# Worksheet 4c

Carl

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1. Use the dataset mpg

1a. Show your solutions on how to import a csv file into the environmen

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

1b. Which variables from mpg dataset are categorical?

```
varCat <- mpg[,c(2:4,6:12)]
varCat
```

```
##     manufacturer                 model displ cyl      trans drv cty hwy fl
## 1           audi                    a4   1.8   4   auto(l5)   f  18  29  p
## 2           audi                    a4   1.8   4 manual(m5)   f  21  29  p
## 3           audi                    a4   2.0   4 manual(m6)   f  20  31  p
## 4           audi                    a4   2.0   4   auto(av)   f  21  30  p
## 5           audi                    a4   2.8   6   auto(l5)   f  16  26  p
## 6           audi                    a4   2.8   6 manual(m5)   f  18  26  p
## 7           audi                    a4   3.1   6   auto(av)   f  18  27  p
## 8           audi             a4 quattro   1.8   4 manual(m5)   4  18  26  p
## 9           audi             a4 quattro   1.8   4   auto(l5)   4  16  25  p
## 10          audi             a4 quattro   2.0   4 manual(m6)   4  20  28  p
## 11          audi             a4 quattro   2.0   4   auto(s6)   4  19  27  p
## 12          audi             a4 quattro   2.8   6   auto(l5)   4  15  25  p
## 13          audi             a4 quattro   2.8   6 manual(m5)   4  17  25  p
## 14          audi             a4 quattro   3.1   6   auto(s6)   4  17  25  p
## 15          audi             a4 quattro   3.1   6 manual(m6)   4  15  25  p
## 16          audi             a6 quattro   2.8   6   auto(l5)   4  15  24  p
## 17          audi             a6 quattro   3.1   6   auto(s6)   4  17  25  p
## 18          audi             a6 quattro   4.2   8   auto(s6)   4  16  23  p
## 19     chevrolet     c1500 suburban 2wd   5.3   8   auto(l4)   r  14  20  r
## 20     chevrolet     c1500 suburban 2wd   5.3   8   auto(l4)   r  11  15  e
## 21     chevrolet     c1500 suburban 2wd   5.3   8   auto(l4)   r  14  20  r
## 22     chevrolet     c1500 suburban 2wd   5.7   8   auto(l4)   r  13  17  r
## 23     chevrolet     c1500 suburban 2wd   6.0   8   auto(l4)   r  12  17  r
## 24     chevrolet               corvette   5.7   8 manual(m6)   r  16  26  p
## 25     chevrolet               corvette   5.7   8   auto(l4)   r  15  23  p
## 26     chevrolet               corvette   6.2   8 manual(m6)   r  16  26  p
## 27     chevrolet               corvette   6.2   8   auto(s6)   r  15  25  p
## 28     chevrolet               corvette   7.0   8 manual(m6)   r  15  24  p
## 29     chevrolet        k1500 tahoe 4wd   5.3   8   auto(l4)   4  14  19  r
## 30     chevrolet        k1500 tahoe 4wd   5.3   8   auto(l4)   4  11  14  e
## 31     chevrolet        k1500 tahoe 4wd   5.7   8   auto(l4)   4  11  15  r
## 32     chevrolet        k1500 tahoe 4wd   6.5   8   auto(l4)   4  14  17  d
## 33     chevrolet                 malibu   2.4   4   auto(l4)   f  19  27  r
```

```
