wd   4.2 1999   6   auto(l4)   4  14
## 85   85         ford        f150 pickup 4wd   4.2 1999   6 manual(m5)   4  14
## 86   86         ford        f150 pickup 4wd   4.6 1999   8 manual(m5)   4  13
## 87   87         ford        f150 pickup 4wd   4.6 1999   8   auto(l4)   4  13
## 88   88         ford        f150 pickup 4wd   4.6 2008   8   auto(l4)   4  13
## 89   89         ford        f150 pickup 4wd   5.4 1999   8   auto(l4)   4  11
## 90   90         ford        f150 pickup 4wd   5.4 2008   8   auto(l4)   4  13
## 91   91         ford                mustang   3.8 1999   6 manual(m5)   r  18
## 92   92         ford                mustang   3.8 1999   6   auto(l4)   r  18
## 93   93         ford                mustang   4.0 2008   6 manual(m5)   r  17
## 94   94         ford                mustang   4.0 2008   6   auto(l5)   r  16
## 95   95         ford                mustang   4.6 1999   8   auto(l4)   r  15
## 96   96         ford                mustang   4.6 1999   8 manual(m5)   r  15
## 97   97         ford                mustang   4.6 2008   8 manual(m5)   r  15
## 98   98         ford                mustang   4.6 2008   8   auto(l5)   r  15
## 99   99         ford                mustang   5.4 2008   8 manual(m6)   r  14
## 100 100       honda                  civic   1.6 1999   4 manual(m5)   f  28
## 101 101       honda                  civic   1.6 1999   4   auto(l4)   f  24
## 102 102       honda                  civic   1.6 1999   4 manual(m5)   f  25
## 103 103       honda                  civic   1.6 1999   4 manual(m5)   f  23
## 104 104       honda                  civic   1.6 1999   4   auto(l4)   f  24
## 105 105       honda                  civic   1.8 2008   4 manual(m5)   f  26
## 106 106       honda                  civic   1.8 2008   4   auto(l5)   f  25
## 107 107       honda                  civic   1.8 2008   4   auto(l5)   f  24
## 108 108       honda                  civic   2.0 2008   4 manual(m6)   f  21
## 109 109     hyundai                 sonata   2.4 1999   4   auto(l4)   f  18
## 110 110     hyundai                 sonata   2.4 1999   4 manual(m5)   f  18
## 111 111     hyundai                 sonata   2.4 2008   4   auto(l4)   f  21
## 112 112     hyundai                 sonata   2.4 2008   4 manual(m5)   f  21
## 113 113     hyundai                 sonata   2.5 1999   6   auto(l4)   f  18
## 114 114     hyundai                 sonata   2.5 1999   6 manual(m5)   f  18
## 115 115     hyundai                 sonata   3.3 2008   6   auto(l5)   f  19
## 116 116     hyundai                tiburon   2.0 1999   4   auto(l4)   f  19
## 117 117     hyundai                tiburon   2.0 1999   4 manual(m5)   f  19
## 118 118     hyundai                tiburon   2.0 2008   4 manual(m5)   f  20
## 119 119     hyundai                tiburon   2.0 2008   4   auto(l4)   f  20
## 120 120     hyundai                tiburon   2.7 2008   6   auto(l4)   f  17
## 121 121     hyundai                tiburon   2.7 2008   6 manual(m6)   f  16
## 122 122     hyundai                tiburon   2.7 2008   6 manual(m5)   f  17
## 123 123        jeep     grand cherokee 4wd   3.0 2008   6   auto(l5)   4  17
## 124 124        jeep     grand cherokee 4wd   3.7 2008   6   auto(l5)   4  15
```

```
## 125 125         jeep     grand cherokee 4wd   4.0 1999   6   auto(l4)   4  15
## 126 126         jeep     grand cherokee 4wd   4.7 1999   8   auto(l4)   4  14
## 127 127         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4   9
## 128 128         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4  14
## 129 129         jeep     grand cherokee 4wd   5.7 2008   8   auto(l5)   4  13
## 130 130         jeep     grand cherokee 4wd   6.1 2008   8   auto(l5)   4  11
## 131 131   land rover            range rover   4.0 1999   8   auto(l4)   4  11
## 132 132   land rover            range rover   4.2 2008   8   auto(s6)   4  12
## 133 133   land rover            range rover   4.4 2008   8   auto(s6)   4  12
## 134 134   land rover            range rover   4.6 1999   8   auto(l4)   4  11
## 135 135      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11
## 136 136      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11
## 137 137      lincoln          navigator 2wd   5.4 2008   8   auto(l6)   r  12
## 138 138      mercury        mountaineer 4wd   4.0 1999   6   auto(l5)   4  14
## 139 139      mercury        mountaineer 4wd   4.0 2008   6   auto(l5)   4  13
## 140 140      mercury        mountaineer 4wd   4.6 2008   8   auto(l6)   4  13
## 141 141      mercury        mountaineer 4wd   5.0 1999   8   auto(l4)   4  13
## 142 142       nissan                altima   2.4 1999   4 manual(m5)   f  21
## 143 143       nissan                altima   2.4 1999   4   auto(l4)   f  19
## 144 144       nissan                altima   2.5 2008   4   auto(av)   f  23
## 145 145       nissan                altima   2.5 2008   4 manual(m6)   f  23
## 146 146       nissan                altima   3.5 2008   6 manual(m6)   f  19
## 147 147       nissan                altima   3.5 2008   6   auto(av)   f  19
## 148 148       nissan                maxima   3.0 1999   6   auto(l4)   f  18
## 149 149       nissan                maxima   3.0 1999   6 manual(m5)   f  19
## 150 150       nissan                maxima   3.5 2008   6   auto(av)   f  19
## 151 151       nissan         pathfinder 4wd   3.3 1999   6   auto(l4)   4  14
## 152 152       nissan         pathfinder 4wd   3.3 1999   6 manual(m5)   4  15
## 153 153       nissan         pathfinder 4wd   4.0 2008   6   auto(l5)   4  14
## 154 154       nissan         pathfinder 4wd   5.6 2008   8   auto(s5)   4  12
## 155 155      pontiac             grand prix   3.1 1999   6   auto(l4)   f  18
## 156 156      pontiac             grand prix   3.8 1999   6   auto(l4)   f  16
## 157 157      pontiac             grand prix   3.8 1999   6   auto(l4)   f  17
## 158 158      pontiac             grand prix   3.8 2008   6   auto(l4)   f  18
## 159 159      pontiac             grand prix   5.3 2008   8   auto(s4)   f  16
## 160 160       subaru           forester awd   2.5 1999   4 manual(m5)   4  18
## 161 161       subaru           forester awd   2.5 1999   4   auto(l4)   4  18
## 162 162       subaru           forester awd   2.5 2008   4 manual(m5)   4  20
## 163 163       subaru           forester awd   2.5 2008   4 manual(m5)   4  19
## 164 164       subaru           forester awd   2.5 2008   4   auto(l4)   4  20
## 165 165       subaru           forester awd   2.5 2008   4   auto(l4)   4  18
## 166 166       subaru            impreza awd   2.2 1999   4   auto(l4)   4  21
## 167 167       subaru            impreza awd   2.2 1999   4 manual(m5)   4  19
## 168 168       subaru            impreza awd   2.5 1999   4 manual(m5)   4  19
## 169 169       subaru            impreza awd   2.5 1999   4   auto(l4)   4  19
## 170 170       subaru            impreza awd   2.5 2008   4   auto(s4)   4  20
## 171 171       subaru            impreza awd   2.5 2008   4   auto(s4)   4  20
## 172 172       subaru            impreza awd   2.5 2008   4 manual(m5)   4  19
## 173 173       subaru            impreza awd   2.5 2008   4 manual(m5)   4  20
## 174 174       toyota            4runner 4wd   2.7 1999   4 manual(m5)   4  15
## 175 175       toyota            4runner 4wd   2.7 1999   4   auto(l4)   4  16
## 176 176       toyota            4runner 4wd   3.4 1999   6   auto(l4)   4  15
## 177 177       toyota            4runner 4wd   3.4 1999   6 manual(m5)   4  15
## 178 178       toyota            4runner 4wd   4.0 2008   6   auto(l5)   4  16
```

