RWorksheet_Josue#4c

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2024-11-02

1. Use the dataset mpg

```
#1A. Show your solutions on how to import a csv file into the environment.
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
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## 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
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## 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
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## 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
```

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## 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
```

```
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" ...
```

```
#1B.Which variables from mpg dataset are categorical?
  #The mpg datasets contain the categorical(labeled) variables such as manufacturer, model, trans, drv,

#1C.Which are continuous variables?
  #Continuous (numeric) variables include variables such as x, displ,year,cyl,cty, hwy.
```

2.Which manufacturer has the most models in this data set? Which model has the most variations? Show your answer.

```
#2A.Group the manufacturers and find the unique models. Show your codes and result.
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
```

```
models <- mpg %>%
  group_by(manufacturer) %>%
  summarise(model_count = n_distinct(model))
most_models_manufacturer <- models %>%
  filter(model_count == max(model_count))
variations <- mpg %>%
  group_by(model) %>%
  summarise(variation_count = n())
most_variations_model <- variations %>%
  filter(variation_count == max(variation_count))
cat("The manufacturer with the most models is", most_models_manufacturer$manufacturer,
    "with", most_models_manufacturer$model_count, "unique models.\n")
```

```
## The manufacturer with the most models is toyota with 6 unique models.
```

```
cat("The model with the most variations is", most_variations_model$model,
    "with", most_variations_model$variation_count, "variations.")
```

```
## The model with the most variations is caravan 2wd with 11 variations.
```

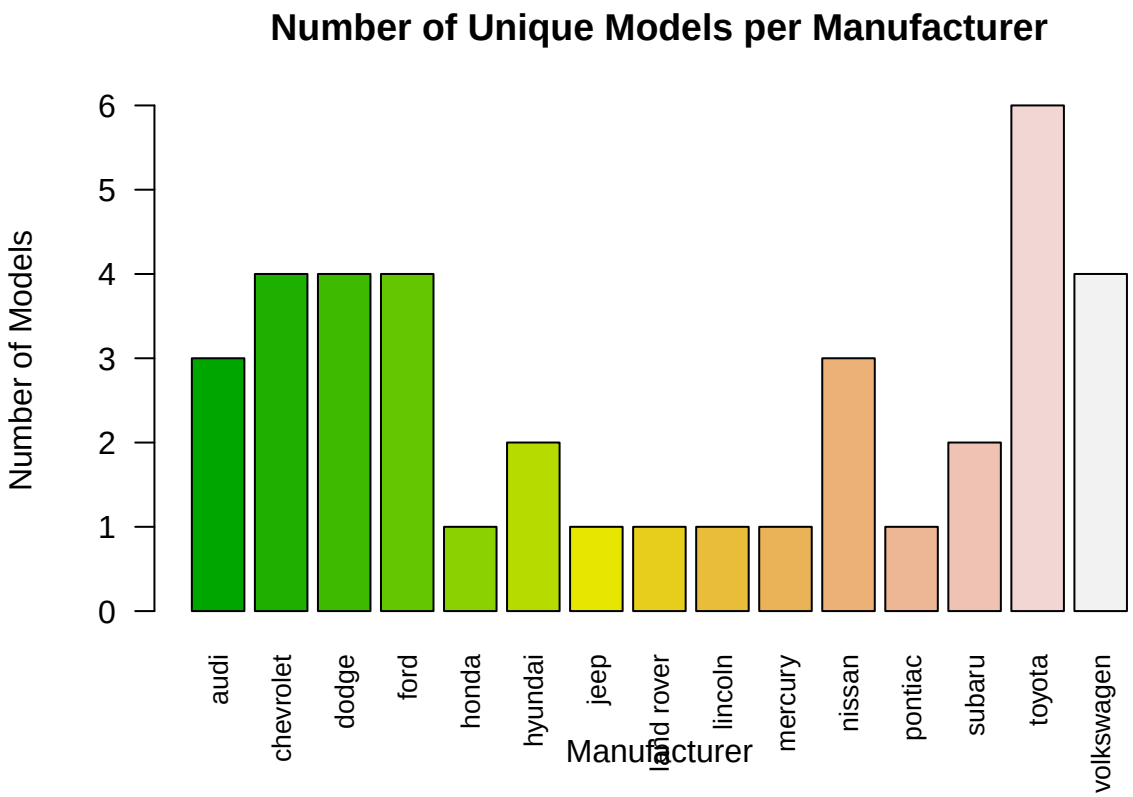
2A. Group the manufacturers and find the unique models. Show your codes and result.

```
#derived from 2
library(dplyr)
model <- mpg %>%
  group_by(manufacturer) %>%
  summarise(model_num = n_distinct(model))
model
```

```
## # A tibble: 15 x 2
##    manufacturer model_num
##    <chr>            <int>
##  1 audi                 3
##  2 chevrolet            4
##  3 dodge                4
##  4 ford                 4
##  5 honda                1
##  6 hyundai              2
##  7 jeep                 1
##  8 land rover           1
##  9 lincoln              1
## 10 mercury              1
## 11 nissan               3
## 12 pontiac              1
## 13 subaru               2
## 14 toyota               6
## 15 volkswagen           4
```

2B.Graph the result by using plot() and ggplot(). Write the codes and its result.

```
# Bar Plot
barplot(model$model_num,
        names.arg = model$manufacturer,
        main = "Number of Unique Models per Manufacturer",
        xlab = "Manufacturer",
        ylab = "Number of Models",
        col = terrain.colors(length(model$model_num)),
        las = 2,
        cex.names = 0.8)
```

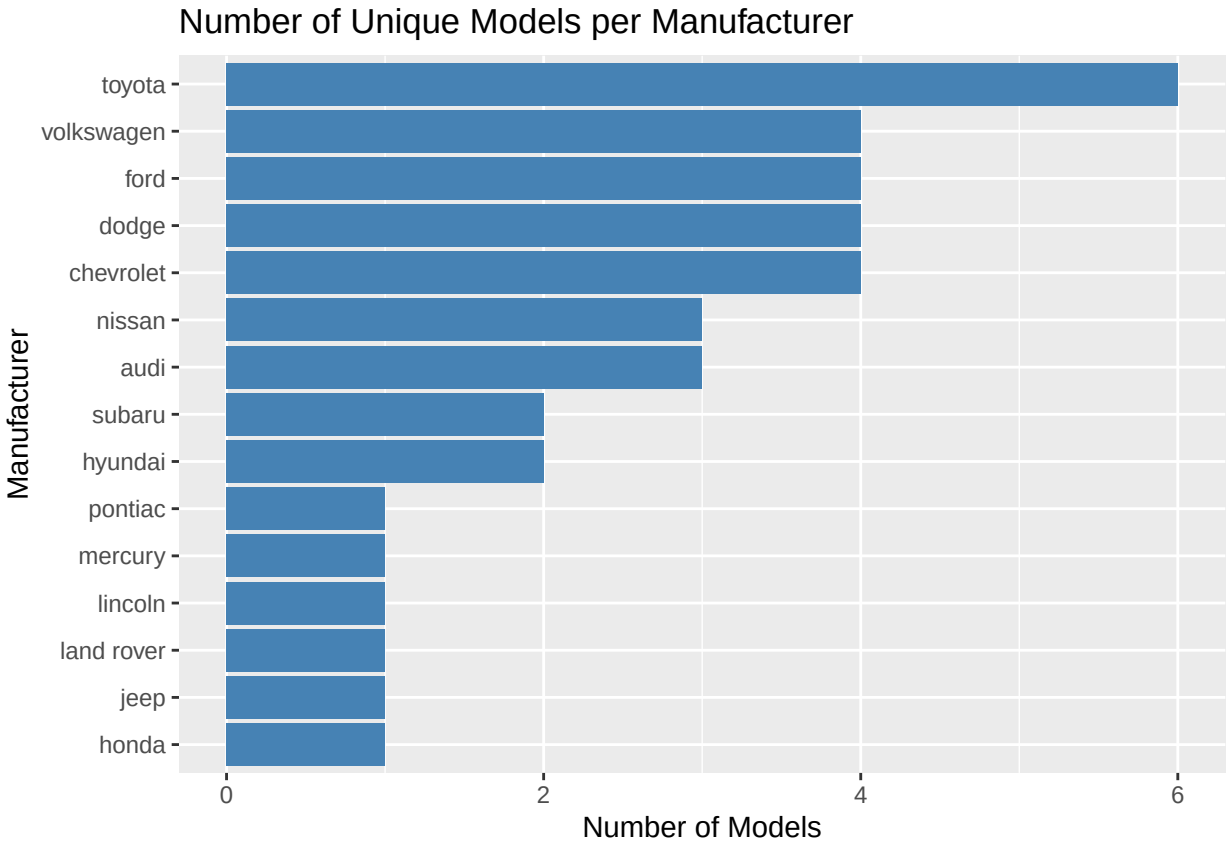