## 34     chevrolet                malibu   2.4   4   auto(l4)   f  22  30  r
## 35     chevrolet                malibu   3.1   6   auto(l4)   f  18  26  r
## 36     chevrolet                malibu   3.5   6   auto(l4)   f  18  29  r
## 37     chevrolet                malibu   3.6   6   auto(s6)   f  17  26  r
## 38         dodge            caravan 2wd   2.4   4   auto(l3)   f  18  24  r
## 39         dodge            caravan 2wd   3.0   6   auto(l4)   f  17  24  r
## 40         dodge            caravan 2wd   3.3   6   auto(l4)   f  16  22  r
## 41         dodge            caravan 2wd   3.3   6   auto(l4)   f  16  22  r
## 42         dodge            caravan 2wd   3.3   6   auto(l4)   f  17  24  r
## 43         dodge            caravan 2wd   3.3   6   auto(l4)   f  17  24  r
## 44         dodge            caravan 2wd   3.3   6   auto(l4)   f  11  17  e
## 45         dodge            caravan 2wd   3.8   6   auto(l4)   f  15  22  r
## 46         dodge            caravan 2wd   3.8   6   auto(l4)   f  15  21  r
## 47         dodge            caravan 2wd   3.8   6   auto(l6)   f  16  23  r
## 48         dodge            caravan 2wd   4.0   6   auto(l6)   f  16  23  r
## 49         dodge      dakota pickup 4wd   3.7   6 manual(m6)   4  15  19  r
## 50         dodge      dakota pickup 4wd   3.7   6   auto(l4)   4  14  18  r
## 51         dodge      dakota pickup 4wd   3.9   6   auto(l4)   4  13  17  r
## 52         dodge      dakota pickup 4wd   3.9   6 manual(m5)   4  14  17  r
## 53         dodge      dakota pickup 4wd   4.7   8   auto(l5)   4  14  19  r
## 54         dodge      dakota pickup 4wd   4.7   8   auto(l5)   4  14  19  r
## 55         dodge      dakota pickup 4wd   4.7   8   auto(l5)   4   9  12  e
## 56         dodge      dakota pickup 4wd   5.2   8 manual(m5)   4  11  17  r
## 57         dodge      dakota pickup 4wd   5.2   8   auto(l4)   4  11  15  r
## 58         dodge            durango 4wd   3.9   6   auto(l4)   4  13  17  r
## 59         dodge            durango 4wd   4.7   8   auto(l5)   4  13  17  r
## 60         dodge            durango 4wd   4.7   8   auto(l5)   4   9  12  e
## 61         dodge            durango 4wd   4.7   8   auto(l5)   4  13  17  r
## 62         dodge            durango 4wd   5.2   8   auto(l4)   4  11  16  r
## 63         dodge            durango 4wd   5.7   8   auto(l5)   4  13  18  r
## 64         dodge            durango 4wd   5.9   8   auto(l4)   4  11  15  r
## 65         dodge    ram 1500 pickup 4wd   4.7   8 manual(m6)   4  12  16  r
## 66         dodge    ram 1500 pickup 4wd   4.7   8   auto(l5)   4   9  12  e
## 67         dodge    ram 1500 pickup 4wd   4.7   8   auto(l5)   4  13  17  r
## 68         dodge    ram 1500 pickup 4wd   4.7   8   auto(l5)   4  13  17  r
## 69         dodge    ram 1500 pickup 4wd   4.7   8 manual(m6)   4  12  16  r
## 70         dodge    ram 1500 pickup 4wd   4.7   8 manual(m6)   4   9  12  e
## 71         dodge    ram 1500 pickup 4wd   5.2   8   auto(l4)   4  11  15  r
## 72         dodge    ram 1500 pickup 4wd   5.2   8 manual(m5)   4  11  16  r
## 73         dodge    ram 1500 pickup 4wd   5.7   8   auto(l5)   4  13  17  r
## 74         dodge    ram 1500 pickup 4wd   5.9   8   auto(l4)   4  11  15  r
## 75          ford         expedition 2wd   4.6   8   auto(l4)   r  11  17  r
## 76          ford         expedition 2wd   5.4   8   auto(l4)   r  11  17  r
## 77          ford         expedition 2wd   5.4   8   auto(l6)   r  12  18  r
## 78          ford           explorer 4wd   4.0   6   auto(l5)   4  14  17  r
## 79          ford           explorer 4wd   4.0   6 manual(m5)   4  15  19  r
## 80          ford           explorer 4wd   4.0   6   auto(l5)   4  14  17  r
## 81          ford           explorer 4wd   4.0   6   auto(l5)   4  13  19  r
## 82          ford           explorer 4wd   4.6   8   auto(l6)   4  13  19  r
## 83          ford           explorer 4wd   5.0   8   auto(l4)   4  13  17  r
## 84          ford        f150 pickup 4wd   4.2   6   auto(l4)   4  14  17  r
## 85          ford        f150 pickup 4wd   4.2   6 manual(m5)   4  14  17  r
## 86          ford        f150 pickup 4wd   4.6   8 manual(m5)   4  13  16  r
## 87          ford        f150 pickup 4wd   4.6   8   auto(l4)   4  13  16  r
```