```
## 179 179       toyota            4runner 4wd   4.7 2008   8   auto(l5)   4  14
## 180 180       toyota                 camry   2.2 1999   4 manual(m5)   f  21
## 181 181       toyota                 camry   2.2 1999   4   auto(l4)   f  21
## 182 182       toyota                 camry   2.4 2008   4 manual(m5)   f  21
## 183 183       toyota                 camry   2.4 2008   4   auto(l5)   f  21
## 184 184       toyota                 camry   3.0 1999   6   auto(l4)   f  18
## 185 185       toyota                 camry   3.0 1999   6 manual(m5)   f  18
## 186 186       toyota                 camry   3.5 2008   6   auto(s6)   f  19
## 187 187       toyota           camry solara   2.2 1999   4   auto(l4)   f  21
## 188 188       toyota           camry solara   2.2 1999   4 manual(m5)   f  21
## 189 189       toyota           camry solara   2.4 2008   4 manual(m5)   f  21
## 190 190       toyota           camry solara   2.4 2008   4   auto(s5)   f  22
## 191 191       toyota           camry solara   3.0 1999   6   auto(l4)   f  18
## 192 192       toyota           camry solara   3.0 1999   6 manual(m5)   f  18
## 193 193       toyota           camry solara   3.3 2008   6   auto(s5)   f  18
## 194 194       toyota                corolla   1.8 1999   4   auto(l3)   f  24
## 195 195       toyota                corolla   1.8 1999   4   auto(l4)   f  24
## 196 196       toyota                corolla   1.8 1999   4 manual(m5)   f  26
## 197 197       toyota                corolla   1.8 2008   4 manual(m5)   f  28
## 198 198       toyota                corolla   1.8 2008   4   auto(l4)   f  26
## 199 199       toyota land cruiser wagon 4wd   4.7 1999   8   auto(l4)   4  11
## 200 200       toyota land cruiser wagon 4wd   5.7 2008   8   auto(s6)   4  13
## 201 201       toyota      toyota tacoma 4wd   2.7 1999   4 manual(m5)   4  15
## 202 202       toyota      toyota tacoma 4wd   2.7 1999   4   auto(l4)   4  16
## 203 203       toyota      toyota tacoma 4wd   2.7 2008   4 manual(m5)   4  17
## 204 204       toyota      toyota tacoma 4wd   3.4 1999   6 manual(m5)   4  15
## 205 205       toyota      toyota tacoma 4wd   3.4 1999   6   auto(l4)   4  15
## 206 206       toyota      toyota tacoma 4wd   4.0 2008   6 manual(m6)   4  15
## 207 207       toyota      toyota tacoma 4wd   4.0 2008   6   auto(l5)   4  16
## 208 208   volkswagen                   gti   2.0 1999   4 manual(m5)   f  21
## 209 209   volkswagen                   gti   2.0 1999   4   auto(l4)   f  19
## 210 210   volkswagen                   gti   2.0 2008   4 manual(m6)   f  21
## 211 211   volkswagen                   gti   2.0 2008   4   auto(s6)   f  22
## 212 212   volkswagen                   gti   2.8 1999   6 manual(m5)   f  17
## 213 213   volkswagen                 jetta   1.9 1999   4 manual(m5)   f  33
## 214 214   volkswagen                 jetta   2.0 1999   4 manual(m5)   f  21
## 215 215   volkswagen                 jetta   2.0 1999   4   auto(l4)   f  19
## 216 216   volkswagen                 jetta   2.0 2008   4   auto(s6)   f  22
## 217 217   volkswagen                 jetta   2.0 2008   4 manual(m6)   f  21
## 218 218   volkswagen                 jetta   2.5 2008   5   auto(s6)   f  21
## 219 219   volkswagen                 jetta   2.5 2008   5 manual(m5)   f  21
## 220 220   volkswagen                 jetta   2.8 1999   6   auto(l4)   f  16
## 221 221   volkswagen                 jetta   2.8 1999   6 manual(m5)   f  17
## 222 222   volkswagen             new beetle   1.9 1999   4 manual(m5)   f  35
## 223 223   volkswagen             new beetle   1.9 1999   4   auto(l4)   f  29
## 224 224   volkswagen             new beetle   2.0 1999   4 manual(m5)   f  21
## 225 225   volkswagen             new beetle   2.0 1999   4   auto(l4)   f  19
## 226 226   volkswagen             new beetle   2.5 2008   5 manual(m5)   f  20
## 227 227   volkswagen             new beetle   2.5 2008   5   auto(s6)   f  20
## 228 228   volkswagen                 passat   1.8 1999   4 manual(m5)   f  21
## 229 229   volkswagen                 passat   1.8 1999   4   auto(l5)   f  18
## 230 230   volkswagen                 passat   2.0 2008   4   auto(s6)   f  19
## 231 231   volkswagen                 passat   2.0 2008   4 manual(m6)   f  21
## 232 232   volkswagen                 passat   2.8 1999   6   auto(l5)   f  16
```

```
## 233 233   volkswagen              passat   2.8 1999   6 manual(m5)   f  18
## 234 234   volkswagen              passat   3.6 2008   6   auto(s6)   f  17
##     hwy fl      class
## 1    29  p    compact
## 2    29  p    compact
## 3    31  p    compact
## 4    30  p    compact
## 5    26  p    compact
## 6    26  p    compact
## 7    27  p    compact
## 8    26  p    compact
## 9    25  p    compact
## 10   28  p    compact
## 11   27  p    compact
## 12   25  p    compact
## 13   25  p    compact
## 14   25  p    compact
## 15   25  p    compact
## 16   24  p    midsize
## 17   25  p    midsize
## 18   23  p    midsize
## 19   20  r        suv
## 20   15  e        suv
## 21   20  r        suv
## 22   17  r        suv
## 23   17  r        suv
## 24   26  p    2seater
## 25   23  p    2seater
## 26   26  p    2seater
## 27   25  p    2seater
## 28   24  p    2seater
## 29   19  r        suv
## 30   14  e        suv
## 31   15  r        suv
## 32   17  d        suv
## 33   27  r    midsize
## 34   30  r    midsize
## 35   26  r    midsize
## 36   29  r    midsize
## 37   26  r    midsize
## 38   24  r    minivan
## 39   24  r    minivan
## 40   22  r    minivan
## 41   22  r    minivan
## 42   24  r    minivan
## 43   24  r    minivan
## 44   17  e    minivan
## 45   22  r    minivan
## 46   21  r    minivan
## 47   23  r    minivan
## 48   23  r    minivan
## 49   19  r     pickup
## 50   18  r     pickup
## 51   17  r     pickup
```

```
## 52   17  r     pickup
## 53   19  r     pickup
## 54   19  r     pickup
## 55   12  e     pickup
## 56   17  r     pickup
## 57   15  r     pickup
## 58   17  r        suv
## 59   17  r        suv
## 60   12  e        suv
## 61   17  r        suv
## 62   16  r        suv
## 63   18  r        suv
## 64   15  r        suv
## 65   16  r     pickup
## 66   12  e     pickup
## 67   17  r     pickup
## 68   17  r     pickup
## 69   16  r     pickup
## 70   12  e     pickup
## 71   15  r     pickup
## 72   16  r     pickup
## 73   17  r     pickup
## 74   15  r     pickup
## 75   17  r        suv
## 76   17  r        suv
## 77   18  r        suv
## 78   17  r        suv
## 79   19  r        suv
## 80   17  r        suv
## 81   19  r        suv
## 82   19  r        suv
## 83   17  r        suv
## 84   17  r     pickup
## 85   17  r     pickup
## 86   16  r     pickup
## 87   16  r     pickup
## 88   17  r     pickup
## 89   15  r     pickup
## 90   17  r     pickup
## 91   26  r subcompact
## 92   25  r subcompact
## 93   26  r subcompact
## 94   24  r subcompact
## 95   21  r subcompact
## 96   22  r subcompact
## 97   23  r subcompact
## 98   22  r subcompact
## 99   20  p subcompact
## 100  33  r subcompact
## 101  32  r subcompact
## 102  32  r subcompact
## 103  29  p subcompact
## 104  32  r subcompact
## 105  34  r subcompact
```

```
## 106  36  r subcompact
## 107  36  c subcompact
## 108  29  p subcompact
## 109  26  r    midsize
## 110  27  r    midsize
## 111  30  r    midsize
## 112  31  r    midsize
## 113  26  r    midsize
## 114  26  r    midsize
## 115  28  r    midsize
## 116  26  r subcompact
## 117  29  r subcompact
## 118  28  r subcompact
## 119  27  r subcompact
## 120  24  r subcompact
## 121  24  r subcompact
## 122  24  r subcompact
## 123  22  d        suv
## 124  19  r        suv
## 125  20  r        suv
## 126  17  r        suv
## 127  12  e        suv
## 128  19  r        suv
## 129  18  r        suv
## 130  14  p        suv
## 131  15  p        suv
## 132  18  r        suv
## 133  18  r        suv
## 134  15  p        suv
## 135  17  r        suv
## 136  16  p        suv
## 137  18  r        suv
## 138  17  r        suv
## 139  19  r        suv
## 140  19  r        suv
## 141  17  r        suv
## 142  29  r    compact
## 143  27  r    compact
## 144  31  r    midsize
## 145  32  r    midsize
## 146  27  p    midsize
## 147  26  p    midsize
## 148  26  r    midsize
## 149  25  r    midsize
## 150  25  p    midsize
## 151  17  r        suv
## 152  17  r        suv
## 153  20  p        suv
## 154  18  p        suv
## 155  26  r    midsize
## 156  26  p    midsize
## 157  27  r    midsize
## 158  28  r    midsize
## 159  25  p    midsize
```

```
## 160  25  r        suv
## 161  24  r        suv
## 162  27  r        suv
## 163  25  p        suv
## 164  26  r        suv
## 165  23  p        suv
## 166  26  r subcompact
## 167  26  r subcompact
## 168  26  r subcompact
## 169  26  r subcompact
## 170  25  p    compact
## 171  27  r    compact
## 172  25  p    compact
## 173  27  r    compact
## 174  20  r        suv
## 175  20  r        suv
## 176  19  r        suv
## 177  17  r        suv
## 178  20  r        suv
## 179  17  r        suv
## 180  29  r    midsize
## 181  27  r    midsize
## 182  31  r    midsize
## 183  31  r    midsize
## 184  26  r    midsize
## 185  26  r    midsize
## 186  28  r    midsize
## 187  27  r    compact
## 188  29  r    compact
## 189  31  r    compact
## 190  31  r    compact
## 191  26  r    compact
## 192  26  r    compact
## 193  27  r    compact
## 194  30  r    compact
## 195  33  r    compact
## 196  35  r    compact
## 197  37  r    compact
## 198  35  r    compact
## 199  15  r        suv
## 200  18  r        suv
## 201  20  r     pickup
## 202  20  r     pickup
## 203  22  r     pickup
## 204  17  r     pickup
## 205  19  r     pickup
## 206  18  r     pickup
## 207  20  r     pickup
## 208  29  r    compact
## 209  26  r    compact
## 210  29  p    compact
## 211  29  p    compact
## 212  24  r    compact
## 213  44  d    compact
```