```
library(ggplot2)
```

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

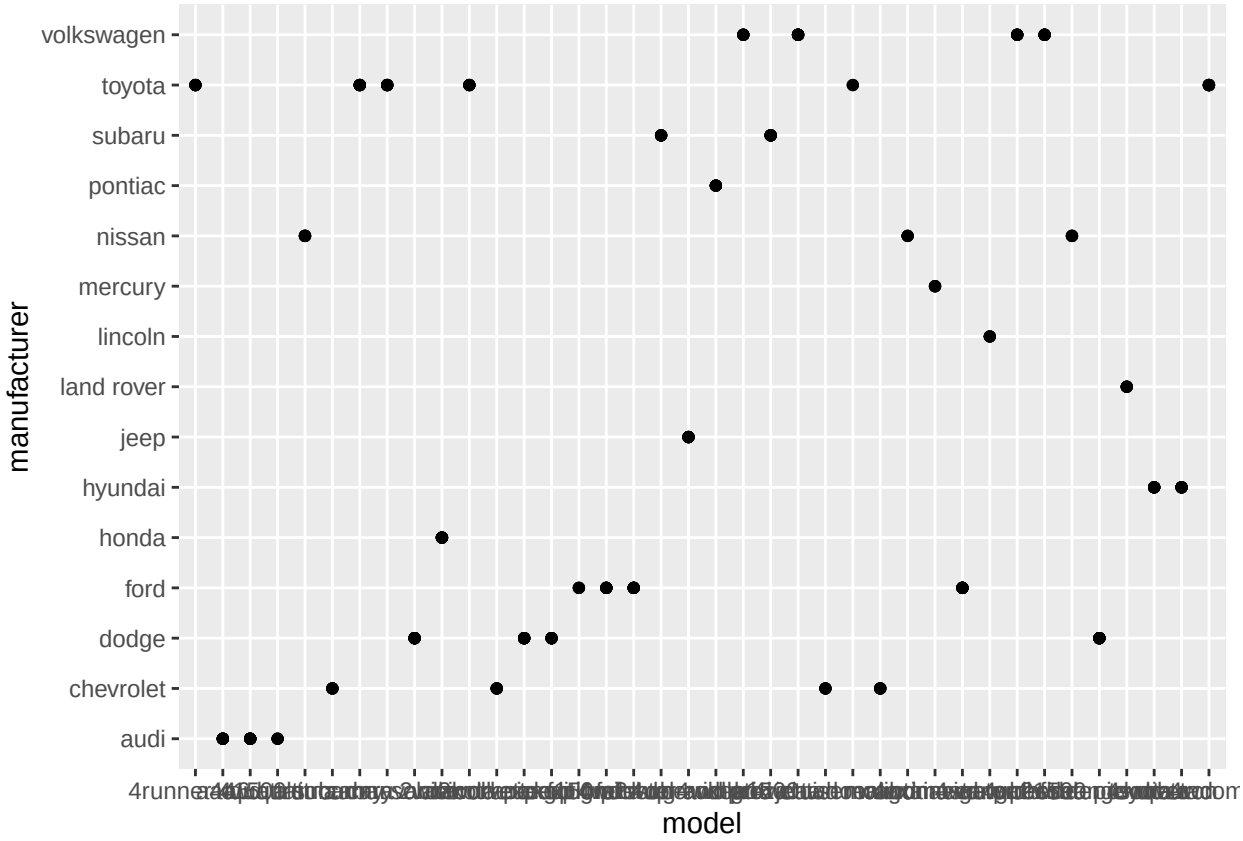
```
## The following object is masked _by_ '.GlobalEnv':
##
##     mpg
```

```
ggplot(model, aes(x = reorder(manufacturer, model_num), y = model_num)) +
  geom_col(fill = "steelblue") +
  labs(title = "Number of Unique Models per Manufacturer",
       x = "Manufacturer",
       y = "Number of Models") +
  coord_flip()
```



2.Same dataset will be used. You are going to show the relationship of the modeland the manufacturer.

```
#2A. What does ggplot(mpg, aes(model, manufacturer)) + geom_point() show?
ggplot(mpg, aes(model, manufacturer)) + geom_point()
```



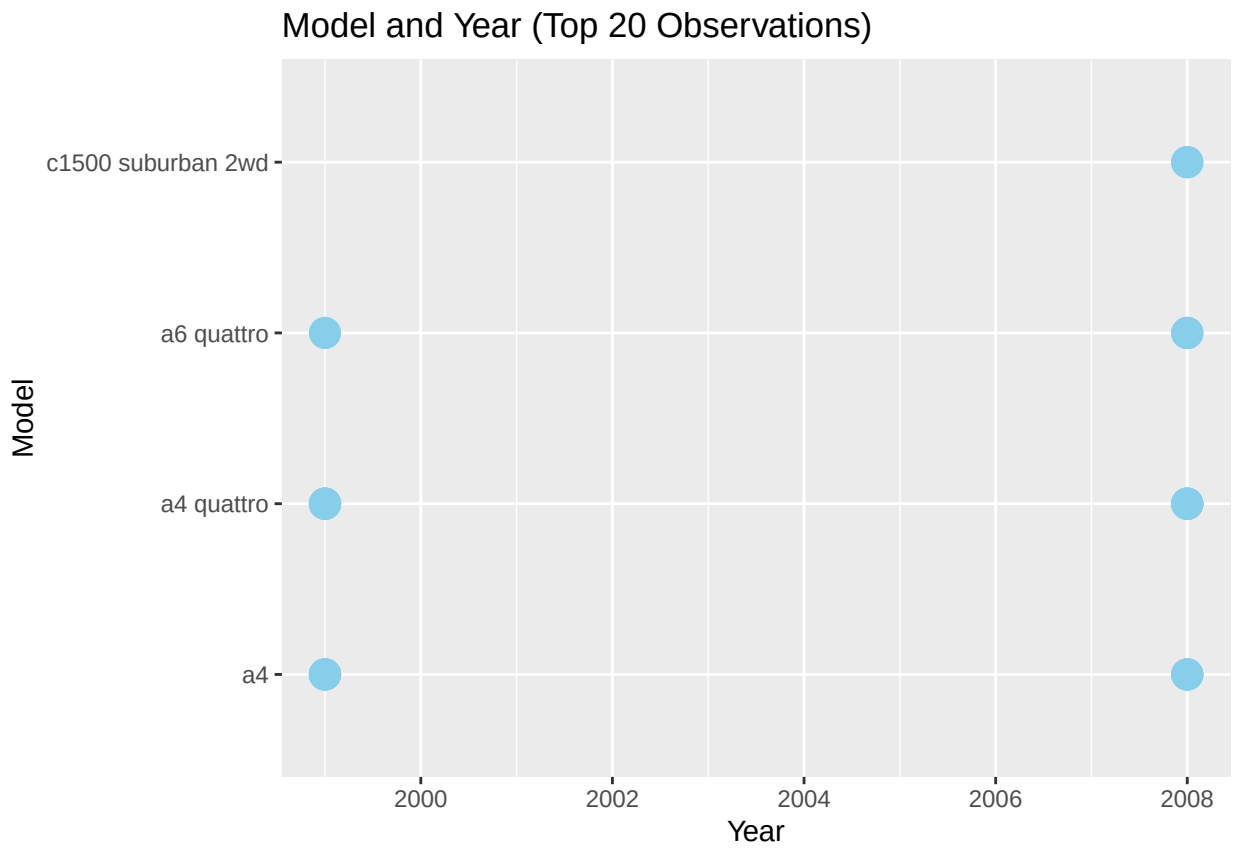

```
#The code ggplot(mpg, aes(model, manufacturer)) + geom_point() creates a scatter plot where the x-axis

#2B. For you, is it useful? If not, how could you modify the data to make it more informative?
#   Using a scatterplot to interpret this data is inadequate and relatively cumbersome to read.To put i
```

3.Plot the model and the year using ggplot(). Use only the top 20 observations. Write the codes and its results.