```
## 88          ford        f150 pickup 4wd   4.6   8   auto(l4)   4  13  17  r
## 89          ford        f150 pickup 4wd   5.4   8   auto(l4)   4  11  15  r
## 90          ford        f150 pickup 4wd   5.4   8   auto(l4)   4  13  17  r
## 91          ford                mustang   3.8   6 manual(m5)   r  18  26  r
## 92          ford                mustang   3.8   6   auto(l4)   r  18  25  r
## 93          ford                mustang   4.0   6 manual(m5)   r  17  26  r
## 94          ford                mustang   4.0   6   auto(l5)   r  16  24  r
## 95          ford                mustang   4.6   8   auto(l4)   r  15  21  r
## 96          ford                mustang   4.6   8 manual(m5)   r  15  22  r
## 97          ford                mustang   4.6   8 manual(m5)   r  15  23  r
## 98          ford                mustang   4.6   8   auto(l5)   r  15  22  r
## 99          ford                mustang   5.4   8 manual(m6)   r  14  20  p
## 100        honda                  civic   1.6   4 manual(m5)   f  28  33  r
## 101        honda                  civic   1.6   4   auto(l4)   f  24  32  r
## 102        honda                  civic   1.6   4 manual(m5)   f  25  32  r
## 103        honda                  civic   1.6   4 manual(m5)   f  23  29  p
## 104        honda                  civic   1.6   4   auto(l4)   f  24  32  r
## 105        honda                  civic   1.8   4 manual(m5)   f  26  34  r
## 106        honda                  civic   1.8   4   auto(l5)   f  25  36  r
## 107        honda                  civic   1.8   4   auto(l5)   f  24  36  c
## 108        honda                  civic   2.0   4 manual(m6)   f  21  29  p
## 109      hyundai                 sonata   2.4   4   auto(l4)   f  18  26  r
## 110      hyundai                 sonata   2.4   4 manual(m5)   f  18  27  r
## 111      hyundai                 sonata   2.4   4   auto(l4)   f  21  30  r
## 112      hyundai                 sonata   2.4   4 manual(m5)   f  21  31  r
## 113      hyundai                 sonata   2.5   6   auto(l4)   f  18  26  r
## 114      hyundai                 sonata   2.5   6 manual(m5)   f  18  26  r
## 115      hyundai                 sonata   3.3   6   auto(l5)   f  19  28  r
## 116      hyundai                tiburon   2.0   4   auto(l4)   f  19  26  r
## 117      hyundai                tiburon   2.0   4 manual(m5)   f  19  29  r
## 118      hyundai                tiburon   2.0   4 manual(m5)   f  20  28  r
## 119      hyundai                tiburon   2.0   4   auto(l4)   f  20  27  r
## 120      hyundai                tiburon   2.7   6   auto(l4)   f  17  24  r
## 121      hyundai                tiburon   2.7   6 manual(m6)   f  16  24  r
## 122      hyundai                tiburon   2.7   6 manual(m5)   f  17  24  r
## 123         jeep     grand cherokee 4wd   3.0   6   auto(l5)   4  17  22  d
## 124         jeep     grand cherokee 4wd   3.7   6   auto(l5)   