```
## 214  29  r    compact
## 215  26  r    compact
## 216  29  p    compact
## 217  29  p    compact
## 218  29  r    compact
## 219  29  r    compact
## 220  23  r    compact
## 221  24  r    compact
## 222  44  d subcompact
## 223  41  d subcompact
## 224  29  r subcompact
## 225  26  r subcompact
## 226  28  r subcompact
## 227  29  r subcompact
## 228  29  p    midsize
## 229  29  p    midsize
## 230  28  p    midsize
## 231  29  p    midsize
## 232  26  p    midsize
## 233  26  p    midsize
## 234  26  p    midsize
```

```
#1.)
#b.)
str(mpg)
```

```
## 'data.frame':    234 obs. of  12 variables:
##  $ X           : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ 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" ...
```

```
#Manufacturer, model, year, cyl, trans, drv, fl, and class are categorical variables
```

```
#1.)
#c.)
#The continuous variables are cty, hwy, and disply
```

```
#2.)
library(ggplot2)
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following object is masked _by_ '.GlobalEnv':
##
##     mpg
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.4.2
```

```
##
## 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
```

```
manufacturer_models <- mpg %>%
  group_by(manufacturer) %>%
  summarize(models = paste(unique(model), collapse = ", "))

manufacturer_models
```

```
## # A tibble: 15 x 2
##    manufacturer models
##    <chr>        <chr>
##  1 audi         a4, a4 quattro, a6 quattro
##  2 chevrolet    c1500 suburban 2wd, corvette, k1500 tahoe 4wd, malibu
##  3 dodge        caravan 2wd, dakota pickup 4wd, durango 4wd, ram 1500 pickup 4wd
##  4 ford         expedition 2wd, explorer 4wd, f150 pickup 4wd, mustang
##  5 honda        civic
##  6 hyundai      sonata, tiburon
##  7 jeep         grand cherokee 4wd
##  8 land rover   range rover
##  9 lincoln      navigator 2wd
## 10 mercury      mountaineer 4wd
## 11 nissan       altima, maxima, pathfinder 4wd
## 12 pontiac      grand prix
## 13 subaru       forester awd, impreza awd
## 14 toyota       4runner 4wd, camry, camry solara, corolla, land cruiser wagon 4~
## 15 volkswagen   gti, jetta, new beetle, passat
```

```
#2.)
#b.)
models <- factor(manufacturer_models$models)
models
```

```
##  [1] a4, a4 quattro, a6 quattro
##  [2] c1500 suburban 2wd, corvette, k1500 tahoe 4wd, malibu
```

```
##  [3] caravan 2wd, dakota pickup 4wd, durango 4wd, ram 1500 pickup 4wd
##  [4] expedition 2wd, explorer 4wd, f150 pickup 4wd, mustang
##  [5] civic
##  [6] sonata, tiburon
##  [7] grand cherokee 4wd
##  [8] range rover
##  [9] navigator 2wd
## [10] mountaineer 4wd
## [11] altima, maxima, pathfinder 4wd
## [12] grand prix
## [13] forester awd, impreza awd
## [14] 4runner 4wd, camry, camry solara, corolla, land cruiser wagon 4wd, toyota tacoma 4wd
## [15] gti, jetta, new beetle, passat
## 15 Levels: 4runner 4wd, camry, camry solara, corolla, land cruiser wagon 4wd, toyota tacoma 4wd ...
```

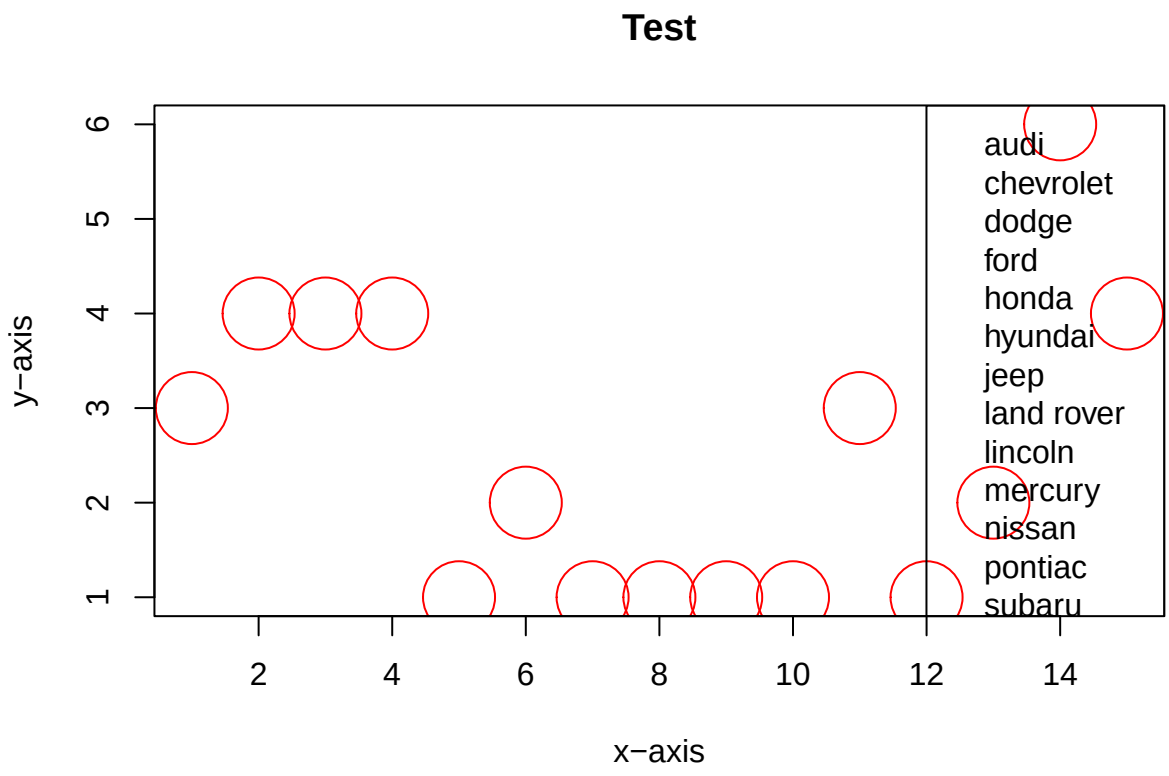
```
no_of_models <- c(3, 4, 4, 4, 1, 2, 1, 1, 1, 1, 3, 1, 2, 6, 4)
no_of_models
```

```
##  [1] 3 4 4 4 1 2 1 1 1 1 3 1 2 6 4
```

```
x <- seq(15)
manufacturers <- manufacturer_models$manufacturer
length(manufacturers)
```