```
observations <- mpg[1:20, ]

ggplot(observations,
       aes(x = model, y = year)) +
       geom_point(color = "skyblue", size = 5) +
       labs(
          title = "Model and Year (Top 20 Observations)",
          x = "Model",
          y = "Year") +
       coord_flip()
```



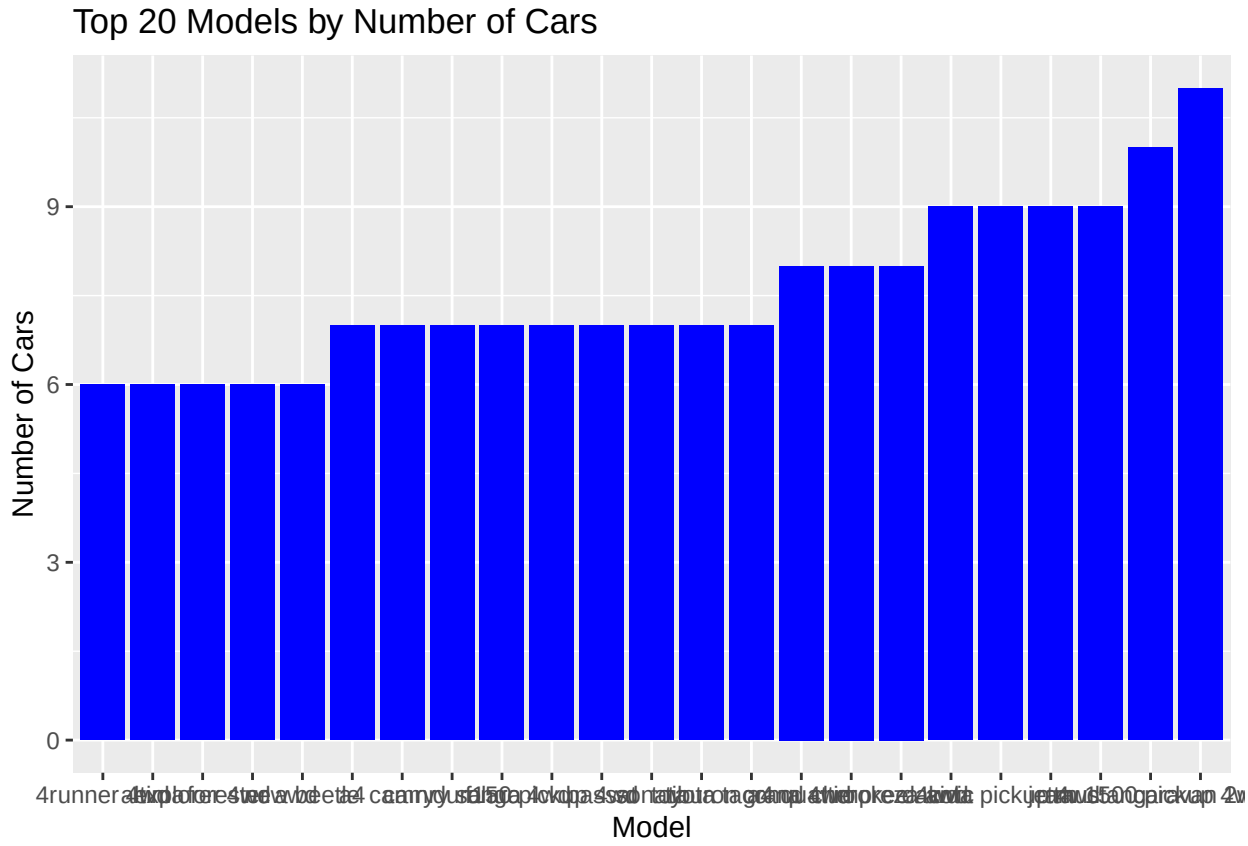
4. Using the pipe (%>%), group the model and get the number of cars per model. Show codes and its result

```
library(dplyr)
cars_per_model <- mpg %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count))
print(cars_per_model)
```

```
## # 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
```

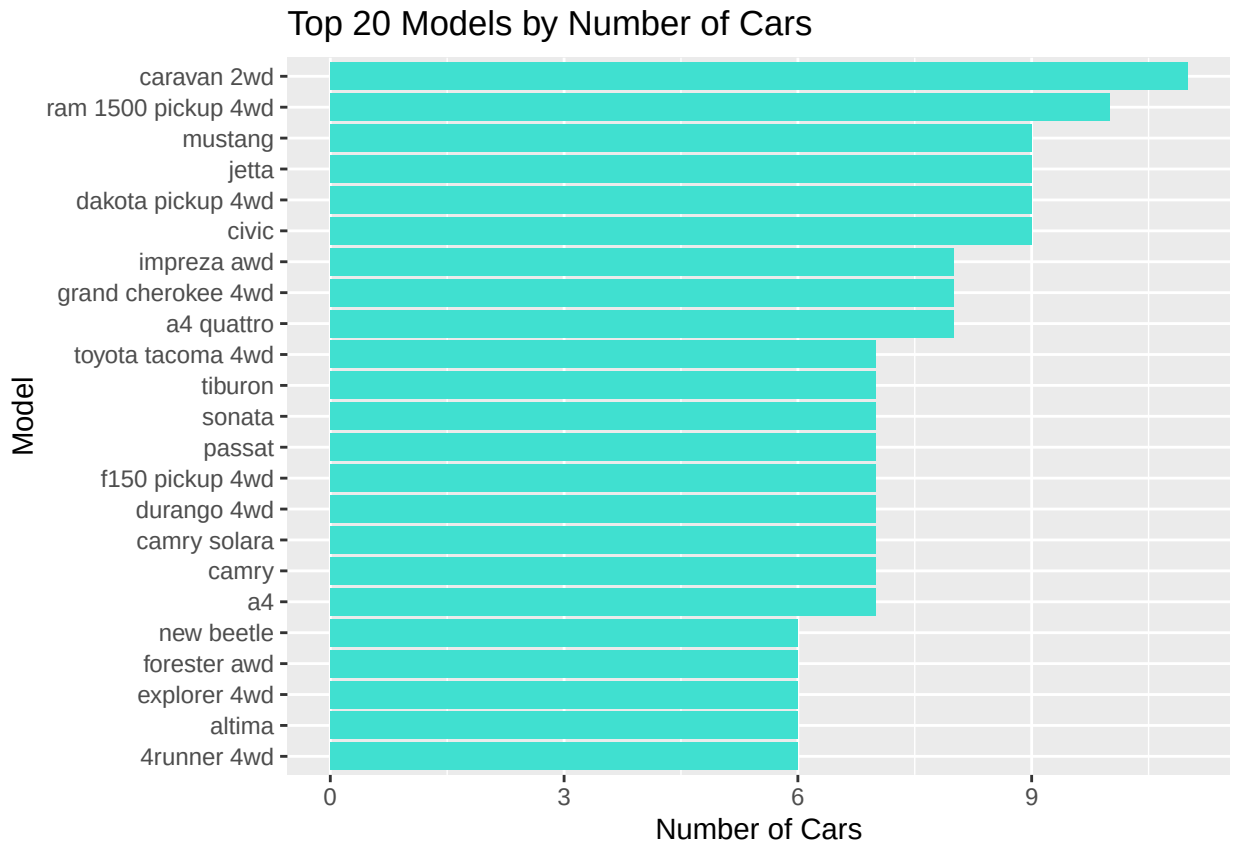
4A. Plot using geom_bar() using the top 20 observations only. The graphs shoudl have a title, labels and colors. Show code and results.

