RWorksheet_Sison#4C.

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```
#1A
library(readr)
mpg <- read.table("mpg.csv", header = TRUE, sep = ",")
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
```

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## 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
```

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## 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
```

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## 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
```

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## 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
```

```
#1B
"The categorical variables in mpg are manufacturer, model, trans, drv, fl, and class."
```

```
## [1] "The categorical variables in mpg are manufacturer, model, trans, drv, fl, and class."
```

```
#1C
"The continous variables are displ, cty, and hwy."
```

```
## [1] "The continous variables are displ, cty, and hwy."
```

```
#2
"The manufacturer with the most models is Toyota, and the most model variations is Caravan 2wd."
```

```
## [1] "The manufacturer with the most models is Toyota, and the most model variations is Caravan 2wd."
```

```
#2A
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(tidyr)
unique_models <- mpg %>%
  group_by(manufacturer) %>%
  summarise(unique_models = list(unique(model))) %>%
  unnest(cols = unique_models)
print(unique_models)
```

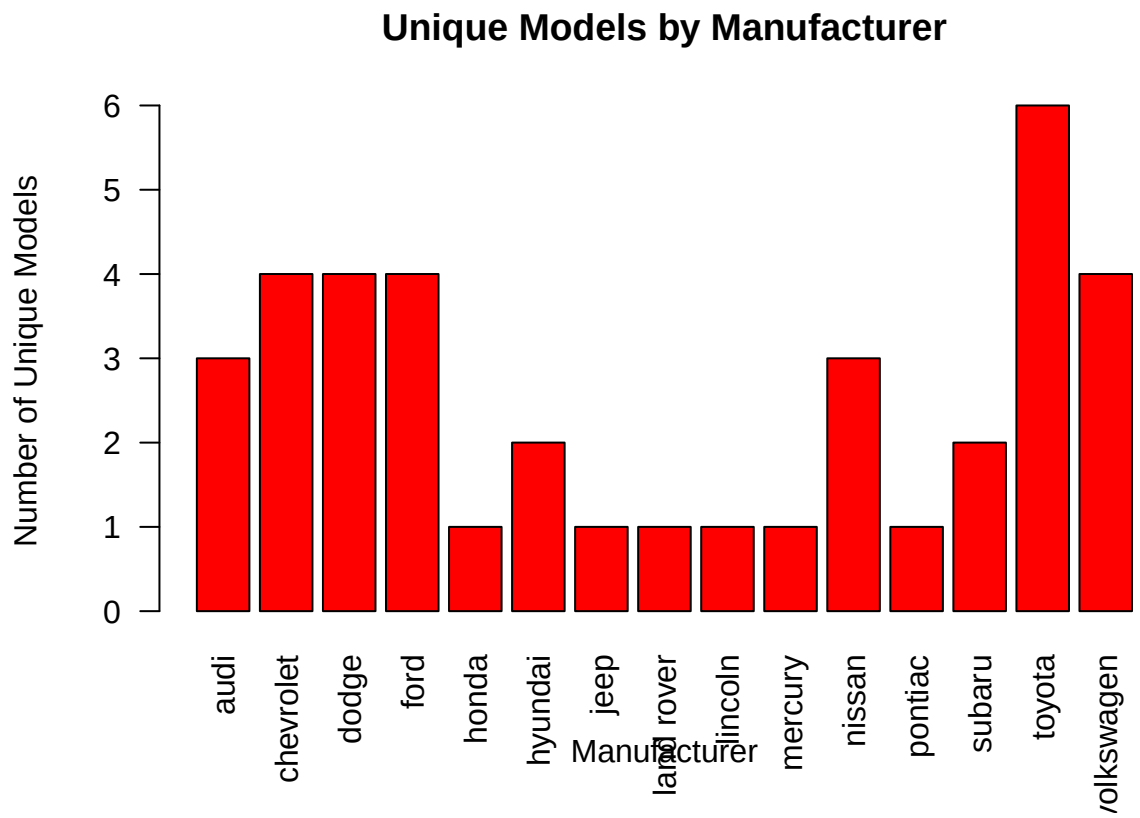
```
## # A tibble: 38 x 2
##    manufacturer unique_models
##    <chr>        <chr>
##  1 audi         a4
##  2 audi         a4 quattro
##  3 audi         a6 quattro
##  4 chevrolet    c1500 suburban 2wd
##  5 chevrolet    corvette
##  6 chevrolet    k1500 tahoe 4wd
##  7 chevrolet    malibu
##  8 dodge        caravan 2wd
##  9 dodge        dakota pickup 4wd
## 10 dodge        durango 4wd
## # i 28 more rows
```