```
## [1] 15
```

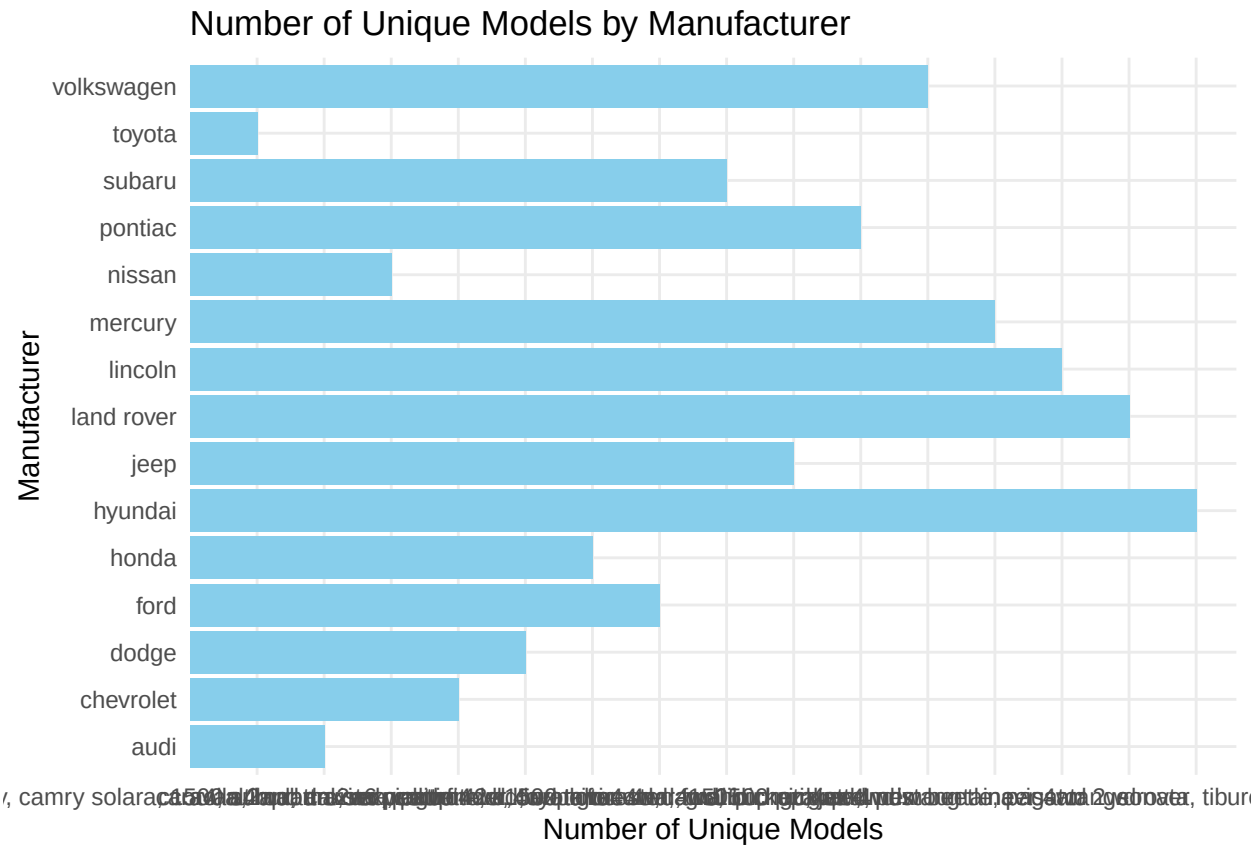
```
plot(x, no_of_models, main = "Test", ylab = "y-axis", xlab = "x-axis", cex = 5, col = "red", )
legend("topright", legend = c(manufacturer_models$manufacturer))
```



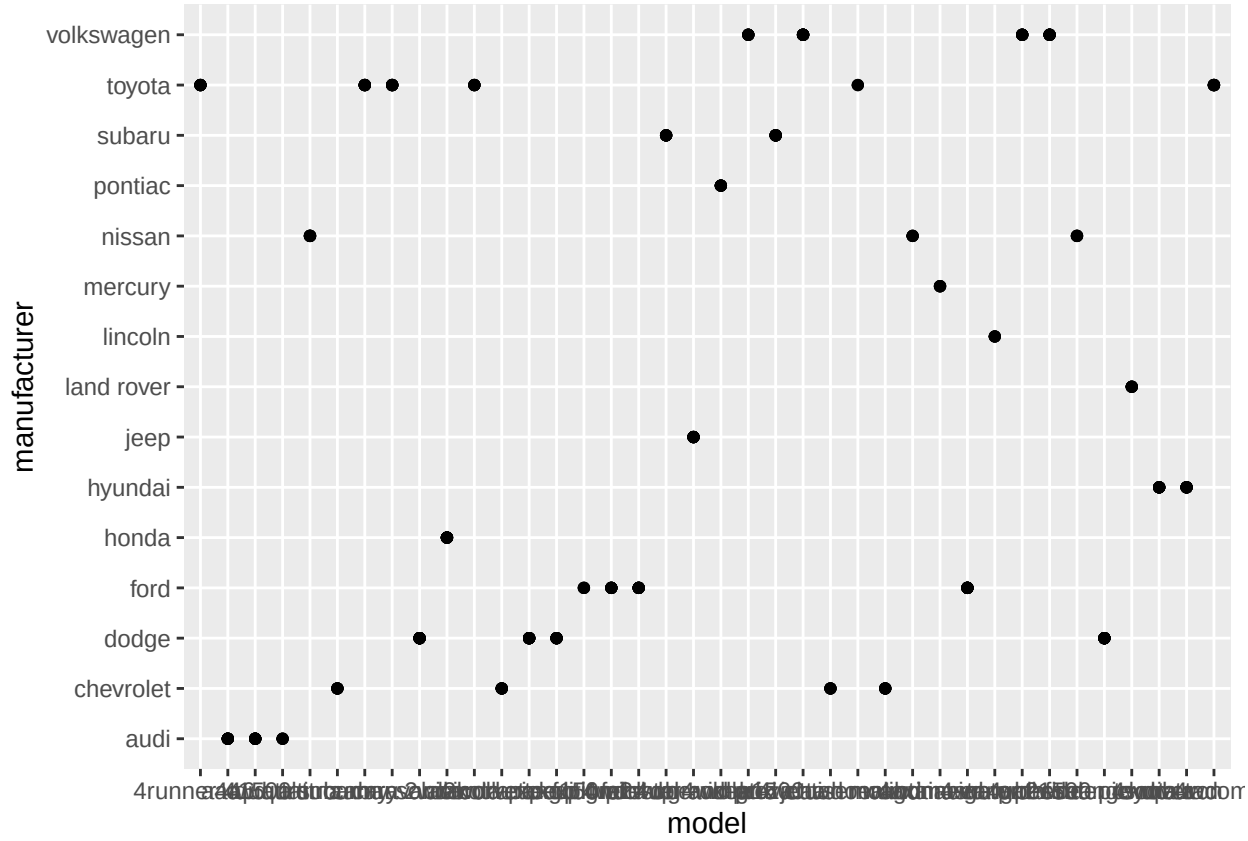

```
#2.)
#b.)
ggplot(manufacturer_models, aes(x = reorder(manufacturers, models), y = models)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  coord_flip() +  # Flip coordinates for easier reading
  labs(title = "Number of Unique Models by Manufacturer",
       x = "Manufacturer",
       y = "Number of Unique Models") +
  theme_minimal()
```

```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
```

```
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```




```
#2.)
#a.)
ggplot(mpg, aes(model, manufacturer)) + geom_point()
```




```
#2.)
#b.)
#Yes, it has some purpose and uses but only in limited applications and the design as well the visual c
```

```
#3.)
model <- mpg$model[1:20]
model
```

```
##  [1] "a4"                 "a4"                 "a4"
##  [4] "a4"                 "a4"                 "a4"
##  [7] "a4"                 "a4 quattro"         "a4 quattro"
## [10] "a4 quattro"         "a4 quattro"         "a4 quattro"
## [13] "a4 quattro"         "a4 quattro"         "a4 quattro"
## [16] "a6 quattro"         "a6 quattro"         "a6 quattro"
## [19] "c1500 suburban 2wd" "c1500 suburban 2wd"
```

```
year <- mpg$year[1:20]
year
```

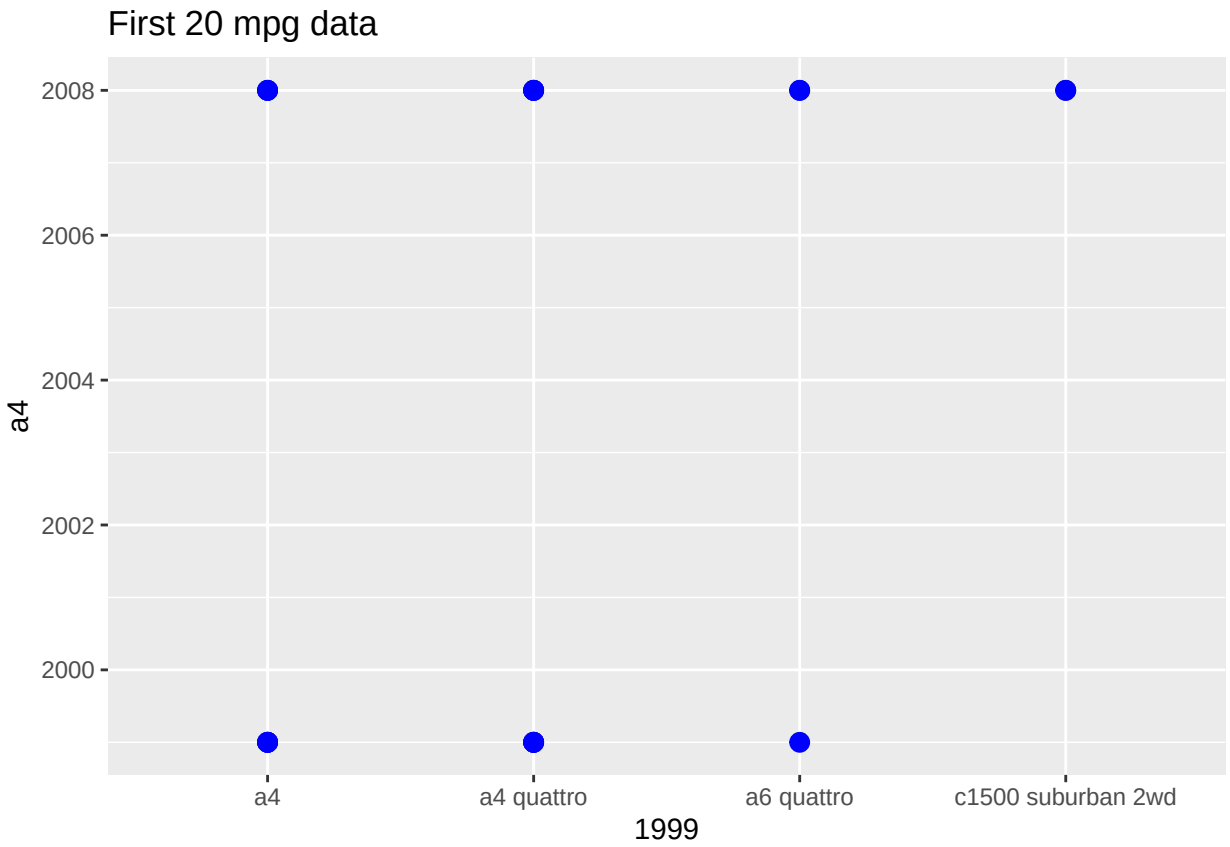
```
##  [1] 1999 1999 2008 2008 1999 1999 2008 1999 1999 2008 2008 1999 1999 2008 2008
## [16] 1999 2008 2008 2008 2008
```

```r
mpg_20 <- mpg[1:20, ]

mpg_20
```

```
##     X manufacturer              model displ year cyl      trans drv cty hwy fl
## 1   1         audi                 a4   1.8 1999   4   auto(l5)   f  18  29  p
## 2   2         audi                 a4   1.8 1999   4 manual(m5)   f  21  29  p
## 3   3         audi                 a4   2.0 2008   4 manual(m6)   f  20  31  p
## 4   4         audi                 a4   2.0 2008   4   auto(av)   f  21  30  p
## 5   5         audi                 a4   2.8 1999   6   auto(l5)   f  16  26  p
## 6   6         audi                 a4   2.8 1999   6 manual(m5)   f  18  26  p
## 7   7         audi                 a4   3.1 2008   6   auto(av)   f  18  27  p
## 8   8         audi         a4 quattro   1.8 1999   4 manual(m5)   4  18  26  p
## 9   9         audi         a4 quattro   1.8 1999   4   auto(l5)   4  16  25  p
## 10 10         audi         a4 quattro   2.0 2008   4 manual(m6)   4  20  28  p
## 11 11         audi         a4 quattro   2.0 2008   4   auto(s6)   4  19  27  p
## 12 12         audi         a4 quattro   2.8 1999   6   auto(l5)   4  15  25  p
## 13 13         audi         a4 quattro   2.8 1999   6 manual(m5)   4  17  25  p
## 14 14         audi         a4 quattro   3.1 2008   6   auto(s6)   4  17  25  p
## 15 15         audi         a4 quattro   3.1 2008   6 manual(m6)   4  15  25  p
## 16 16         audi         a6 quattro   2.8 1999   6   auto(l5)   4  15  24  p
## 17 17         audi         a6 quattro   3.1 2008   6   auto(s6)   4  17  25  p
## 18 18         audi         a6 quattro   4.2 2008   8   auto(s6)   4  16  23  p
## 19 19    chevrolet c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14  20  r
## 20 20    chevrolet c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  11  15  e
##       class
## 1   compact
## 2   compact
## 3   compact
## 4   compact
## 5   compact
## 6   compact
## 7   compact
## 8   compact
## 9   compact
## 10  compact
## 11  compact
## 12  compact
## 13  compact
## 14  compact
## 15  compact
## 16  midsize
## 17  midsize
## 18  midsize
## 19      suv
## 20      suv
```

```r
ggplot(mpg_20, aes(model,year)) + geom_point(color = "blue", size = 3) + labs(title = "First 20 mpg data
```




```
#4.)
model_count <- mpg %>%
  group_by(model) %>%
  summarize(count = n())
model_count
```