```r
library(ggplot2)
top_20_models <- cars_per_model %>%
  top_n(20, count)

ggplot(top_20_models, aes(x = reorder(model, count), y = count)) +
  geom_bar( stat = "identity",fill = "blue") +
  labs(title = "Top 20 Models by Number of Cars",
       x = "Model",
       y = "Number of Cars")
```



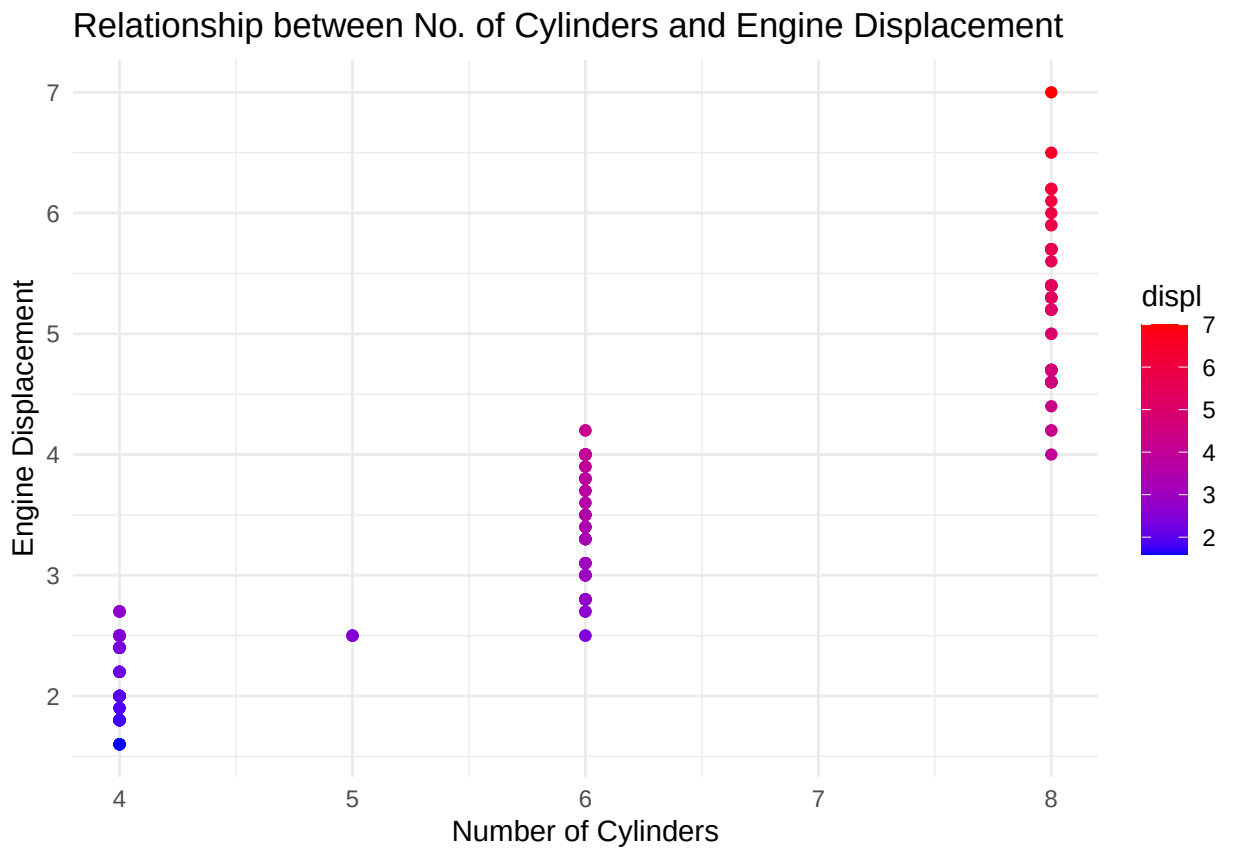
4B. Plot using the geom_bar() + coord_flip() just like what is shown below. Show codes and its result.

```r
top_20_models <- cars_per_model %>%
  top_n(20, count)

ggplot(top_20_models, aes(x = reorder(model, count), y = count)) +
  geom_bar( stat = "identity",fill = "turquoise") +
  labs(title = "Top 20 Models by Number of Cars",
       x = "Model",
       y = "Number of Cars") +
     coord_flip()
```



5.Plot the relationship between cyl - number of cylinders and displ - engine displacement using geom_point with aesthetic color = engine displacement. Title should be "Relationship between No. of Cylinders and Engine Displacement".

```
library(ggplot2)
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") +
  scale_color_gradient(low = "blue", high = "red") +
  theme_minimal()
```

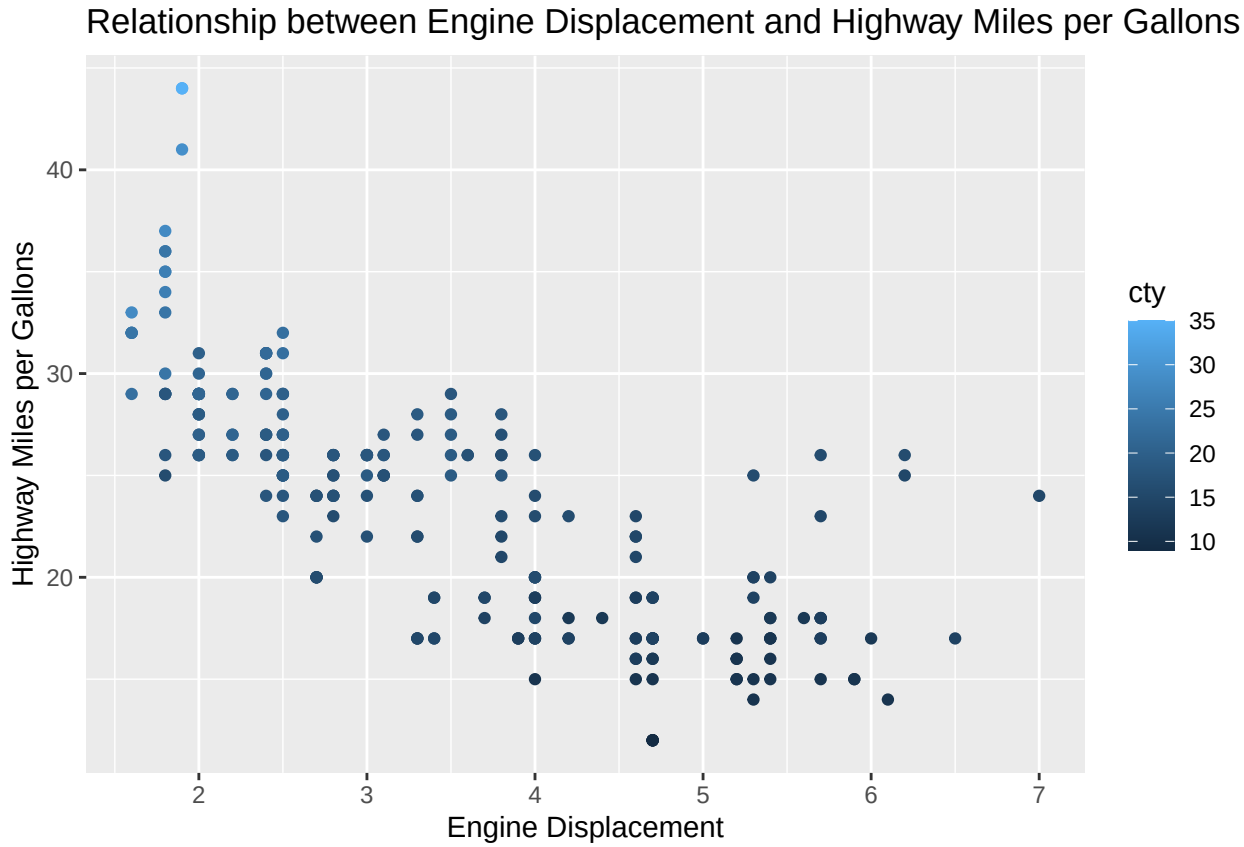


5A.How would you describe its relationship? Show the codes and its result

```
# As the number of cylinders increases, the engine displacement also increases in proportion.
```

6. Plot the relationship between displ (engine displacement) and hwy(highway miles per gallon). Mapped it with a continuous variable you have identified in #1-c. What is its result? Why it produced such output?

```
library(ggplot2)
ggplot(mpg,
       aes(x = displ, y = hwy, color = cty)
       ) +
       geom_point() +
       labs(
         title = "Relationship between Engine Displacement and Highway Miles per Gallons",
         x = "Engine Displacement",
         y = "Highway Miles per Gallons"
       )
```




```
#   The result outputs a plot showing that as engine displacement increases, highway MPG relatively dec
```

6. Import the traffic.csv onto your R environment.