```
#2B
library(dplyr)
library(tidyr)
library(ggplot2)
```

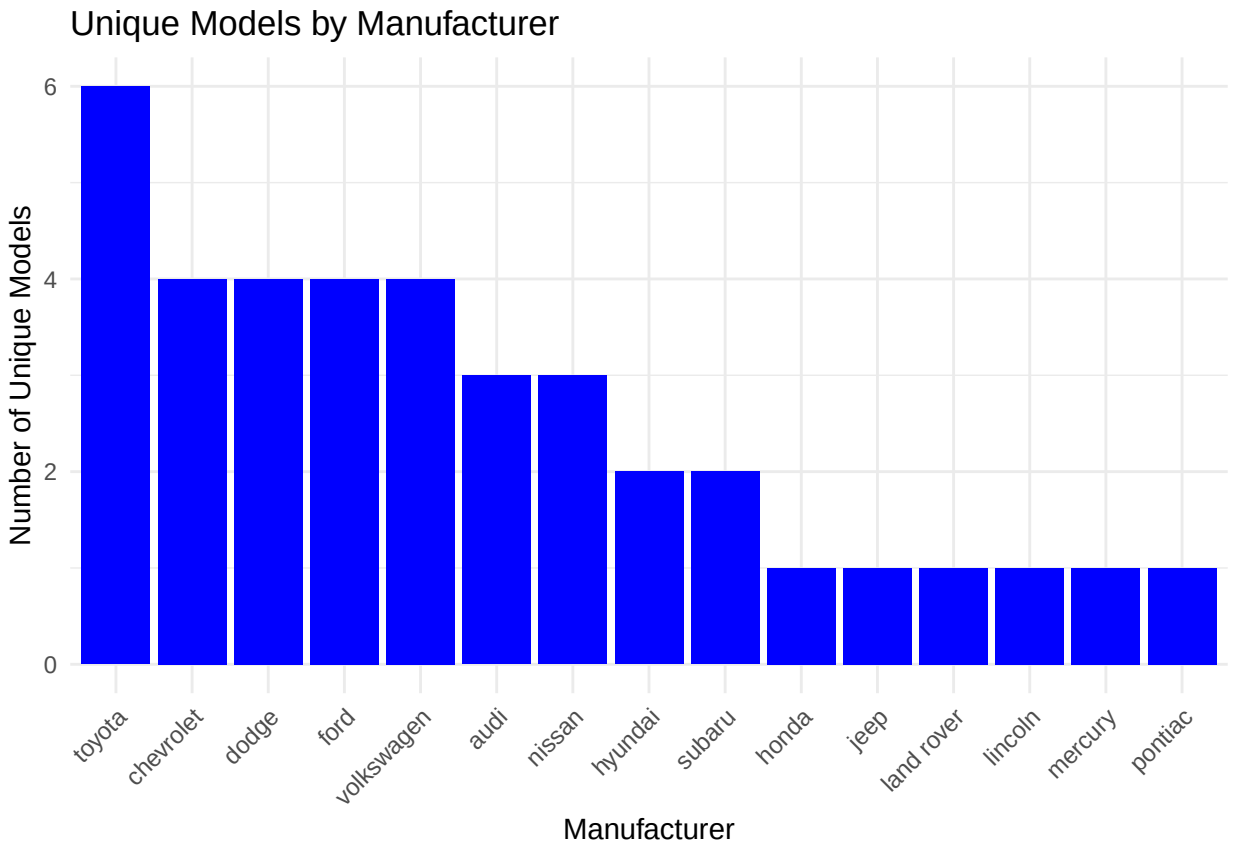
```
##
## Attaching package: 'ggplot2'
```

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

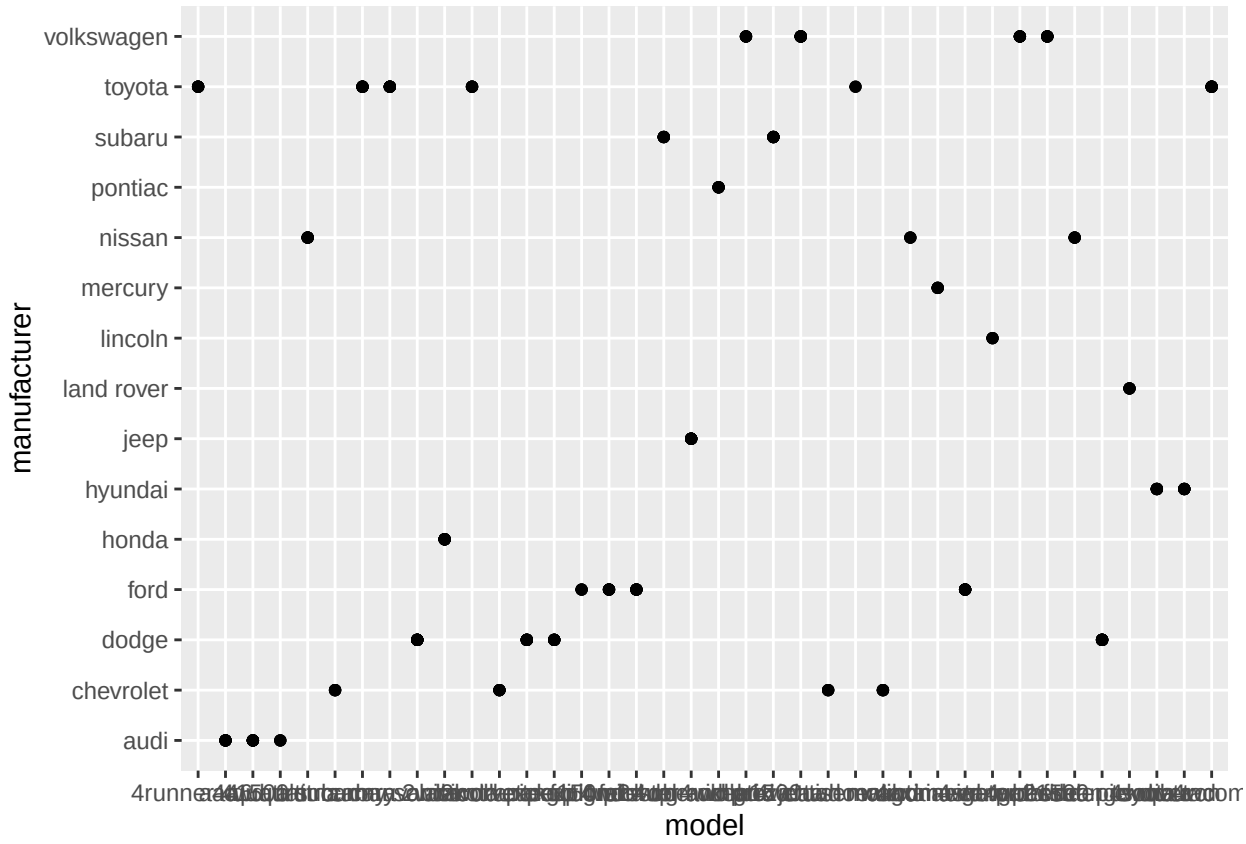
```
library(readr)
mpg <- read.table("mpg.csv", header = TRUE, sep = ",")
unique_model_counts <- mpg %>%
  group_by(manufacturer) %>%
  summarise(unique_model_count = n_distinct(model))
unique_model_counts$manufacturer <- factor(unique_model_counts$manufacturer, levels =unique_model_counts
barplot(unique_model_counts$unique_model_count,
        names.arg = unique_model_counts$manufacturer,
        main = "Unique Models by Manufacturer",
        xlab = "Manufacturer",
        ylab = "Number of Unique Models",
        las = 2,
        col = "red")
```




```
ggplot(unique_model_counts, aes(x = reorder(manufacturer, -unique_model_count), y = unique_model_count)
  geom_bar(stat = "identity", fill = "blue") +
  labs(title = "Unique Models by Manufacturer", x = "Manufacturer", y = "Number of Unique Models") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