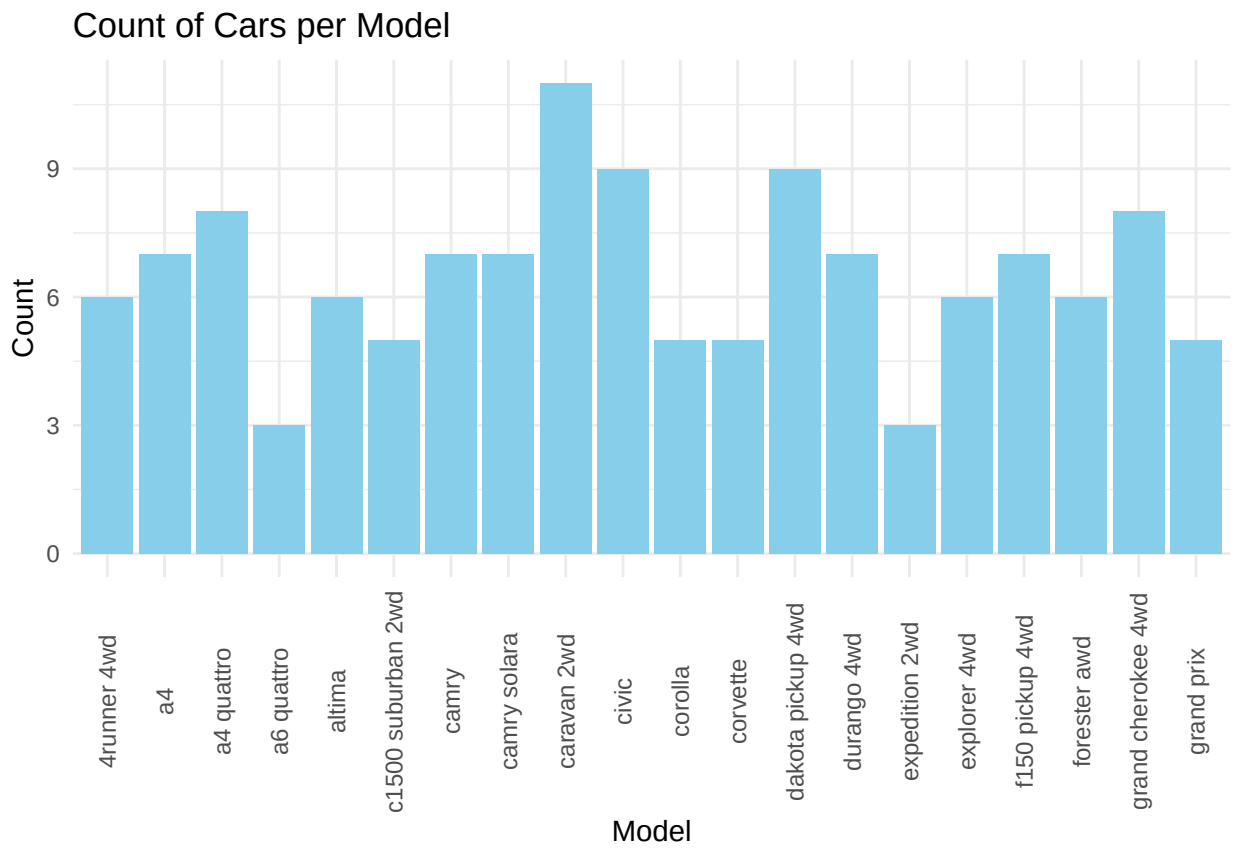
```
## # A tibble: 38 x 2
##    model              count
##    <chr>              <int>
##  1 4runner 4wd            6
##  2 a4                     7
##  3 a4 quattro             8
##  4 a6 quattro             3
##  5 altima                 6
##  6 c1500 suburban 2wd     5
##  7 camry                  7
##  8 camry solara           7
##  9 caravan 2wd           11
## 10 civic                  9
## # i 28 more rows
```

```
model_count <- model_count[1:20, ]
model_count
```

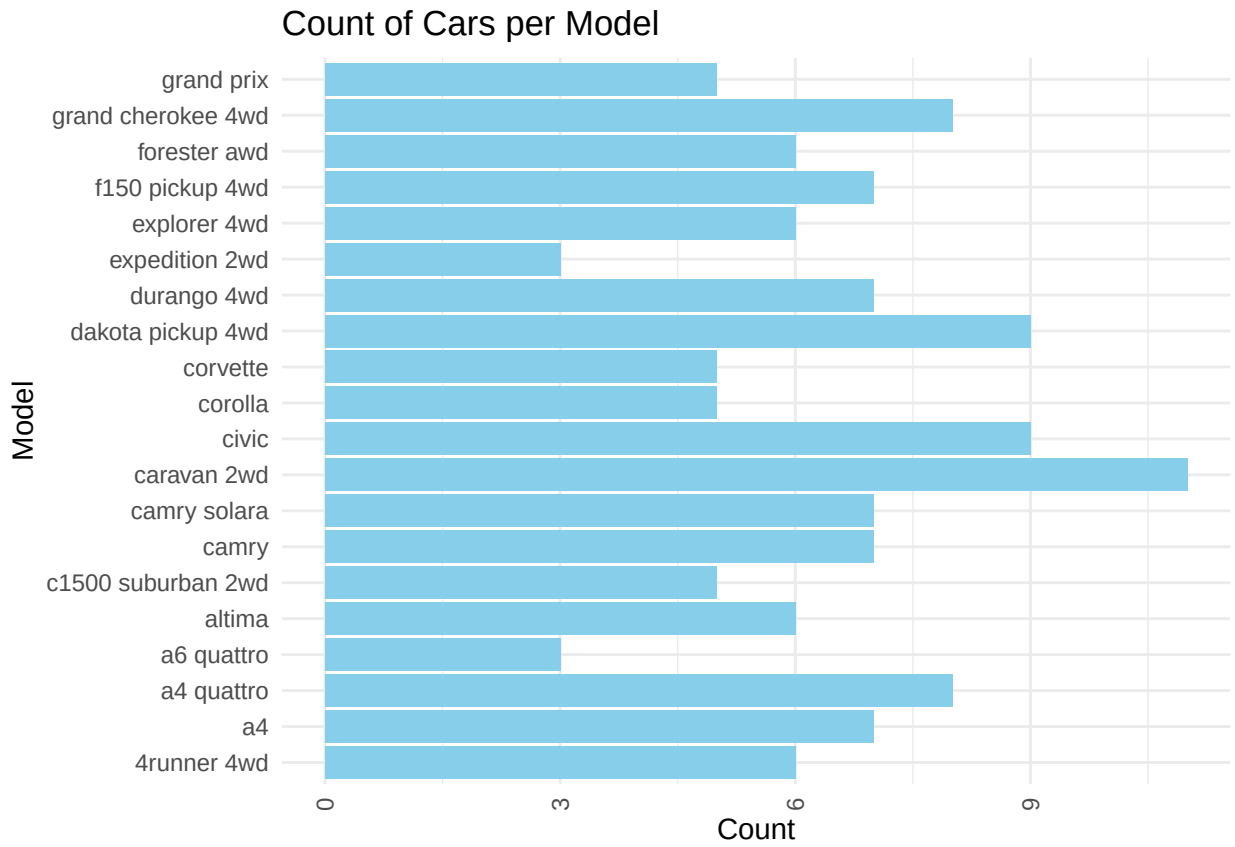
```
## # A tibble: 20 x 2
```

```
##    model              count
##    <chr>              <int>
##  1 4runner 4wd            6
##  2 a4                     7
##  3 a4 quattro             8
##  4 a6 quattro             3
##  5 altima                 6
##  6 c1500 suburban 2wd     5
##  7 camry                  7
##  8 camry solara           7
##  9 caravan 2wd           11
## 10 civic                  9
## 11 corolla                5
## 12 corvette               5
## 13 dakota pickup 4wd      9
## 14 durango 4wd            7
## 15 expedition 2wd         3
## 16 explorer 4wd           6
## 17 f150 pickup 4wd        7
## 18 forester awd           6
## 19 grand cherokee 4wd     8
## 20 grand prix             5
```