4  15  19  r
## 125         jeep     grand cherokee 4wd   4.0   6   auto(l4)   4  15  20  r
## 126         jeep     grand cherokee 4wd   4.7   8   auto(l4)   4  14  17  r
## 127         jeep     grand cherokee 4wd   4.7   8   auto(l5)   4   9  12  e
## 128         jeep     grand cherokee 4wd   4.7   8   auto(l5)   4  14  19  r
## 129         jeep     grand cherokee 4wd   5.7   8   auto(l5)   4  13  18  r
## 130         jeep     grand cherokee 4wd   6.1   8   auto(l5)   4  11  14  p
## 131   land rover            range rover   4.0   8   auto(l4)   4  11  15  p
## 132   land rover            range rover   4.2   8   auto(s6)   4  12  18  r
## 133   land rover            range rover   4.4   8   auto(s6)   4  12  18  r
## 134   land rover            range rover   4.6   8   auto(l4)   4  11  15  p
## 135      lincoln          navigator 2wd   5.4   8   auto(l4)   r  11  17  r
## 136      lincoln          navigator 2wd   5.4   8   auto(l4)   r  11  16  p
## 137      lincoln          navigator 2wd   5.4   8   auto(l6)   r  12  18  r
## 138      mercury        mountaineer 4wd   4.0   6   auto(l5)   4  14  17  r
## 139      mercury        mountaineer 4wd   4.0   6   auto(l5)   4  13  19  r
## 140      mercury        mountaineer 4wd   4.6   8   auto(l6)   4  13  19  r
## 141      mercury        mountaineer 4wd   5.0   8   auto(l4)   4  13  17  r
```

```
## 142       nissan                altima   2.4   4 manual(m5)   f  21  29  r
## 143       nissan                altima   2.4   4   auto(l4)   f  19  27  r
## 144       nissan                altima   2.5   4   auto(av)   f  23  31  r
## 145       nissan                altima   2.5   4 manual(m6)   f  23  32  r
## 146       nissan                altima   3.5   6 manual(m6)   f  19  27  p
## 147       nissan                altima   3.5   6   auto(av)   f  19  26  p
## 148       nissan                maxima   3.0   6   auto(l4)   f  18  26  r
## 149       nissan                maxima   3.0   6 manual(m5)   f  19  25  r
## 150       nissan                maxima   3.5   6   auto(av)   f  19  25  p
## 151       nissan         pathfinder 4wd   3.3   6   auto(l4)   4  14  17  r
## 152       nissan         pathfinder 4wd   3.3   6 manual(m5)   4  15  17  r
## 153       nissan         pathfinder 4wd   4.0   6   auto(l5)   4  14  20  p
## 154       nissan         pathfinder 4wd   5.6   8   auto(s5)   4  12  18  p
## 155      pontiac             grand prix   3.1   6   auto(l4)   f  18  26  r
## 156      pontiac             grand prix   3.8   6   auto(l4)   f  16  26  p
## 157      pontiac             grand prix   3.8   6   auto(l4)   f  17  27  r
## 158      pontiac             grand prix   3.8   6   auto(l4)   f  18  28  r
## 159      pontiac             grand prix   5.3   8   auto(s4)   f  16  25  p
## 160       subaru           forester awd   2.5   4 manual(m5)   4  18  25  r
## 161       subaru           forester awd   2.5   4   auto(l4)   4  18  24  r
## 162       subaru           forester awd   2.5   4 manual(m5)   4  20  27  r
## 163       subaru           forester awd   2.5   4 manual(m5)   4  19  25  p
## 164       subaru           forester awd   2.5   4   auto(l4)   4  20  26  r
## 165       subaru           forester awd   2.5   4   auto(l4)   4  18  23  p
## 166       subaru            impreza awd   2.2   4   auto(l4)   4  21  26  r
## 167       subaru            impreza awd   2.2   4 manual(m5)   4  