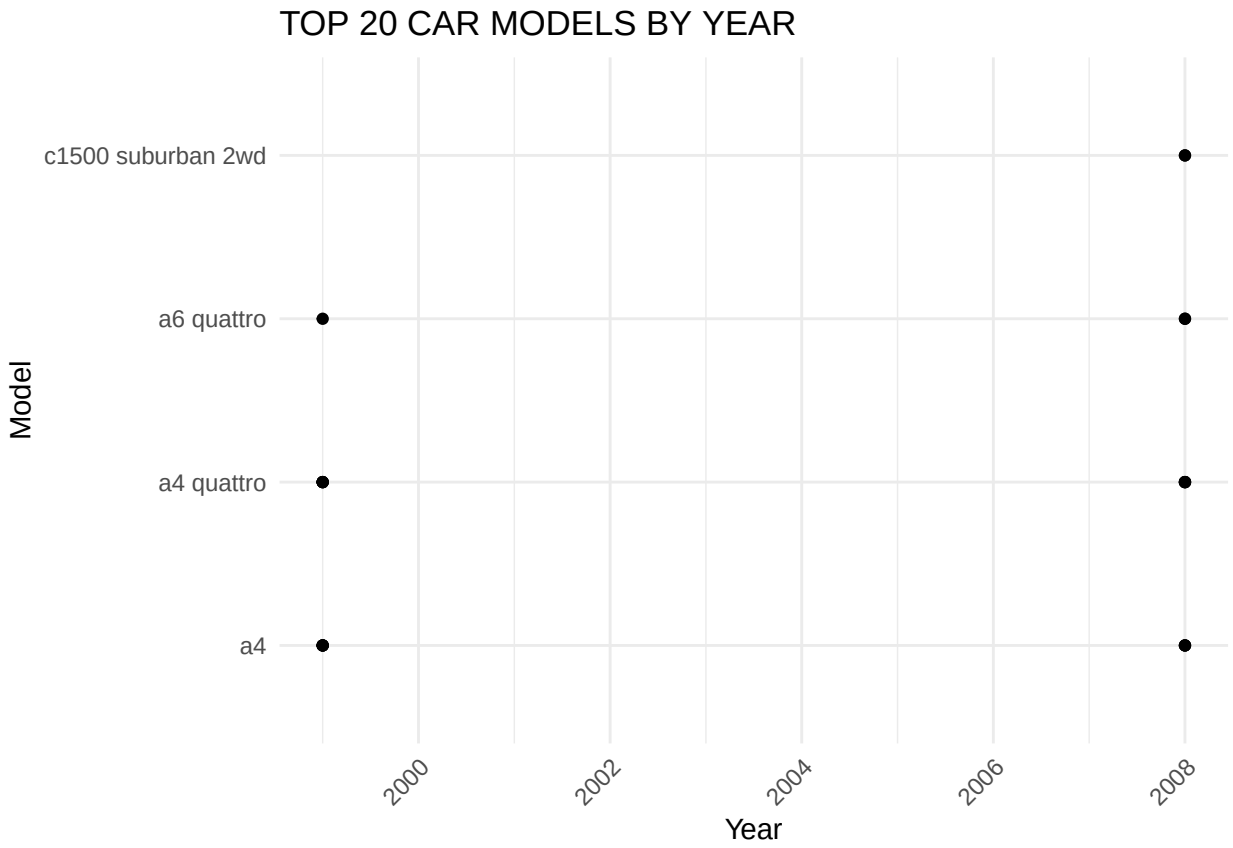

```
#2A
ggplot(mpg, aes(model, manufacturer)) + geom_point()
```




```
#2B
"It is useful in a way that you can easily see the view of car models by manufacturer, but it doesn't c
```

```
## [1] "It is useful in a way that you can easily see the view of car models by manufacturer, but it do
```

```
#3
colnames(mpg) <- make.names(colnames(mpg))

top_20_data <- head(mpg, 20)
top_20_data$model <- as.factor(top_20_data$model)

ggplot(top_20_data, aes(x = year, y = model)) +
  geom_point(color = "black") +
  theme_minimal() +
  labs(title = "TOP 20 CAR MODELS BY YEAR", x = "Year", y = "Model") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

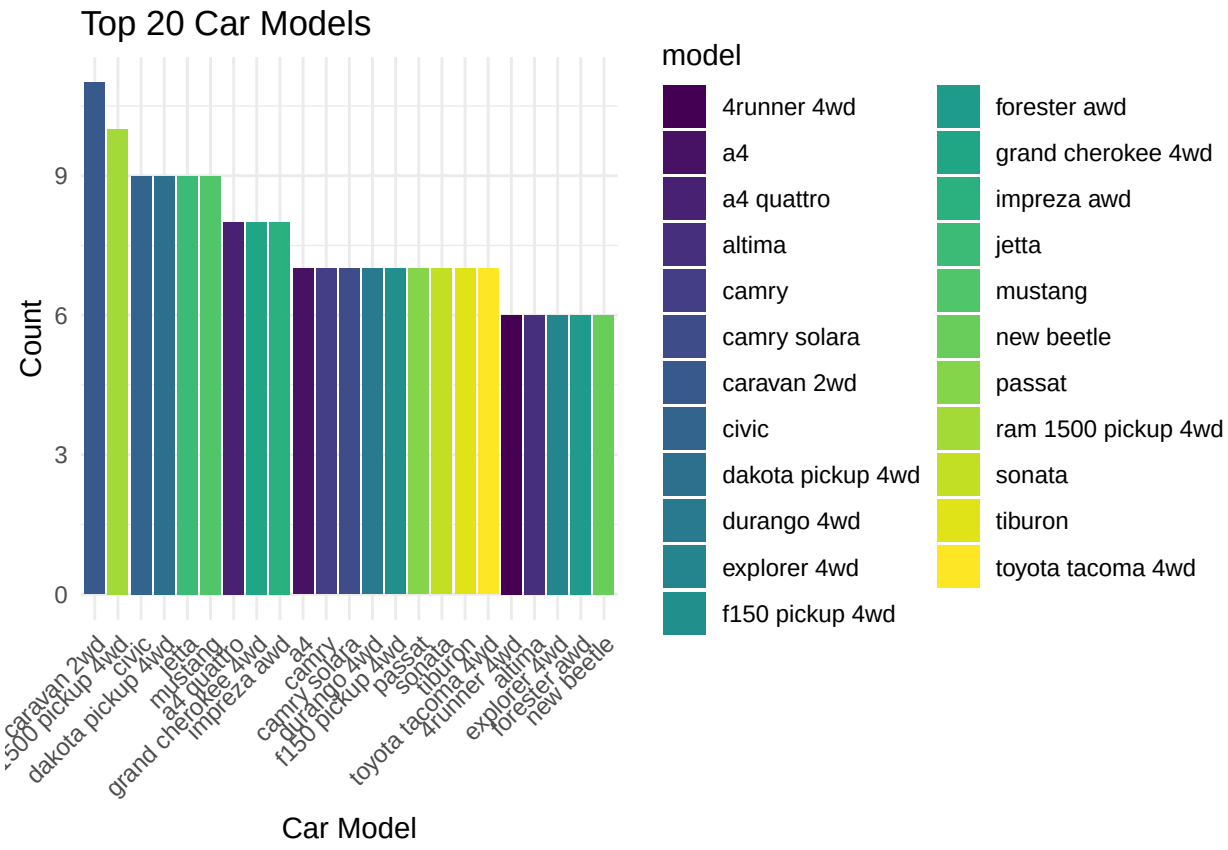