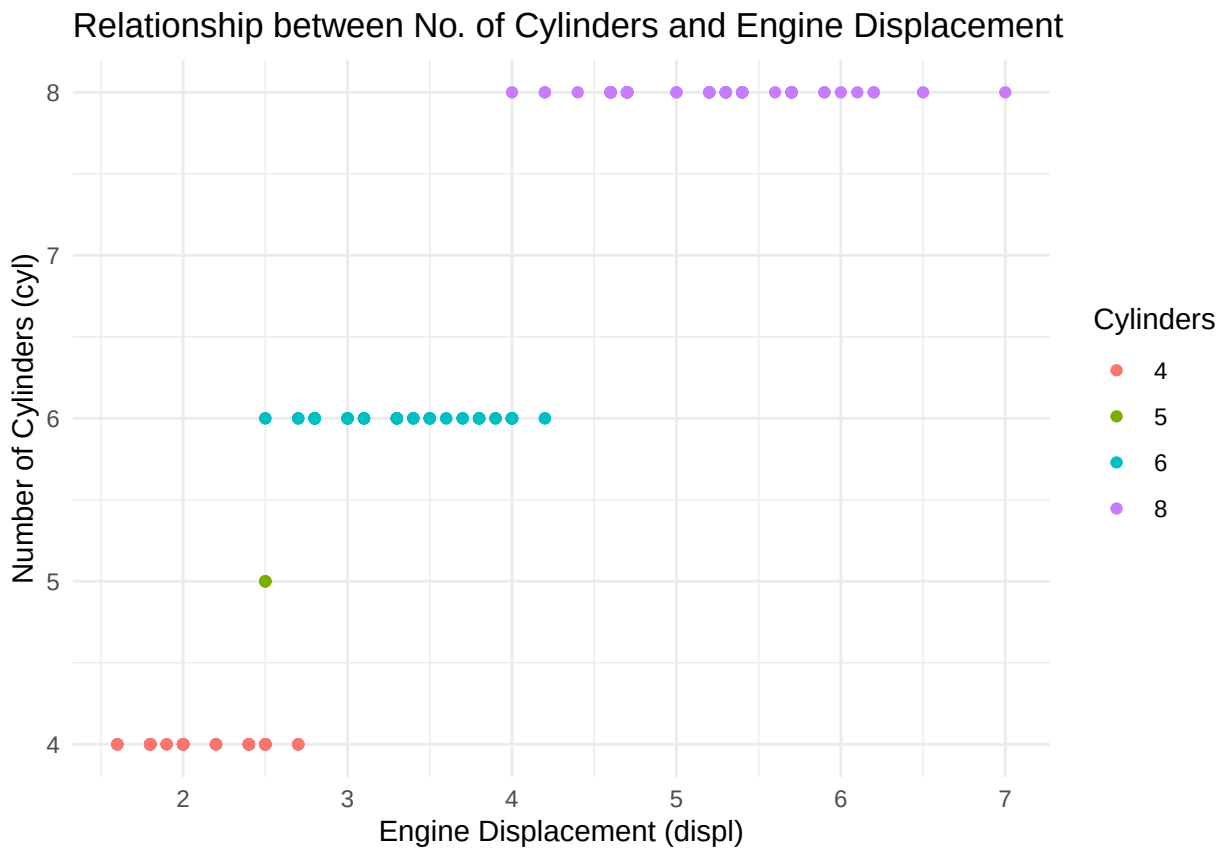
```r
#4.)
#a.)
ggplot(model_count, aes(model, count)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  labs(title = "Count of Cars per Model", x = "Model", y = "Count") +
  theme_minimal() + theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```




```
#4.)
#b.)
ggplot(model_count, aes(model, count)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  labs(title = "Count of Cars per Model", x = "Model", y = "Count") +
  theme_minimal() + theme(axis.text.x = element_text(angle = 90, vjust = 0.5)) + coord_flip()
```

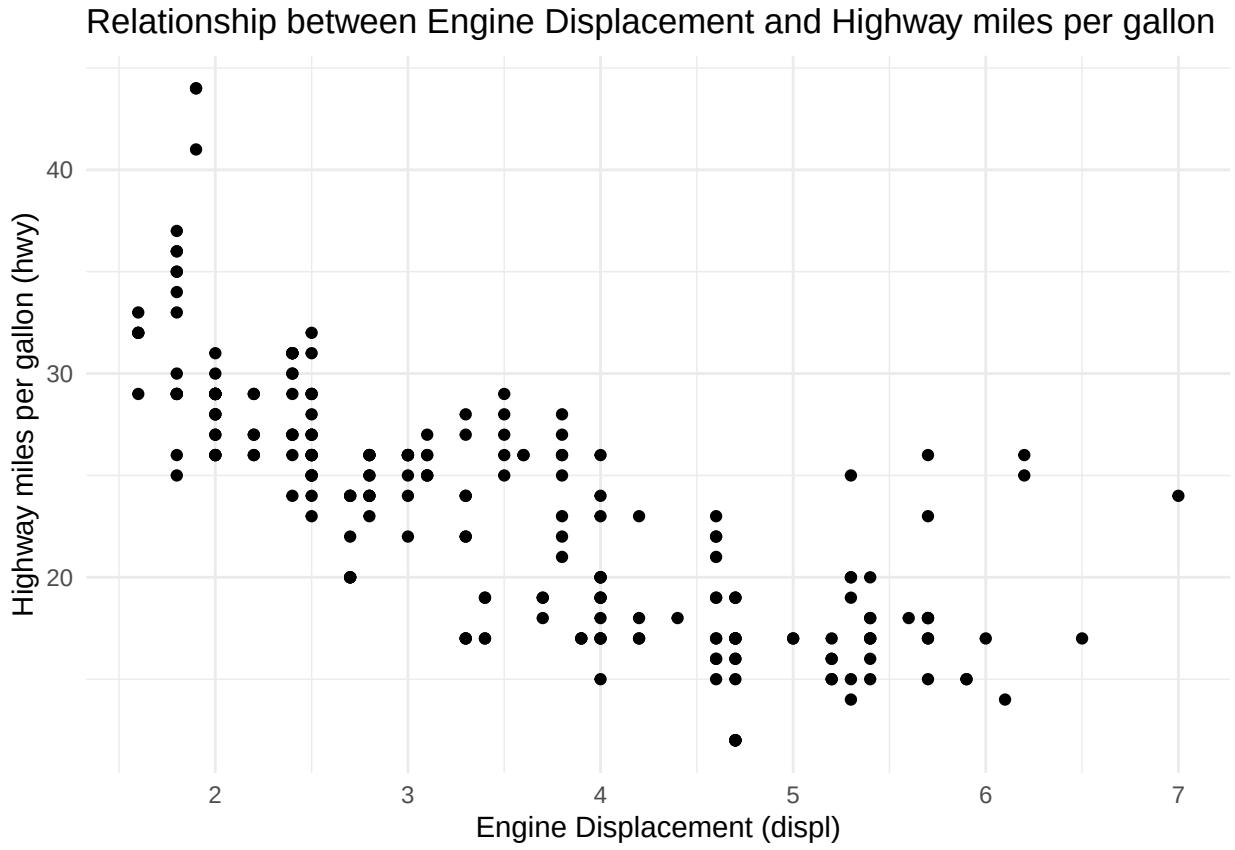



```
#5.)
ggplot(mpg, aes(x = displ, y = cyl, color = factor(cyl))) +
  geom_point() +
  labs(title = "Relationship between No. of Cylinders and Engine Displacement",
       x = "Engine Displacement (displ)",
       y = "Number of Cylinders (cyl)",
       color = "Cylinders") +
  theme_minimal()
```




```
#5.)
#a.)
#The higher the engine displacement are, the more cylinders are present. This means to say that Cylinde
```