```
traffic<- read.csv("traffic.csv")
```

6A. How many numbers of observation does it have? What are the variables of the traffic dataset the Show your answer.

```
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 ...
```

```
#   The traffic data set contains 48120 observations and has 4 variables namely, DateTime, Junction,Veh
```

6B. subset the traffic dataset into junctions. What is the R codes and its output?

```
Junction1 <- subset(traffic, Junction == 1)
Junction2 <- subset(traffic, Junction == 2)
Junction3 <- subset(traffic, Junction == 3)
Junction4 <- subset(traffic, Junction == 4)
head(Junction1)
```

```
##              DateTime Junction Vehicles          ID
## 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
```

```
head(Junction2)
```

```
##                  DateTime Junction Vehicles          ID
## 14593 2015-11-01 00:00:00        2        6 20151101002
## 14594 2015-11-01 01:00:00        2        6 20151101012
## 14595 2015-11-01 02:00:00        2        5 20151101022
## 14596 2015-11-01 03:00:00        2        6 20151101032
## 14597 2015-11-01 04:00:00        2        7 20151101042
## 14598 2015-11-01 05:00:00        2        2 20151101052
```

```
head(Junction3)
```

```
##                  DateTime Junction Vehicles          ID
## 29185 2015-11-01 00:00:00        3        9 20151101003
## 29186 2015-11-01 01:00:00        3        7 20151101013
## 29187 2015-11-01 02:00:00        3        5 20151101023
## 29188 2015-11-01 03:00:00        3        1 20151101033
## 29189 2015-11-01 04:00:00        3        2 20151101043
## 29190 2015-11-01 05:00:00        3        2 20151101053
```

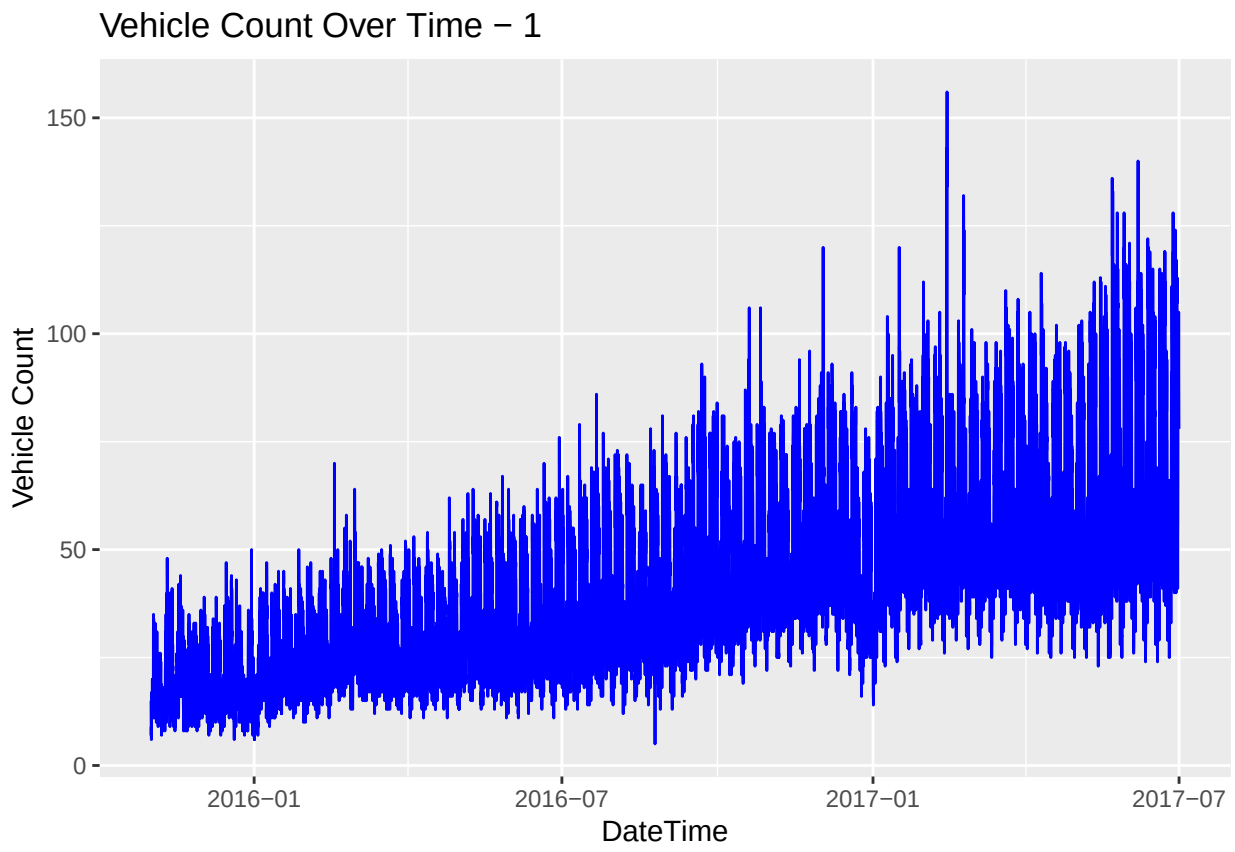
```
head(Junction4)
```

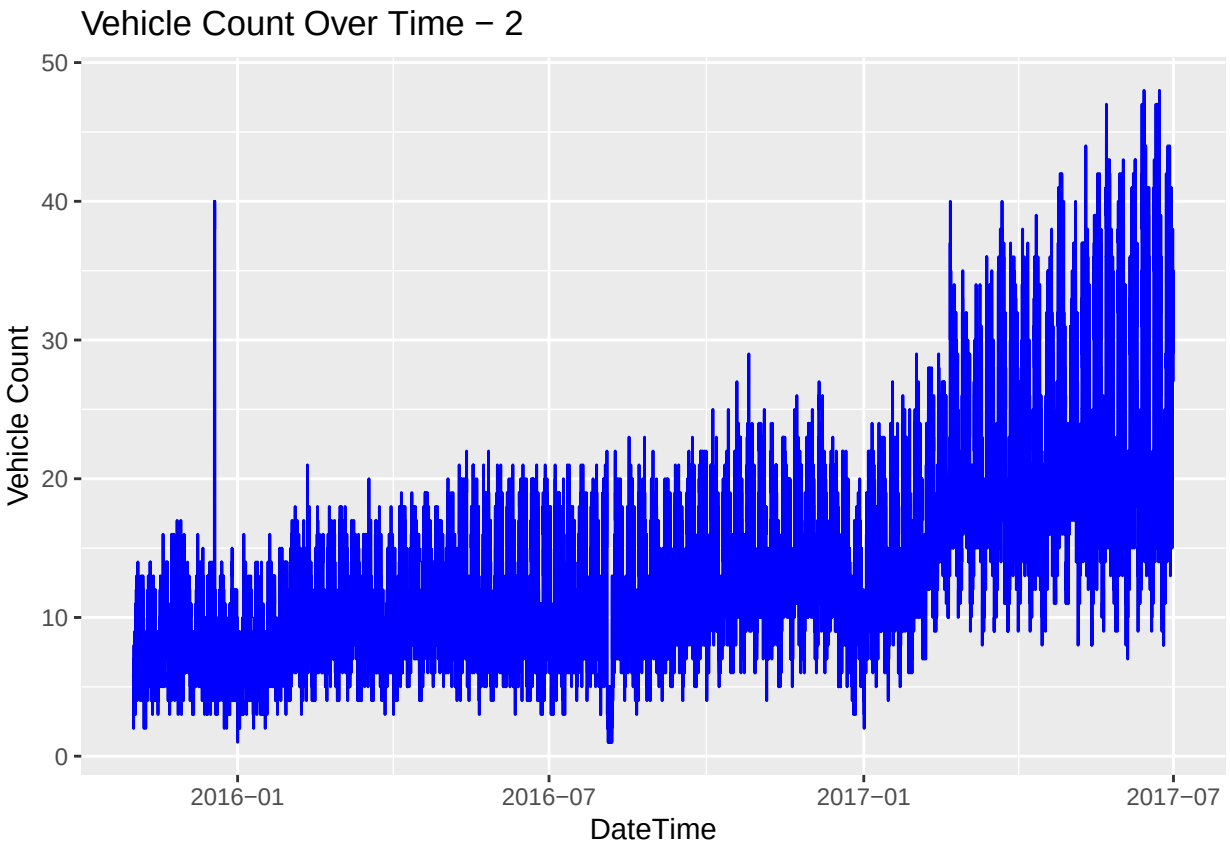
```
##                  DateTime Junction Vehicles          ID
## 43777 2017-01-01 00:00:00        4        3 20170101004
## 43778 2017-01-01 01:00:00        4        1 20170101014
## 43779 2017-01-01 02:00:00        4        4 20170101024
## 43780 2017-01-01 03:00:00        4        4 20170101034
## 43781 2017-01-01 04:00:00        4        2 20170101044
## 43782 2017-01-01 05:00:00        4        1 20170101054
```

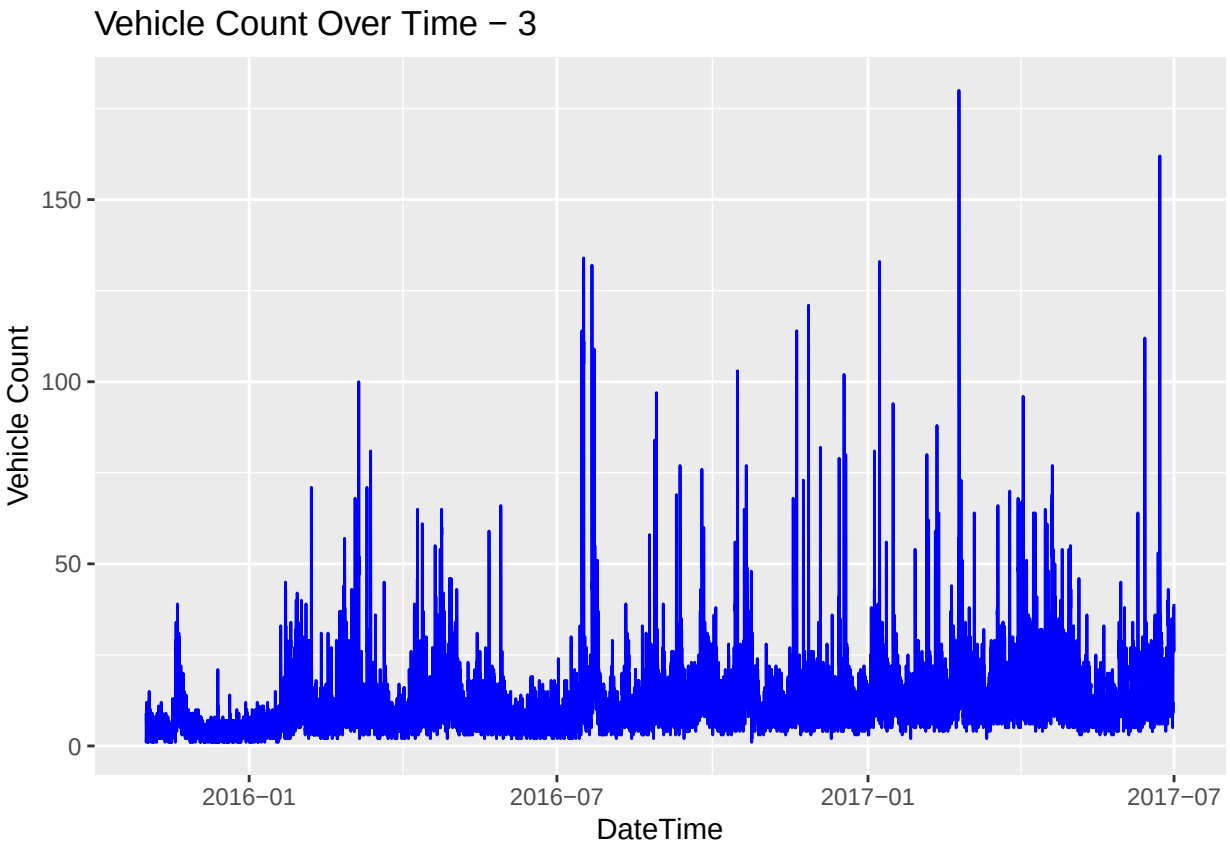
6C. Plot each junction in a using geom_line(). Show your solution and output.

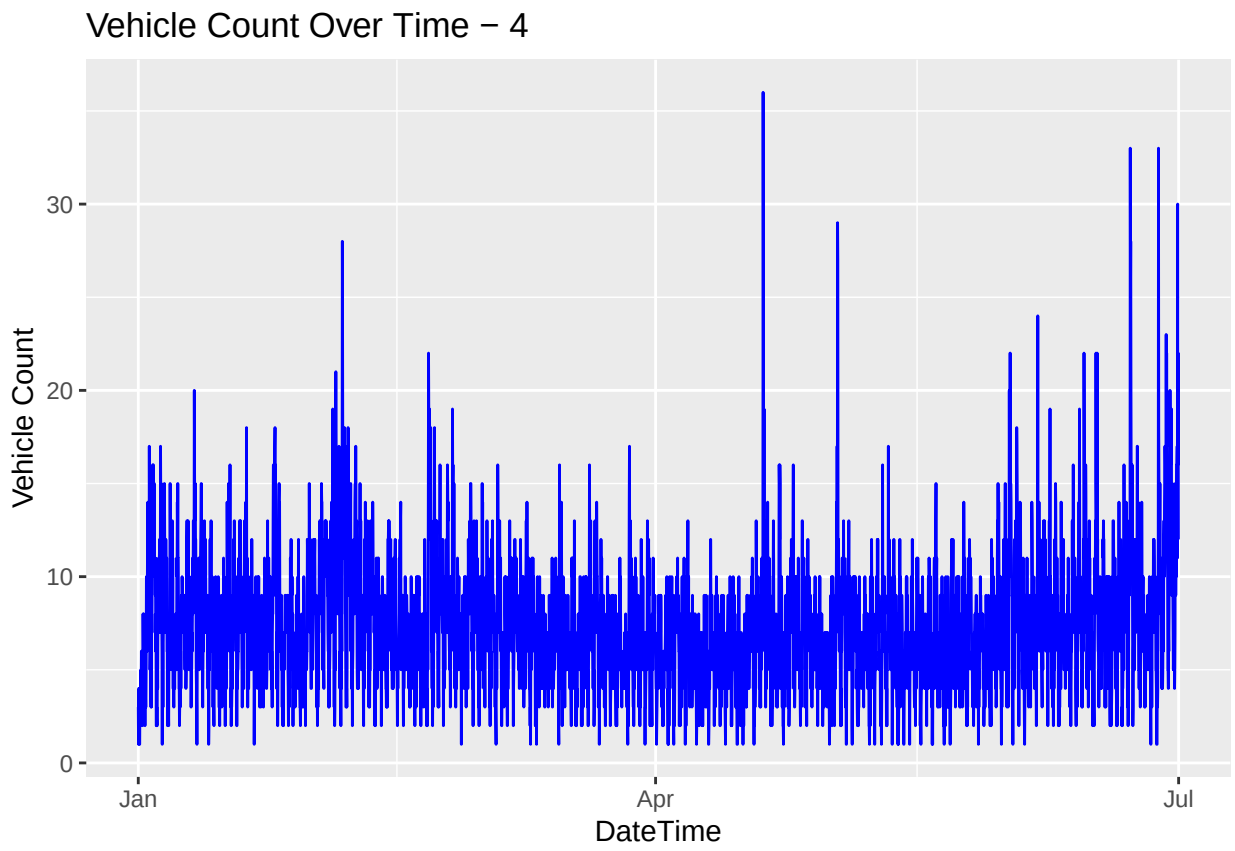
```
library(dplyr)
library(ggplot2)
traffic <- traffic %>%
  mutate(DateTime = as.POSIXct(DateTime, format="%Y-%m-%d %H:%M:%S"))

junctions <- unique(traffic$Junction)

for (j in junctions) {
  junction_data <- subset(traffic, Junction == j)
  p <- ggplot(junction_data, aes(x = DateTime, y = Vehicles)) +
    geom_line(color = "blue") +
```