```
#4
library(dplyr)
model_counts <- mpg %>%
  group_by(model) %>%
  summarise(count = n())

model_counts
```

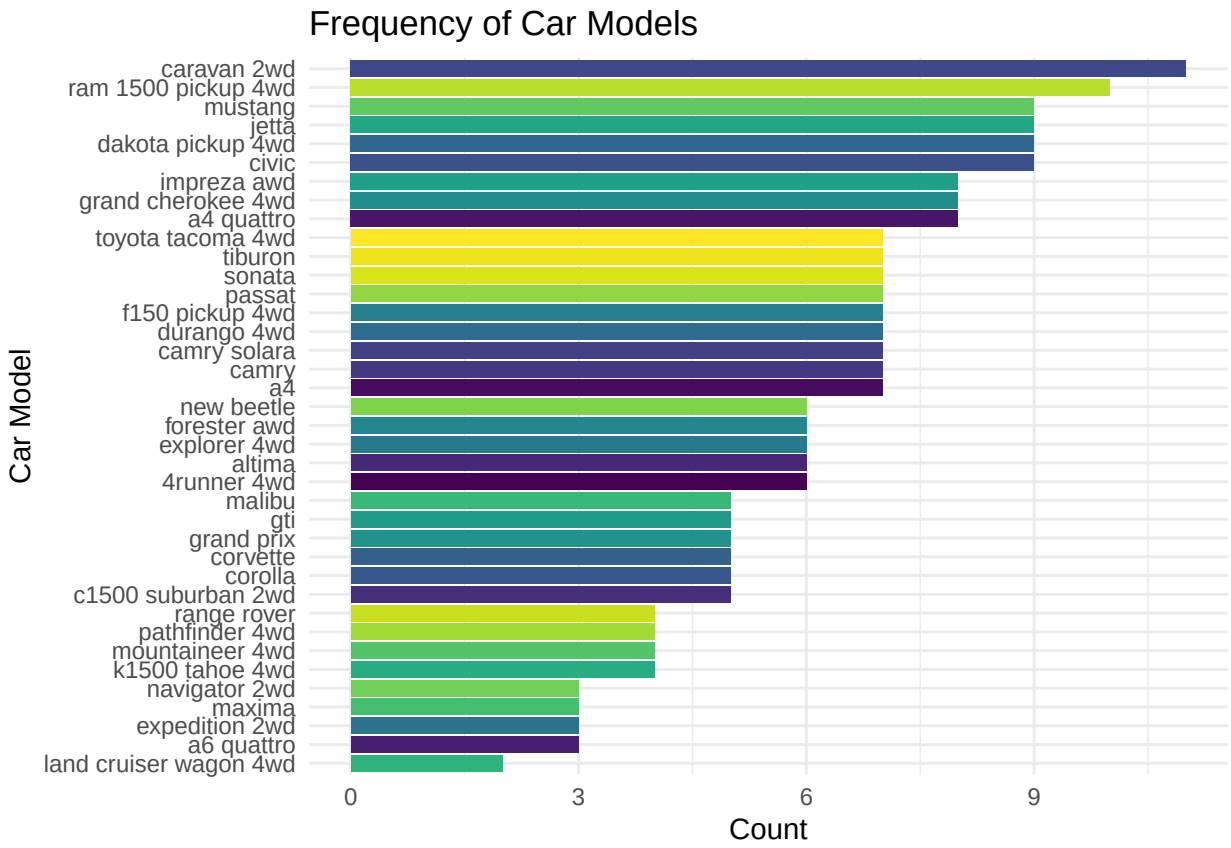
```
## # A tibble: 38 x 2
##    model              count
##    <chr>              <int>
##  1 4runner 4wd            6
##  2 a4                     7
##  3 a4 quattro             8
##  4 a6 quattro             3
##  5 altima                 6
##  6 c1500 suburban 2wd     5
##  7 camry               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

```
#4A
top_20_models <- mpg %>%
  count(model) %>%
  top_n(20, n) %>%
  arrange(desc(n))
```