19  26  r
## 168       subaru            impreza awd   2.5   4 manual(m5)   4  19  26  r
## 169       subaru            impreza awd   2.5   4   auto(l4)   4  19  26  r
## 170       subaru            impreza awd   2.5   4   auto(s4)   4  20  25  p
## 171       subaru            impreza awd   2.5   4   auto(s4)   4  20  27  r
## 172       subaru            impreza awd   2.5   4 manual(m5)   4  19  25  p
## 173       subaru            impreza awd   2.5   4 manual(m5)   4  20  27  r
## 174       toyota            4runner 4wd   2.7   4 manual(m5)   4  15  20  r
## 175       toyota            4runner 4wd   2.7   4   auto(l4)   4  16  20  r
## 176       toyota            4runner 4wd   3.4   6   auto(l4)   4  15  19  r
## 177       toyota            4runner 4wd   3.4   6 manual(m5)   4  15  17  r
## 178       toyota            4runner 4wd   4.0   6   auto(l5)   4  16  20  r
## 179       toyota            4runner 4wd   4.7   8   auto(l5)   4  14  17  r
## 180       toyota                  camry   2.2   4 manual(m5)   f  21  29  r
## 181       toyota                  camry   2.2   4   auto(l4)   f  21  27  r
## 182       toyota                  camry   2.4   4 manual(m5)   f  21  31  r
## 183       toyota                  camry   2.4   4   auto(l5)   f  21  31  r
## 184       toyota                  camry   3.0   6   auto(l4)   f  18  26  r
## 185       toyota                  camry   3.0   6 manual(m5)   f  18  26  r
## 186       toyota                  camry   3.5   6   auto(s6)   f  19  28  r
## 187       toyota           camry solara   2.2   4   auto(l4)   f  21  27  r
## 188       toyota           camry solara   2.2   4 manual(m5)   f  21  29  r
## 189       toyota           camry solara   2.4   4 manual(m5)   f  21  31  r
## 190       toyota           camry solara   2.4   4   auto(s5)   f  22  31  r
## 191       toyota           camry solara   3.0   6   auto(l4)   f  18  26  r
## 192       toyota           camry solara   3.0   6 manual(m5)   f  18  26  r
## 193       toyota           camry solara   3.3   6   auto(s5)   f  18  27  r
## 194       toyota                corolla   1.8   4   auto(l3)   f  24  30  r
## 195       toyota                corolla   1.8   4   auto(l4)   f  24  33  r
```

```
## 196       toyota                corolla   1.8   4 manual(m5)   f  26  35  r
## 197       toyota                corolla   1.8   4 manual(m5)   f  28  37  r
## 198       toyota                corolla   1.8   4   auto(l4)   f  26  35  r
## 199       toyota land cruiser wagon 4wd   4.7   8   auto(l4)   4  11  15  r
## 200       toyota land cruiser wagon 4wd   5.7   8   auto(s6)   4  13  18  r
## 201       toyota      toyota tacoma 4wd   2.7   4 manual(m5)   4  15  20  r
## 202       toyota      toyota tacoma 4wd   2.7   4   auto(l4)   4  16  20  r
## 203       toyota      toyota tacoma 4wd   2.7   4 manual(m5)   4  17  22  r
## 204       toyota      toyota tacoma 4wd   3.4   6 manual(m5)   4  15  17  r
## 205       toyota      toyota tacoma 4wd   3.4   6   auto(l4)   4  15  19  r
## 206       toyota      toyota tacoma 4wd   4.0   6 manual(m6)   4  15  18  r
## 207       toyota      toyota tacoma 4wd   4.0   6   auto(l5)   4  16  20  r
## 208   volkswagen                   gti   2.0   4 manual(m5)   f  21  29  r
## 209   volkswagen                   gti   2.0   4   auto(l4)   f  19  26  r
## 210   volkswagen                   gti   2.0   4 manual(m6)   