```
    labs(title = paste("Vehicle Count Over Time -", j),
         x = "DateTime",
         y = "Vehicle Count")
  print(p)
}
```

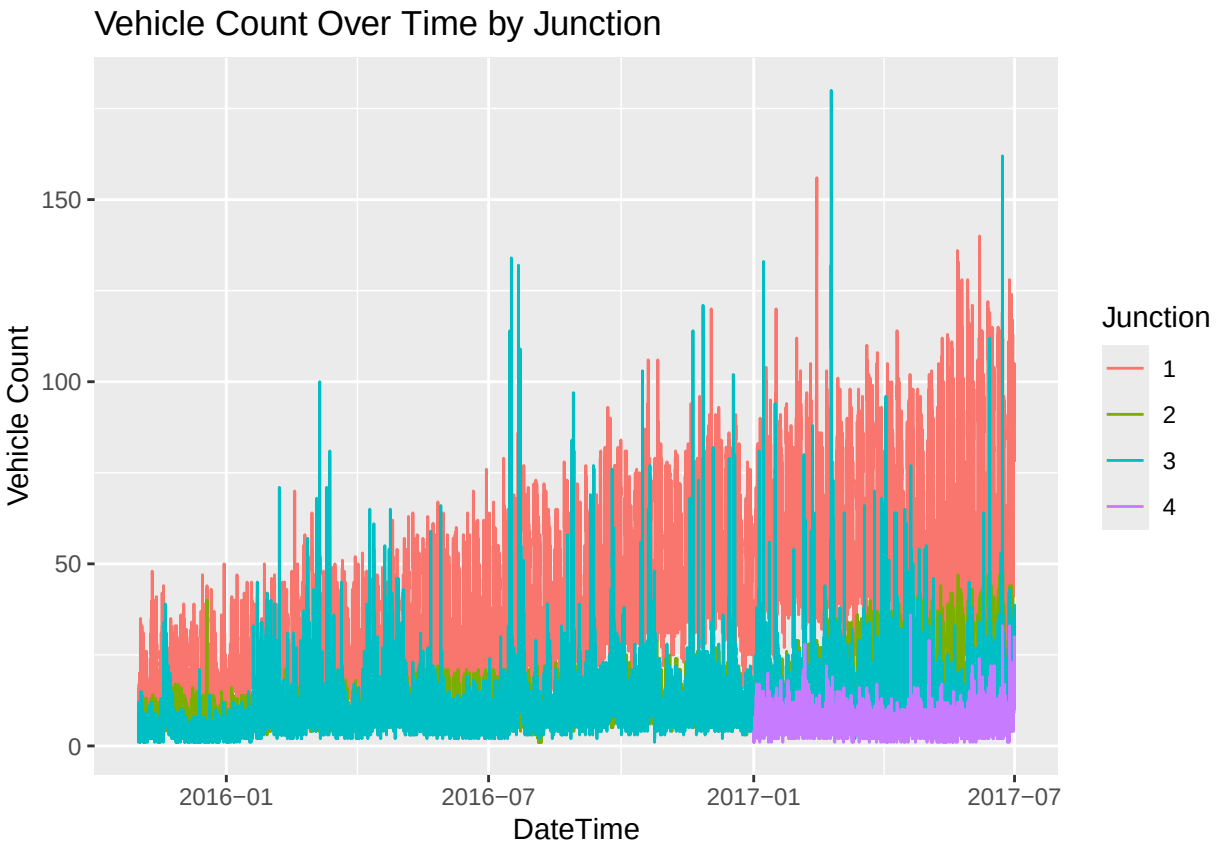



Vehicle Count Over Time − 2
Vehicle Count
50
40
30
20
10
0
2016−01
2016−07
2017−01
2017−07
DateTime


Vehicle Count Over Time − 3
Vehicle Count
150
100
50
0
2016−01
2016−07
2017−01
2017−07
DateTime




```
#or

junction_plot <- traffic %>% select(DateTime, Junction, Vehicles)

junction_plot$DateTime <- as.POSIXct(junction_plot$DateTime, format="%Y-%m-%d %H:%M:%S")

ggplot(junction_plot, aes(x = DateTime, y = Vehicles, color = factor(Junction))) +
  geom_line() +
  labs(title = "Vehicle Count Over Time by Junction",
       x = "DateTime",
       y = "Vehicle Count",
       color = "Junction")
```



7. From alexa_file.xlsx, import it to your environment

```
library(readxl)
alexa <- read_xlsx("alexa_file.xlsx")
```

7A. How many observations does alexa_file has? What about the number of columns? Show your solution and answer.

```
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 ...
```

```
ncol(alexa)
```

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

```
#    The alexa file has 3150 observations and 5 columns
```

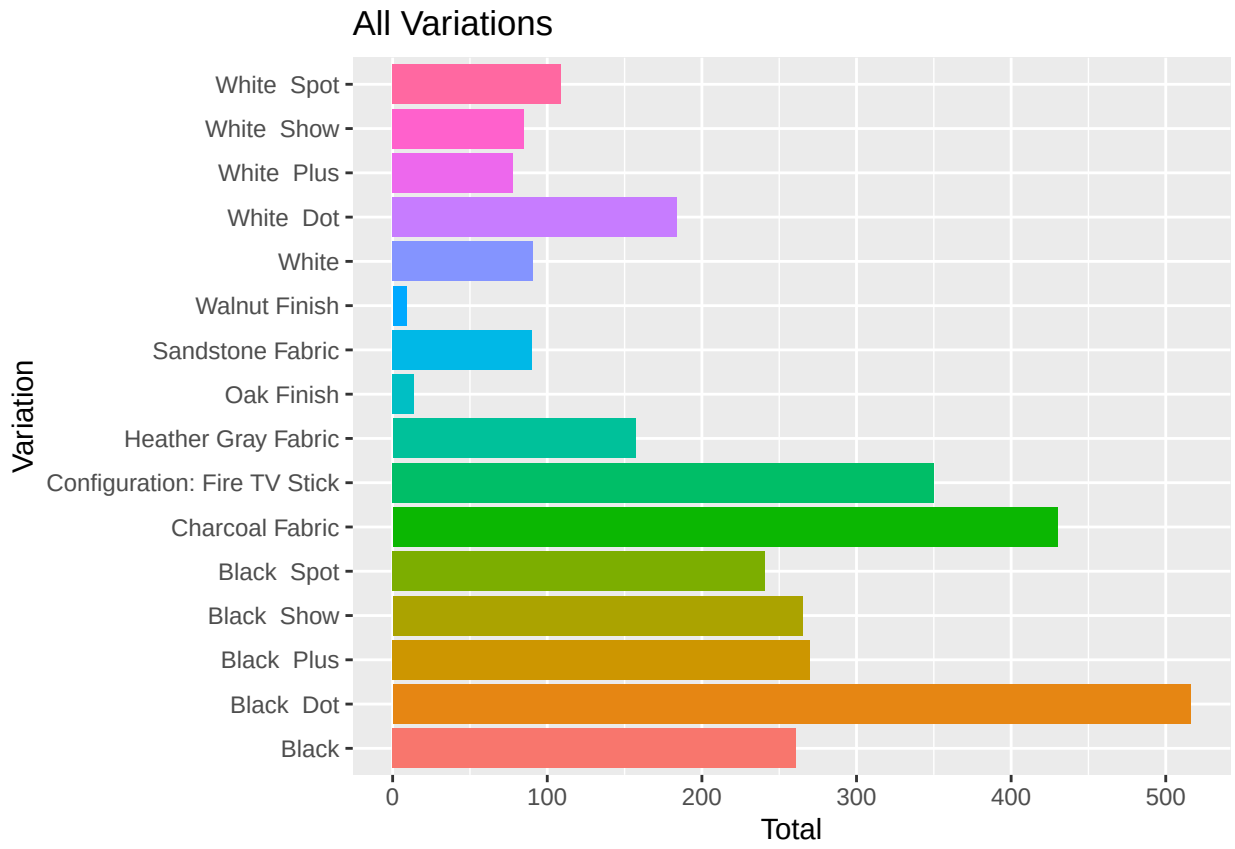
7B.group the variations and get the total of each variations. Use dplyr package. Show solution and answer.