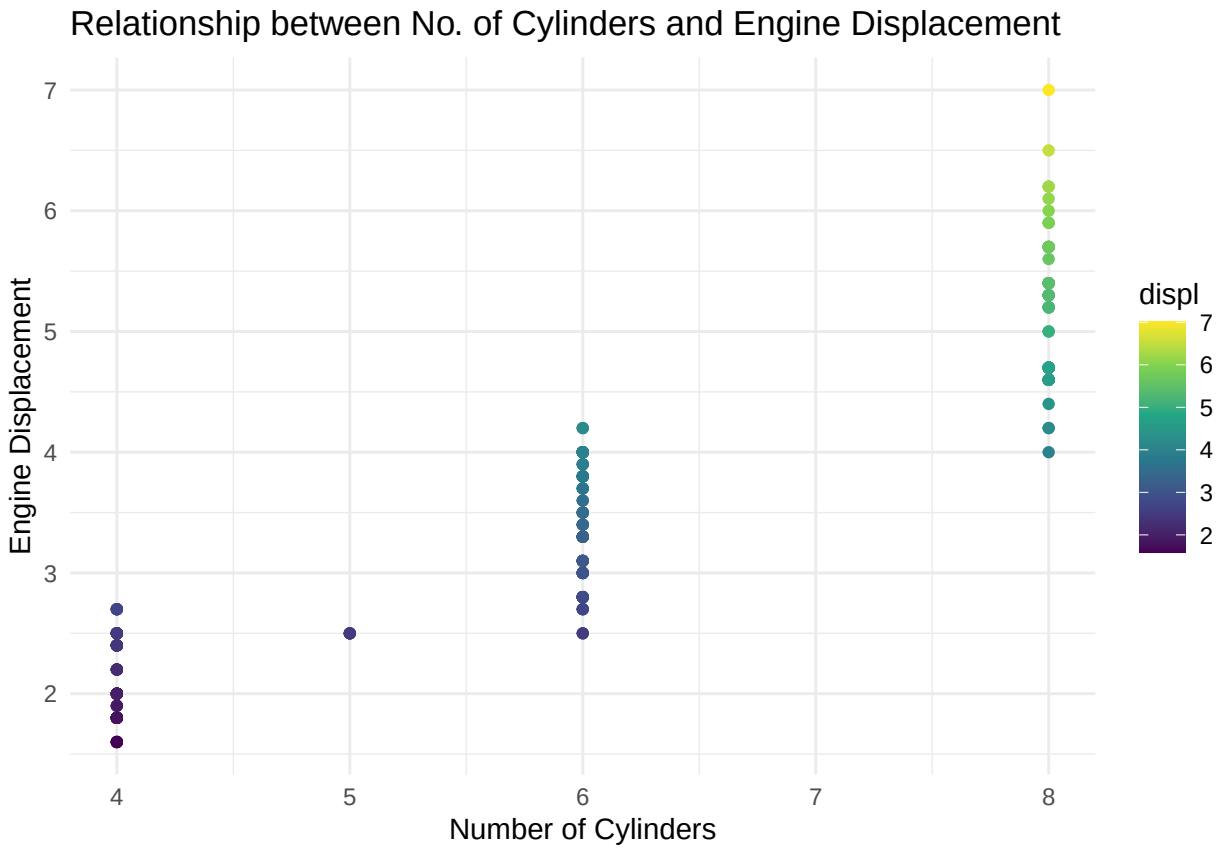
```
ggplot(top_20_models, aes(x = reorder(model, -n), y = n, fill = model)) +
  geom_bar(stat = "identity") +
  labs(
    title = "Top 20 Car Models",
    x = "Car Model",
    y = "Count"
  ) +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_viridis_d()
```




```
#4B
model_counts <- mpg %>%
  count(model) %>%
  arrange(desc(n))
ggplot(model_counts, aes(x = reorder(model, n), y = n, fill = model)) +
  geom_bar(stat = "identity") +
  labs(
    title = "Frequency of Car Models",
    x = "Car Model",
    y = "Count"
  ) +
  coord_flip() +
  theme_minimal() +
  scale_fill_viridis_d() +
  theme(legend.position = "none")
```



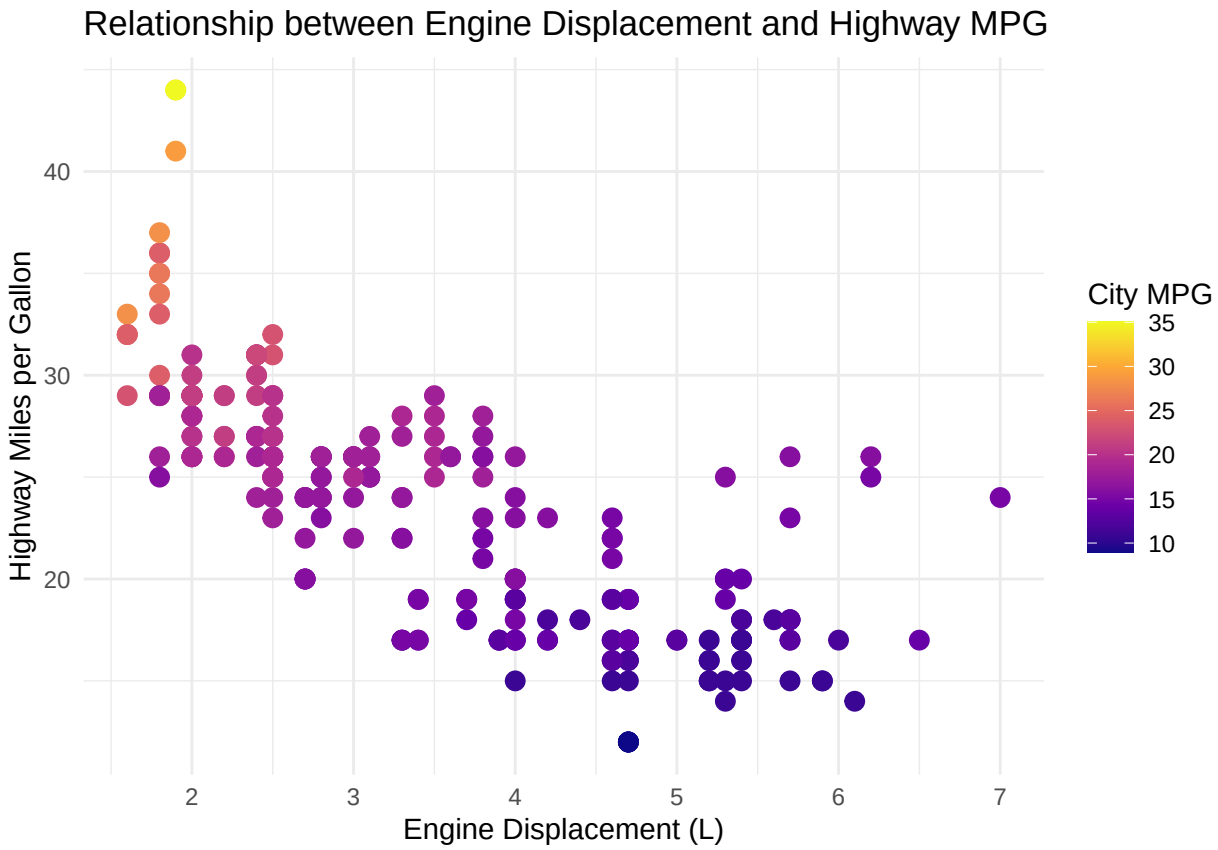

```r
#5
ggplot(mpg, aes(x = cyl, y = displ, color = displ)) +
  geom_point() +
  labs(
    title = "Relationship between No. of Cylinders and Engine Displacement",
    x = "Number of Cylinders",
    y = "Engine Displacement"
  ) +
  theme_minimal() +
  scale_color_viridis_c()
```




```
#5A
"The scatter plot illustrates a significant positive relationship between the number of cylinders and en
```

```
## [1] "The scatter plot illustrates a significant positive relationship between the number of cylinders
```

```
#6
ggplot(mpg, aes(x = displ, y = hwy, color = cty)) +
  geom_point(size = 3) +  # Adjust point size if needed
  labs(
    title = "Relationship between Engine Displacement and Highway MPG",
    x = "Engine Displacement (L)",
    y = "Highway Miles per Gallon",
    color = "City MPG"
  ) +
  theme_minimal() +
  scale_color_viridis_c(option = "C")
```




```
#6
trf <- read_csv("traffic.csv")
```

```
## Rows: 48120 Columns: 4
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## dbl  (3): Junction, Vehicles, ID
## dttm (1): DateTime
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
trf
```

```
## # A tibble: 48,120 x 4
##    DateTime            Junction Vehicles          ID
##    <dttm>                 <dbl>    <dbl>       <dbl>
##  1 2015-11-01 00:00:00        1       15 20151101001
##  2 2015-11-01 01:00:00        1       13 20151101011
##  3 2015-11-01 02:00:00        1       10 20151101021
##  4 2015-11-01 03:00:00        1        7 20151101031
##  5 2015-11-01 04:00:00        1        9 20151101041
##  6 2015-11-01 05:00:00        1        6 20151101051
##  7 2015-11-01 06:00:00        1        9 20151101061
##  8 2015-11-01 07:00:00        1        8 20151101071
##  9 2015-11-01 08:00:00        1       11 20151101081
## 10 2015-11-01 09:00:00        1       12 20151101091
## # i 48,110 more rows
```

```r
#6A
observations <- nrow(trf)
variables <- ncol(trf)
vnames <- names(trf)
cat("Number of observations:", observations, "\n")
```

```
## Number of observations: 48120
```

```r
cat("Number of Variables:", variables, "\n")
```

```
## Number of Variables: 4
```

```r
cat("Variables:", vnames, "\n")
```