```
ggplot(mpg, aes(x = displ, y = hwy)) +
  geom_point() +
  labs(title = "Relationship between Engine Displacement and Highway miles per gallon",
       x = "Engine Displacement (displ)",
       y = "Highway miles per gallon (hwy)") +
  theme_minimal()
```




```
#6.)
#I personally cannot comprehend the relationship between the two, but it appears that hwy appears more
```

```
#6.)
traffic <- read.csv("traffic.csv")
str(traffic)
```

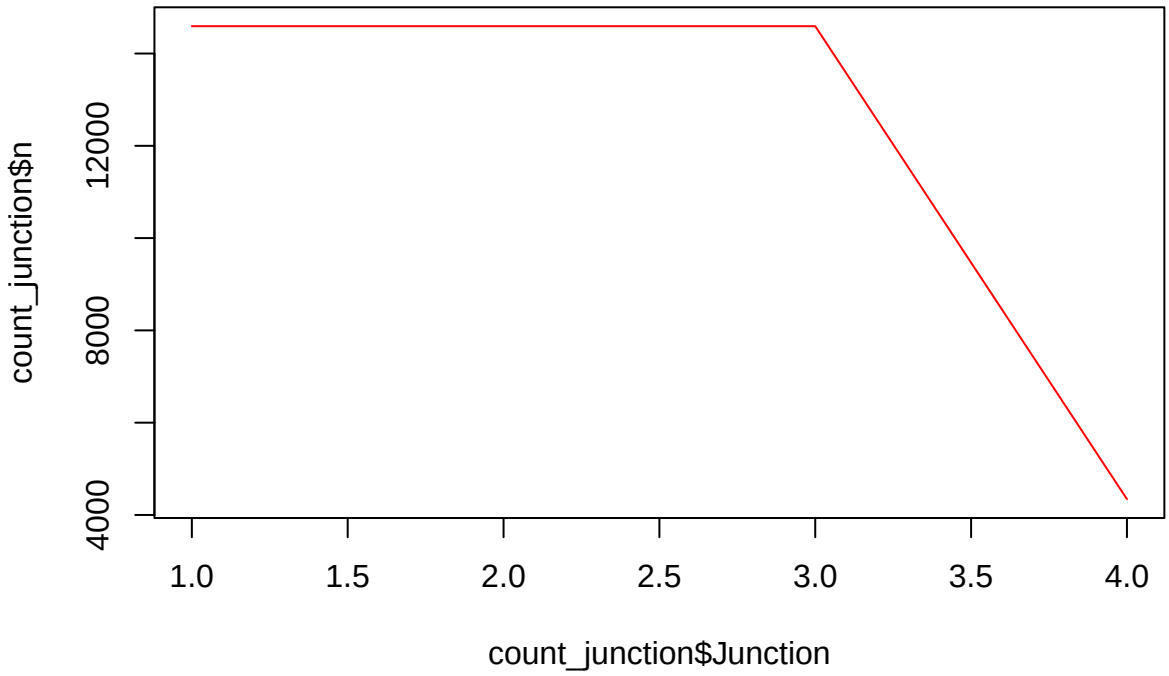
```
## 'data.frame':    48120 obs. of  4 variables:
##  $ DateTime: chr  "2015-11-01 00:00:00" "2015-11-01 01:00:00" "2015-11-01 02:00:00" "2015-11-01 03:0
##  $ Junction: int  1 1 1 1 1 1 1 1 1 1 ...
##  $ Vehicles: int  15 13 10 7 9 6 9 8 11 12 ...
##  $ ID      : num  2.02e+10 2.02e+10 2.02e+10 2.02e+10 2.02e+10 ...
```

```
count_junction <- traffic %>%
  count(Junction)

print(count_junction)
```

```
##   Junction     n
## 1        1 14592
## 2        2 14592
## 3        3 14592
## 4        4  4344
```

```r
#6.)
#b.)
plot(count_junction$Junction, count_junction$n, cex = 5, col = "red", type="l")
```




```r
#7.)
library(readxl)

alexa <- read_xlsx("alexa_file.xlsx")
head(alexa, 20)
```

```
## # A tibble: 20 x 5
##    rating date                variation           verified_reviews      feedback
##     <dbl> <dttm>              <chr>               <chr>                    <dbl>
##  1      5 2018-07-31 00:00:00 Charcoal Fabric     Love my Echo!                1
##  2      5 2018-07-31 00:00:00 Charcoal Fabric     Loved it!                    1
##  3      4 2018-07-31 00:00:00 Walnut Finish       Sometimes while play~        1
##  4      5 2018-07-31 00:00:00 Charcoal Fabric     I have had a lot of ~        1
##  5      5 2018-07-31 00:00:00 Charcoal Fabric     Music                        1
##  6      5 2018-07-31 00:00:00 Heather Gray Fabric I received the echo ~        1
##  7      3 2018-07-31 00:00:00 Sandstone Fabric    Without having a cel~        1
##  8      5 2018-07-31 00:00:00 Charcoal Fabric     I think this is the ~        1
##  9      5 2018-07-30 00:00:00 Heather Gray Fabric looks great                  1
## 10      5 2018-07-30 00:00:00 Heather Gray Fabric Love it! I've listen~        1
## 11      5 2018-07-30 00:00:00 Charcoal Fabric     I sent it to my 85 y~        1
## 12      5 2018-07-30 00:00:00 Charcoal Fabric     I love it! Learning ~        1
```

```
## 13      5 2018-07-30 00:00:00 Oak Finish          I purchased this for~        1
## 14      5 2018-07-30 00:00:00 Charcoal Fabric     Love, Love, Love!!           1
## 15      5 2018-07-30 00:00:00 Oak Finish          Just what I expected~        1
## 16      5 2018-07-30 00:00:00 Heather Gray Fabric I love it, wife hate~        1
## 17      5 2018-07-30 00:00:00 Heather Gray Fabric Really happy with th~        1
## 18      5 2018-07-30 00:00:00 Heather Gray Fabric We have only been us~        1
## 19      5 2018-07-30 00:00:00 Charcoal Fabric     We love the size of ~        1
## 20      4 2018-07-30 00:00:00 Sandstone Fabric    I liked the original~        1
```

```
str(alexa)
```

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

```
#7.)
#a.)
#3150 observations
ncol(alexa)
```

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

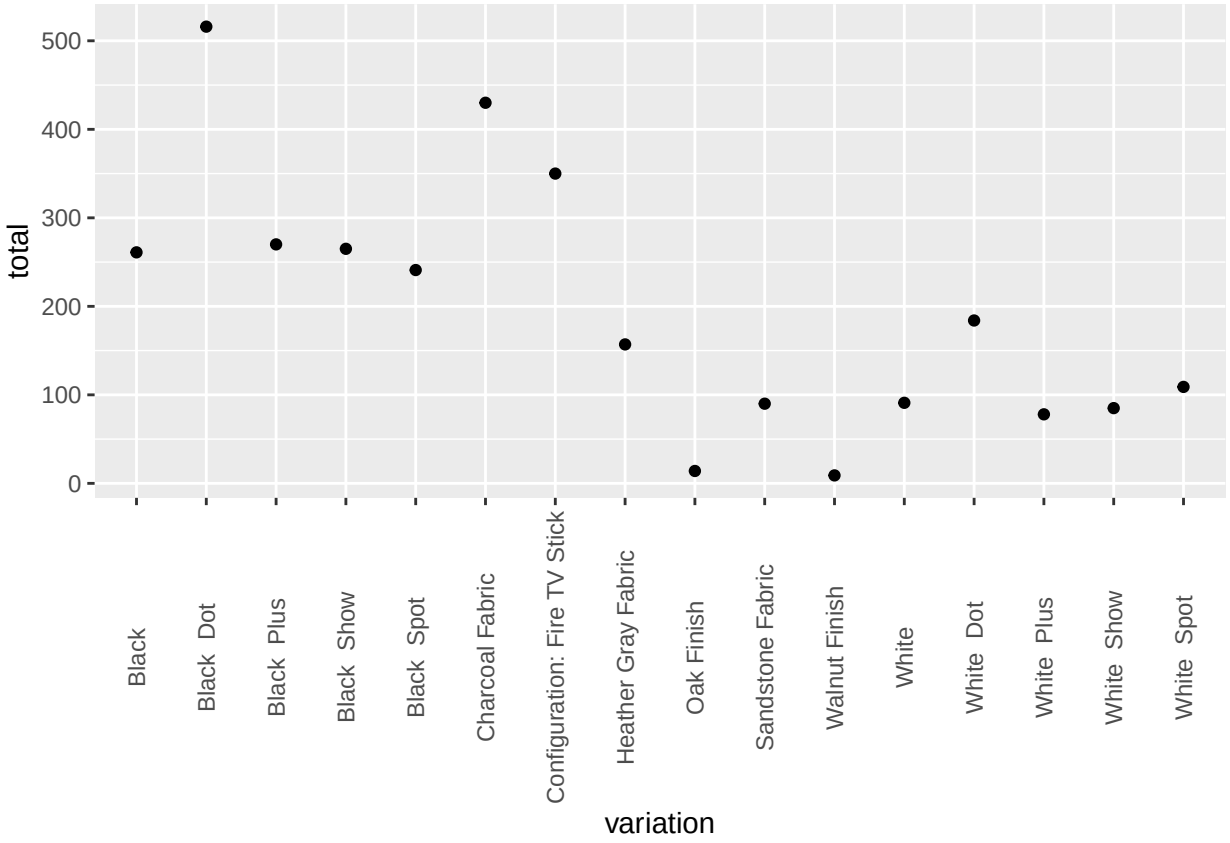
```
#5 columns
```