```
alexa_variations <- alexa %>%
  group_by(variation) %>%
   summarise(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
```

7C.Plot the variations using the ggplot() function. What did you observe? Complete the details of the graph. Show solution and answer.

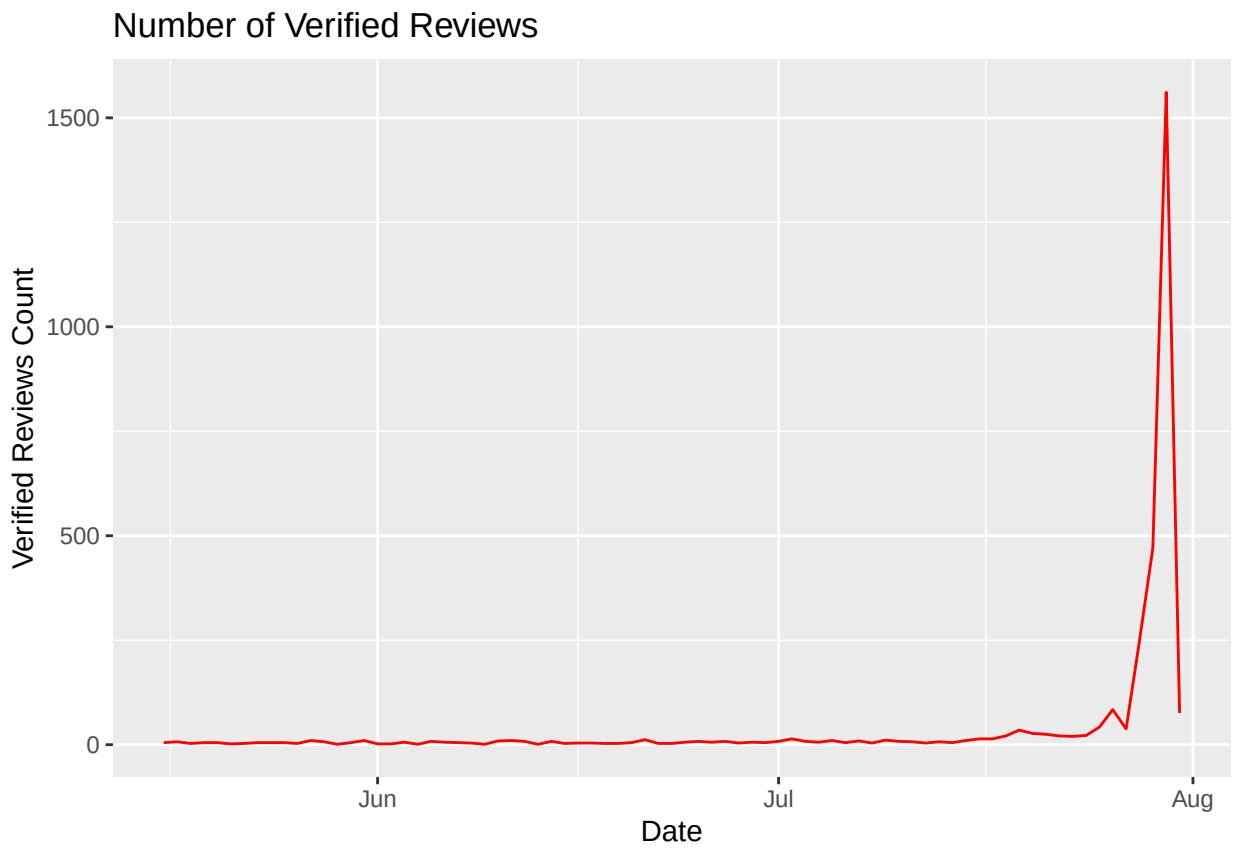
```
library(ggplot2)

ggplot(alexa_variations, aes(x = variation, y = total, fill = variation)) +
  geom_bar(stat = "identity") +
  labs(title = "All Variations",
       x = "Variation",
       y = "Total") +
       theme(legend.position = "none")+
  coord_flip()
```




```
#   It is observed in the plot that dark colors dominate lighter ones by a significant margin. Dotted d
```

7D. Plot a geom_line() with the date and the number of verified reviews. Complete the details of the graphs. Show your answer and solution.

```
library(ggplot2)
library(dplyr)

reviews <- alexa %>%
  filter(!is.na(verified_reviews)) %>%
  group_by(date) %>%
  summarise(reviews_num = n())
ggplot(reviews, aes(x = date, y = reviews_num)) +
  geom_line(color = "red") +
  labs(title = "Number of Verified Reviews",
       x = "Date",
       y = "Verified Reviews Count")
```



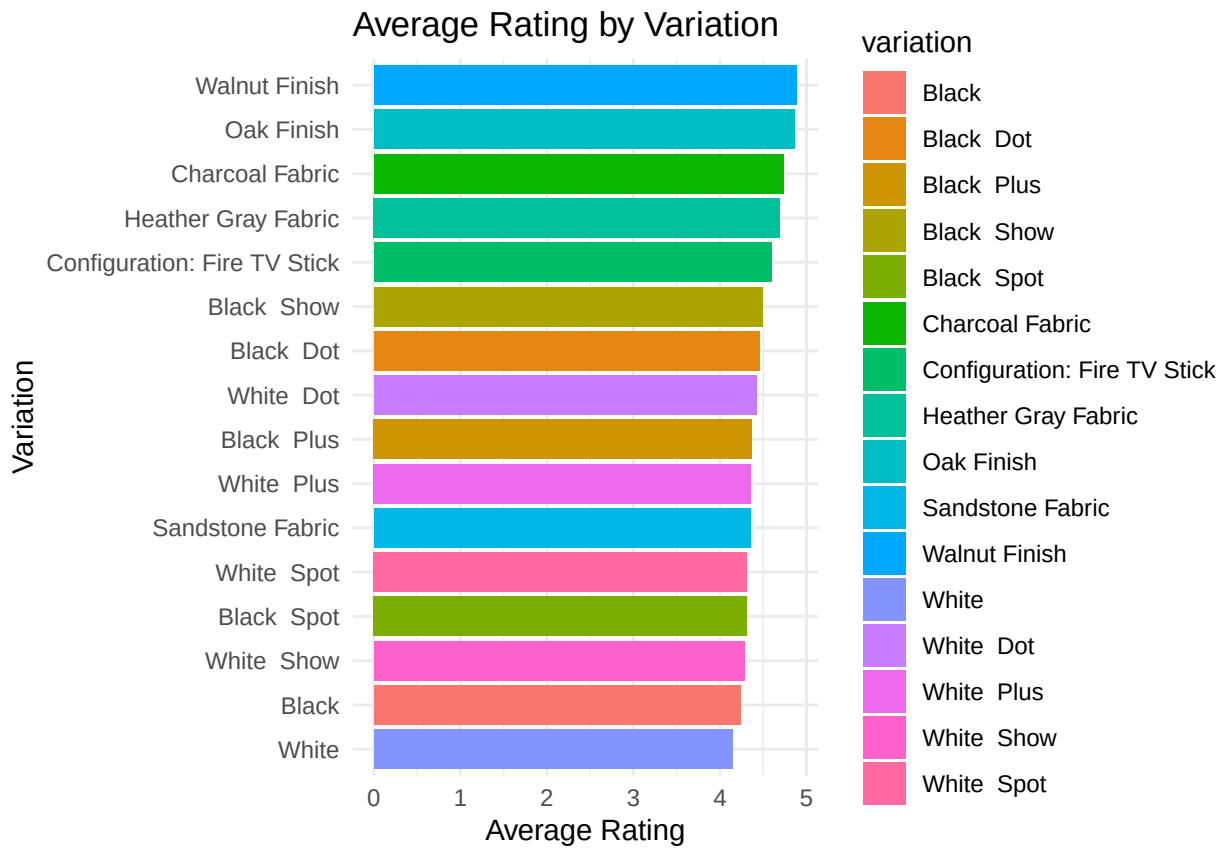
7E.Get the relationship of variations and ratings. Which variations got the most highest in rating? Plot a graph to show its relationship. Show your solution and answer.

```
library(ggplot2)
library(dplyr)
variation_ratings <- alexa %>%
  group_by(variation) %>%
  summarise(avg_rating = mean(rating)) %>%
  arrange(desc(avg_rating))

print(variation_ratings)
```

```
## # 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
```

```r
ggplot(variation_ratings, aes(x = reorder(variation, avg_rating), y = avg_rating, fill = variation)) +
  geom_bar(stat = "identity") +
  labs(title = "Average Rating by Variation",
       x = "Variation",
       y = "Average Rating") +
  theme_minimal() +
  coord_flip()
```




```r
#  Ironically, the walnut and oak finishes have the highest ratings, despite their infrequent appearanc
```