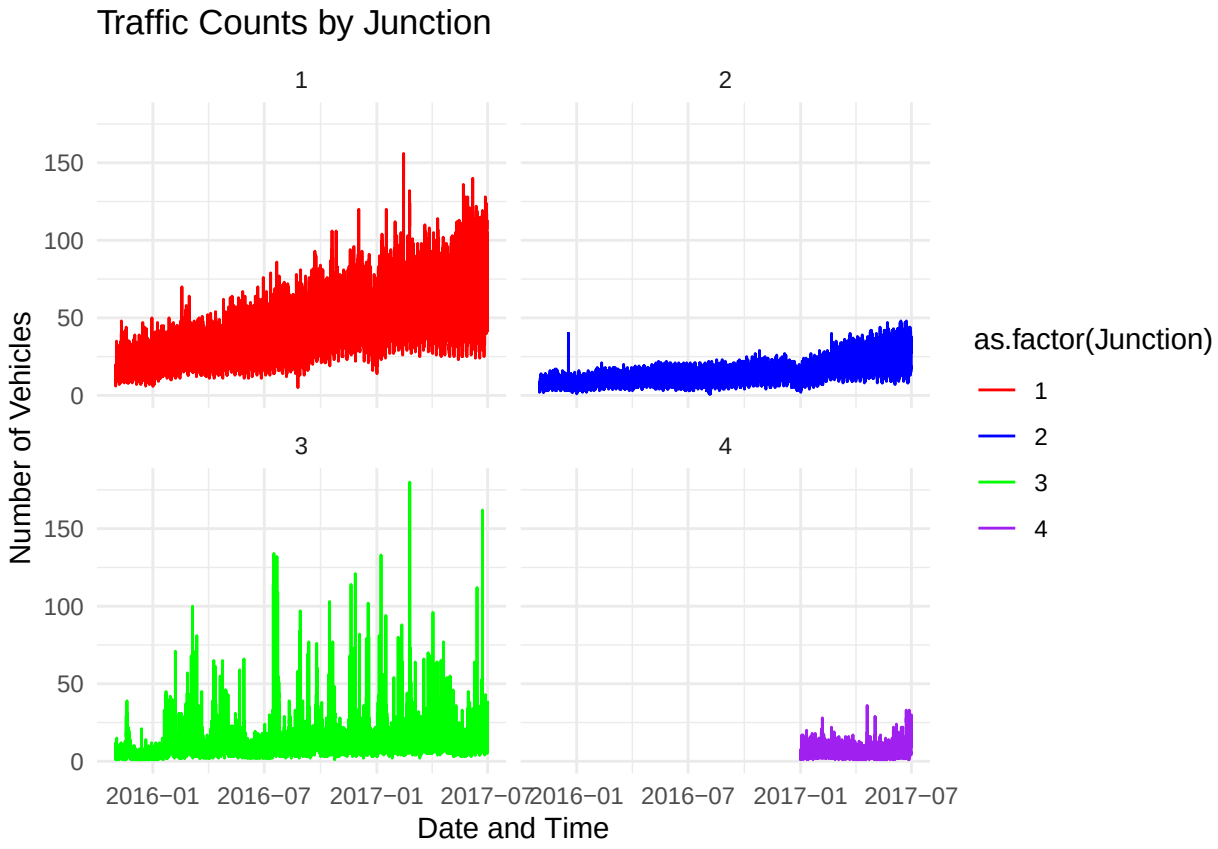
```
## Variables: DateTime Junction Vehicles ID
```

```r
#6B
jdata <- split(trf, trf$Junction)

for(junction in names(jdata)) {
  cat("Data for juncton:", junction, "\n")
  print(head(jdata[[junction]]))
  cat("\n")}
```

```
## Data for juncton: 1
## # A tibble: 6 x 4
##   DateTime            Junction Vehicles          ID
##   <dttm>                 <dbl>    <dbl>       <dbl>
## 1 2015-11-01 00:00:00        1       15 20151101001
## 2 2015-11-01 01:00:00        1       13 20151101011
## 3 2015-11-01 02:00:00        1       10 20151101021
## 4 2015-11-01 03:00:00        1        7 20151101031
## 5 2015-11-01 04:00:00        1        9 20151101041
## 6 2015-11-01 05:00:00        1        6 20151101051
##
## Data for juncton: 2
## # A tibble: 6 x 4
##   DateTime            Junction Vehicles          ID
##   <dttm>                 <dbl>    <dbl>       <dbl>
## 1 2015-11-01 00:00:00        2        6 20151101002
## 2 2015-11-01 01:00:00        2        6 20151101012
## 3 2015-11-01 02:00:00        2        5 20151101022
## 4 2015-11-01 03:00:00        2        6 20151101032
## 5 2015-11-01 04:00:00        2        7 20151101042
## 6 2015-11-01 05:00:00        2        2 20151101052
##
## Data for juncton: 3
## # A tibble: 6 x 4
##   DateTime            Junction Vehicles          ID
##   <dttm>                 <dbl>    <dbl>       <dbl>
## 1 2015-11-01 00:00:00        3        9 20151101003
## 2 2015-11-01 01:00:00        3        7 20151101013
## 3 2015-11-01 02:00:00        3        5 20151101023
## 4 2015-11-01 03:00:00        3        1 20151101033
## 5 2015-11-01 04:00:00        3        2 20151101043
## 6 2015-11-01 05:00:00        3        2 20151101053
```

```
##
## Data for juncton: 4
## # A tibble: 6 x 4
##   DateTime            Junction Vehicles          ID
##   <dttm>                 <dbl>    <dbl>       <dbl>
## 1 2017-01-01 00:00:00        4        3 20170101004
## 2 2017-01-01 01:00:00        4        1 20170101014
## 3 2017-01-01 02:00:00        4        4 20170101024
## 4 2017-01-01 03:00:00        4        4 20170101034
## 5 2017-01-01 04:00:00        4        2 20170101044
## 6 2017-01-01 05:00:00        4        1 20170101054
```

```r
#6C
library(ggplot2)
trf$DateTime <- as.POSIXct(trf$DateTime, format = "%Y-%m-%d %H:%M:%S")
ggplot(trf, aes(x = DateTime, y = Vehicles, color = as.factor(Junction))) +
  geom_line() +
  facet_wrap(~ Junction) +
  labs(title = "Traffic Counts by Junction", x = "Date and Time", y = "Number of Vehicles") +
  scale_color_manual(values = c("red", "blue", "green", "purple")) +  # Adjust colors as needed
  theme_minimal()
```




```r
#7
library(readxl)
alexa_data <- read_excel("alexa_file.xlsx")
alexa_data
```

```
## # A tibble: 3,150 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
## # i 3,140 more rows
```

```
#7A
num_observations <- nrow(alexa_data)
num_columns <- ncol(alexa_data)
cat("Number of observations:", num_observations, "\n")
```

```
## Number of observations: 3150
```

```
cat("Number of columns:", num_columns, "\n")
```