f  21  29  p
## 211   volkswagen                   gti   2.0   4   auto(s6)   f  22  29  p
## 212   volkswagen                   gti   2.8   6 manual(m5)   f  17  24  r
## 213   volkswagen                 jetta   1.9   4 manual(m5)   f  33  44  d
## 214   volkswagen                 jetta   2.0   4 manual(m5)   f  21  29  r
## 215   volkswagen                 jetta   2.0   4   auto(l4)   f  19  26  r
## 216   volkswagen                 jetta   2.0   4   auto(s6)   f  22  29  p
## 217   volkswagen                 jetta   2.0   4 manual(m6)   f  21  29  p
## 218   volkswagen                 jetta   2.5   5   auto(s6)   f  21  29  r
## 219   volkswagen                 jetta   2.5   5 manual(m5)   f  21  29  r
## 220   volkswagen                 jetta   2.8   6   auto(l4)   f  16  23  r
## 221   volkswagen                 jetta   2.8   6 manual(m5)   f  17  24  r
## 222   volkswagen            new beetle   1.9   4 manual(m5)   f  35  44  d
## 223   volkswagen            new beetle   1.9   4   auto(l4)   f  29  41  d
## 224   volkswagen            new beetle   2.0   4 manual(m5)   f  21  29  r
## 225   volkswagen            new beetle   2.0   4   auto(l4)   f  19  26  r
## 226   volkswagen            new beetle   2.5   5 manual(m5)   f  20  28  r
## 227   volkswagen            new beetle   2.5   5   auto(s6)   f  20  29  r
## 228   volkswagen                passat   1.8   4 manual(m5)   f  21  29  p
## 229   volkswagen                passat   1.8   4   auto(l5)   f  18  29  p
## 230   volkswagen                passat   2.0   4   auto(s6)   f  19  28  p
## 231   volkswagen                passat   2.0   4 manual(m6)   f  21  29  p
## 232   volkswagen                passat   2.8   6   auto(l5)   f  16  26  p
## 233   volkswagen                passat   2.8   6 manual(m5)   f  18  26  p
## 234   volkswagen                passat   3.6   6   auto(s6)   f  17  26  p
##          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
## 21         suv
## 22         suv
## 23         suv
## 24     2seater
## 25     2seater
## 26     2seater
## 27     2seater
## 28     2seater
## 29         suv
## 30         suv
## 31         suv
## 32         suv
## 33     midsize
## 34     midsize
## 35     midsize
## 36     midsize
## 37     midsize
## 38     minivan
## 39     minivan
## 40     minivan
## 41     minivan
## 42     minivan
## 43     minivan
## 44     minivan
## 45     minivan
## 46     minivan
## 47     minivan
## 48     minivan
## 49      pickup
## 50      pickup
## 51      pickup
## 52      pickup
## 53      pickup
## 54      pickup
## 55      pickup
## 56      pickup
## 57      pickup
## 58         suv
## 59         suv
## 60         suv
## 61         suv
## 62         suv
## 63         suv
## 64         suv
## 65      pickup
## 66      pickup
## 67      pickup
## 68      pickup
```

```
## 69      pickup
## 70      pickup
## 71      pickup
## 72      pickup
## 73      pickup
## 74      pickup
## 75         suv
## 76         suv
## 77         suv
## 78         suv
## 79         suv
## 80         suv
## 81         suv
## 82         suv
## 83         suv
## 84      pickup
## 85      pickup
## 86      pickup
## 87      pickup
## 88      pickup
## 89      pickup
## 90      pickup
## 91  subcompact
## 92  subcompact
## 93  subcompact
## 94  subcompact
## 95  subcompact
## 96  subcompact
## 97  subcompact
## 98  subcompact
## 99  subcompact
## 100 subcompact
## 101 subcompact
## 102 subcompact
## 103 subcompact
## 104 subcompact
## 105 subcompact
## 106 subcompact
## 107 subcompact
## 108 subcompact
## 109    midsize
## 110    midsize
## 111    midsize
## 112    midsize
## 113    midsize
## 114    midsize
## 115    midsize
## 116 subcompact
## 117 subcompact
## 118 subcompact
## 119 subcompact
## 120 subcompact
## 121 subcompact
## 122 subcompact
```