```
#7.)
#b.)
alexa_variations <- alexa %>%
  group_by(variation) %>%
  summarize(total = n())

alexa_variations
```

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

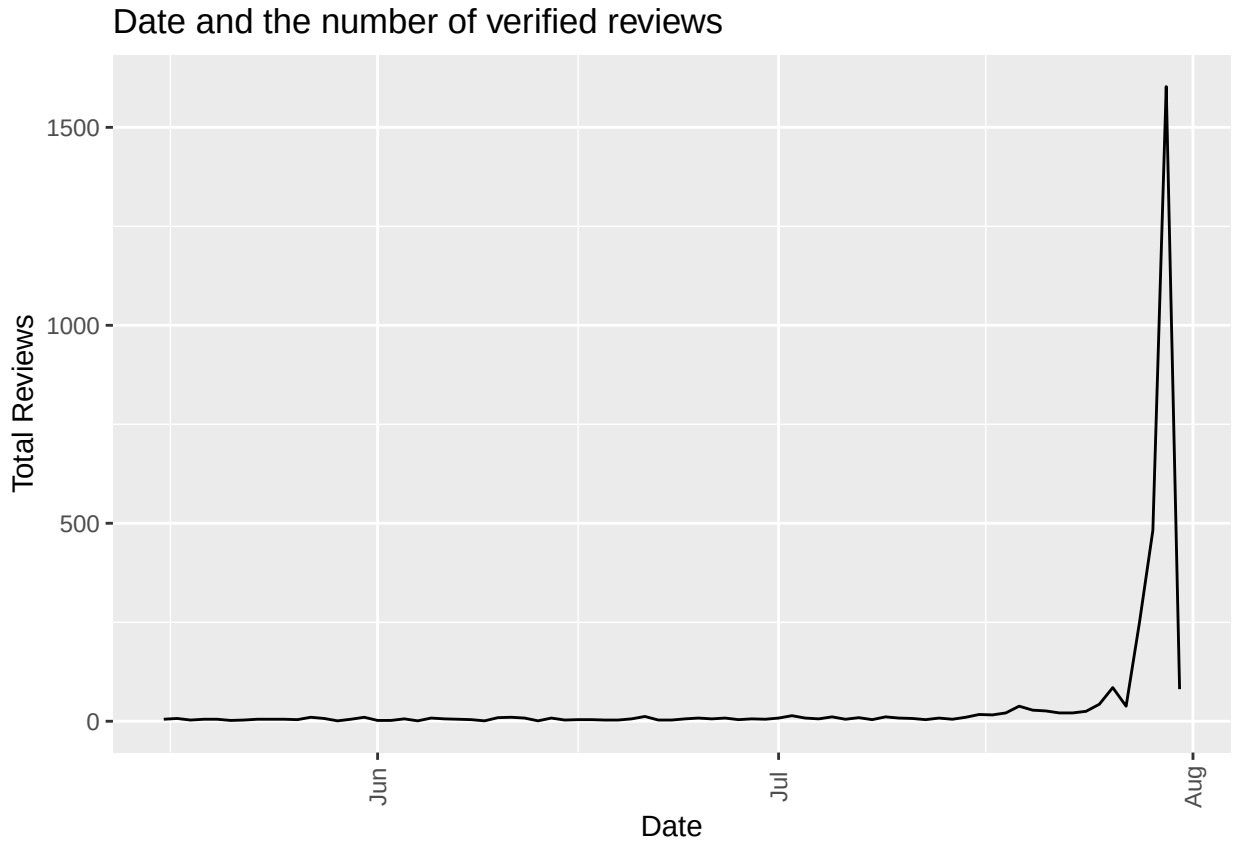
```
#7.)
#c.)
ggplot(alexa_variations, aes(variation, total)) + geom_point() + theme(axis.text.x = element_text(angle
```




```
#7.)
#d.)
date_reviews <- alexa %>%
  group_by(date) %>%
  summarize(total_reviews = n())
date_reviews
```

```
## # A tibble: 77 x 2
##    date                total_reviews
##    <dttm>                      <int>
##  1 2018-05-16 00:00:00             5
##  2 2018-05-17 00:00:00             7
##  3 2018-05-18 00:00:00             3
##  4 2018-05-19 00:00:00             5
##  5 2018-05-20 00:00:00             5
##  6 2018-05-21 00:00:00             2
##  7 2018-05-22 00:00:00             3
##  8 2018-05-23 00:00:00             5
##  9 2018-05-24 00:00:00             5
## 10 2018-05-25 00:00:00             5
## # i 67 more rows
```

```
#7.)
#d.)
ggplot(date_reviews, aes(date, total_reviews)) + geom_line() + theme(axis.text.x = element_text(angle =
```



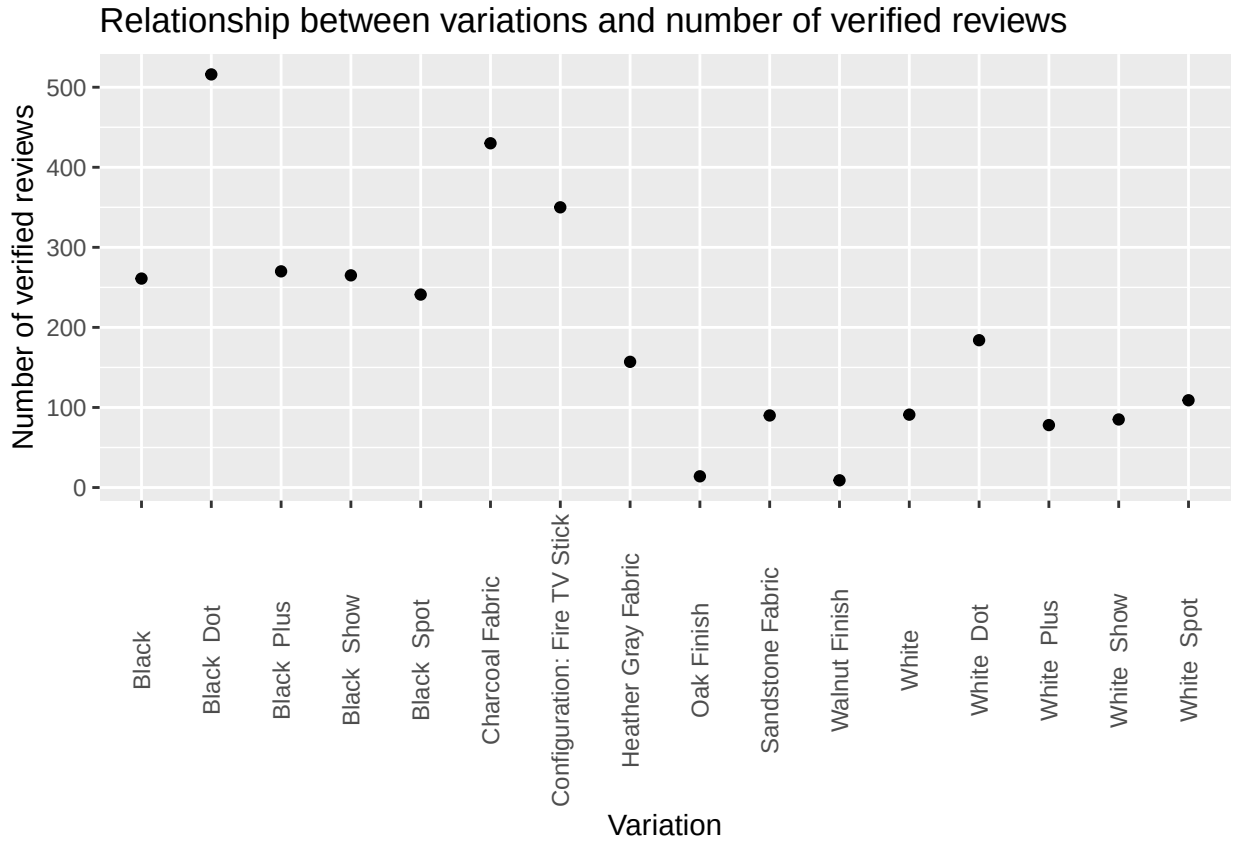

```
#7.)
#e.)
ratings_and_variations <- alexa %>%
  group_by(variation) %>%
  summarize(number_of_verified_reviews = n())

ratings_and_variations
```

```
## # A tibble: 16 x 2
##    variation                    number_of_verified_reviews
##    <chr>                                             <int>
##  1 Black                                               261
##  2 Black  Dot                                         516
##  3 Black  Plus                                        270
##  4 Black  Show                                        265
##  5 Black  Spot                                        241
##  6 Charcoal Fabric                                    430
##  7 Configuration: Fire TV Stick                       350
##  8 Heather Gray Fabric                                157
##  9 Oak Finish                                          14
## 10 Sandstone Fabric                                    90
```

```
## 11 Walnut Finish                                9
## 12 White                                       91
## 13 White  Dot                                 184
## 14 White  Plus                                 78
## 15 White  Show                                 85
## 16 White  Spot                                109
```

```
#7.)
#e.)
ggplot(ratings_and_variations, aes(variation, number_of_verified_reviews)) + geom_point() + theme(axis.t
```




```
#The Black Dot variation has the highest rating with over 516 number of verified reviews
```