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

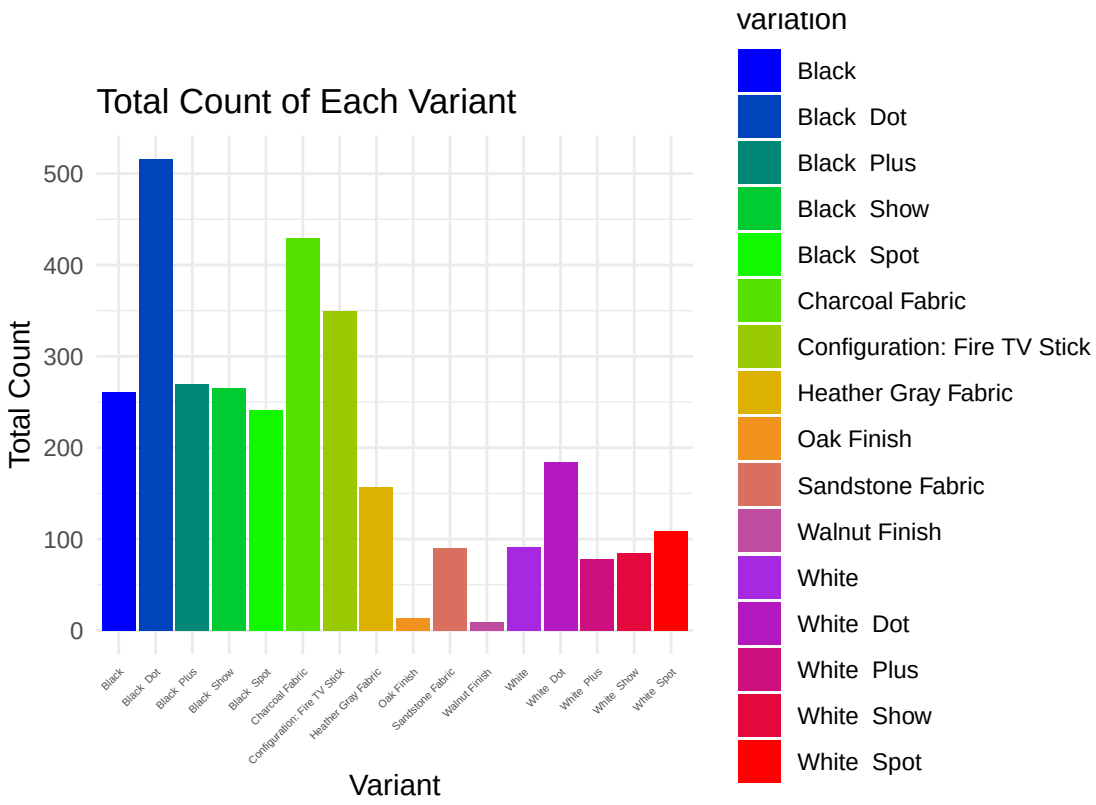
```
#7B
variation_totals <- alexa_data %>%
  group_by(variation) %>%
  summarise(total = n())
print(variation_totals)
```

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

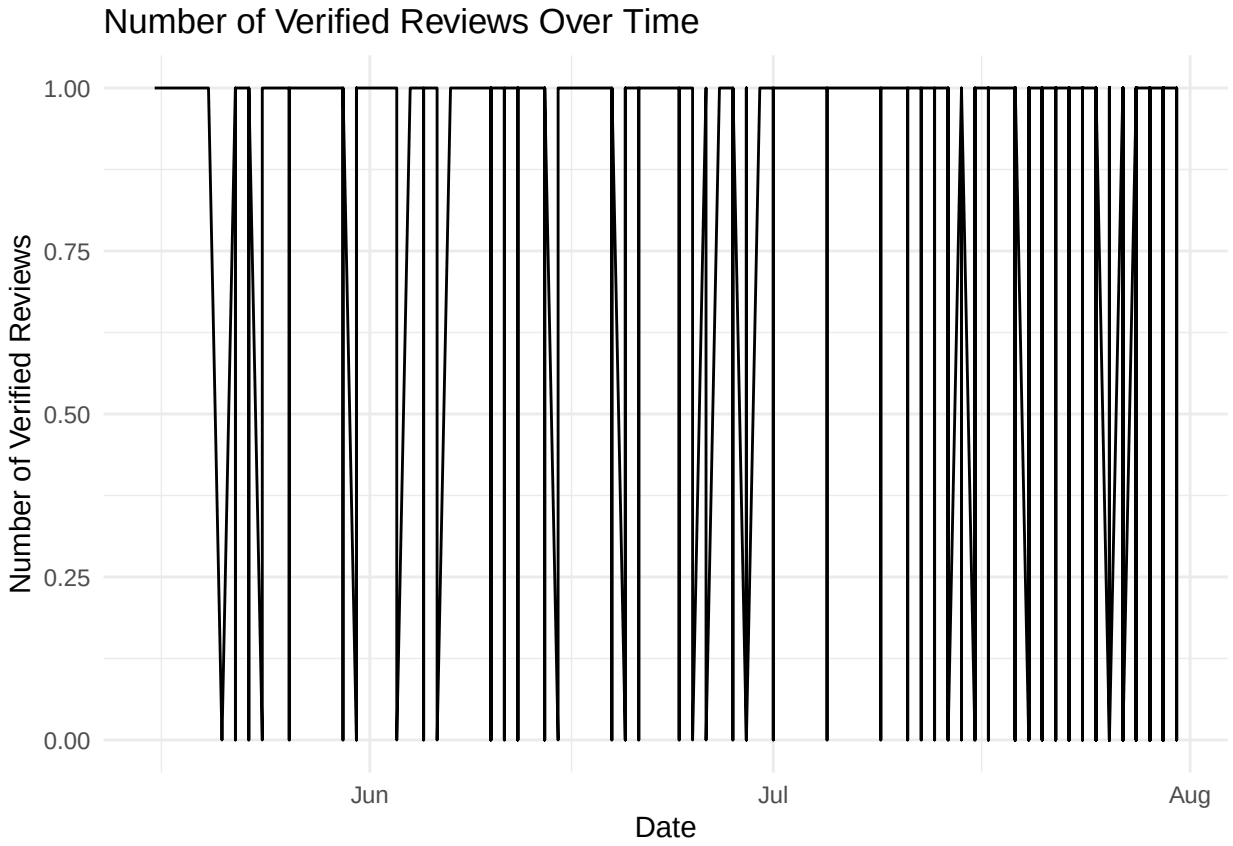
```
#7C
library(ggplot2)
unique_variations <- length(unique(variation_totals$variation))
print(unique_variations)
```

```
## [1] 16
```

```r
variation_colors <- colorRampPalette(c("blue", "green", "orange", "purple", "red"))(unique_variations)
ggplot(variation_totals, aes(x = variation, y = total, fill = variation)) +
  geom_bar(stat = "identity") +
  labs(title = "Total Count of Each Variant", x = "Variant", y = "Total Count") +
  scale_fill_manual(values = variation_colors) +
  theme_minimal() +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1, size = 4),
    plot.margin = margin(1, 1, 1, 1, "cm")
  )
```



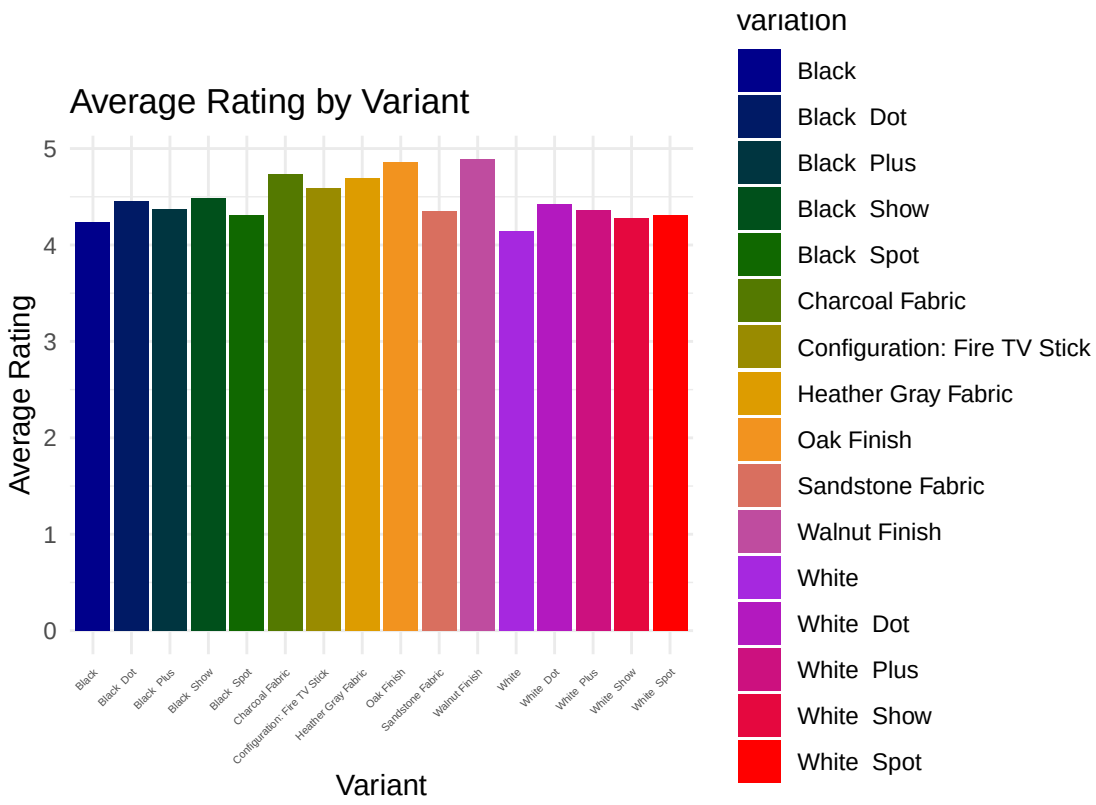

```r
#7D
alexa_data$date <- as.Date(alexa_data$date)

ggplot(alexa_data, aes(x = date, y = feedback)) +
  geom_line() +
  labs(title = "Number of Verified Reviews Over Time", x = "Date",
       y = "Number of Verified Reviews") +
  theme_minimal()
```




```
#7E
rating <- alexa_data %>%
  group_by(variation) %>%
  summarise(avg_rating = mean(rating, na.rm = TRUE))
unique_variations <- length(unique(rating$variation))
print(unique_variations)  # Check the number of unique variations
```

```
## [1] 16
```

```
rating_colors <- colorRampPalette(c("darkblue", "darkgreen", "orange", "purple", "red"))(unique_variati
ggplot(rating, aes(x = variation, y = avg_rating, fill = variation)) +
  geom_bar(stat = "identity") +
  labs(title = "Average Rating by Variant", x = "Variant", y = "Average Rating") +
  scale_fill_manual(values = rating_colors) +
  theme_minimal() +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1, size = 4),
    plot.margin = margin(1, 1, 1, 1, "cm")
  )
```


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