```
## 123        suv
## 124        suv
## 125        suv
## 126        suv
## 127        suv
## 128        suv
## 129        suv
## 130        suv
## 131        suv
## 132        suv
## 133        suv
## 134        suv
## 135        suv
## 136        suv
## 137        suv
## 138        suv
## 139        suv
## 140        suv
## 141        suv
## 142    compact
## 143    compact
## 144    midsize
## 145    midsize
## 146    midsize
## 147    midsize
## 148    midsize
## 149    midsize
## 150    midsize
## 151        suv
## 152        suv
## 153        suv
## 154        suv
## 155    midsize
## 156    midsize
## 157    midsize
## 158    midsize
## 159    midsize
## 160        suv
## 161        suv
## 162        suv
## 163        suv
## 164        suv
## 165        suv
## 166 subcompact
## 167 subcompact
## 168 subcompact
## 169 subcompact
## 170    compact
## 171    compact
## 172    compact
## 173    compact
## 174        suv
## 175        suv
## 176        suv
```

```
## 177        suv
## 178        suv
## 179        suv
## 180    midsize
## 181    midsize
## 182    midsize
## 183    midsize
## 184    midsize
## 185    midsize
## 186    midsize
## 187    compact
## 188    compact
## 189    compact
## 190    compact
## 191    compact
## 192    compact
## 193    compact
## 194    compact
## 195    compact
## 196    compact
## 197    compact
## 198    compact
## 199        suv
## 200        suv
## 201     pickup
## 202     pickup
## 203     pickup
## 204     pickup
## 205     pickup
## 206     pickup
## 207     pickup
## 208    compact
## 209    compact
## 210    compact
## 211    compact
## 212    compact
## 213    compact
## 214    compact
## 215    compact
## 216    compact
## 217    compact
## 218    compact
## 219    compact
## 220    compact
## 221    compact
## 222 subcompact
## 223 subcompact
## 224 subcompact
## 225 subcompact
## 226 subcompact
## 227 subcompact
## 228    midsize
## 229    midsize
## 230    midsize
```

```
## 231    midsize
## 232    midsize
## 233    midsize
## 234    midsize
```

1c. Which are continuous variables?

```
carCon <- mpg[,c(4:6,9,10)]
carCon
```

```
##     displ year cyl cty hwy
## 1     1.8 1999   4  18  29
## 2     1.8 1999   4  21  29
## 3     2.0 2008   4  20  31
## 4     2.0 2008   4  21  30
## 5     2.8 1999   6  16  26
## 6     2.8 1999   6  18  26
## 7     3.1 2008   6  18  27
## 8     1.8 1999   4  18  26
## 9     1.8 1999   4  16  25
## 10    2.0 2008   4  20  28
## 11    2.0 2008   4  19  27
## 12    2.8 1999   6  15  25
## 13    2.8 1999   6  17  25
## 14    3.1 2008   6  17  25
## 15    3.1 2008   6  15  25
## 16    2.8 1999   6  15  24
## 17    3.1 2008   6  17  25
## 18    4.2 2008   8  16  23
## 19    5.3 2008   8  14  20
## 20    5.3 2008   8  11  15
## 21    5.3 2008   8  14  20
## 22    5.7 1999   8  13  17
## 23    6.0 2008   8  12  17
## 24    5.7 1999   8  16  26
## 25    5.7 1999   8  15  23
## 26    6.2 2008   8  16  26
## 27    6.2 2008   8  15  25
## 28    7.0 2008   8  15  24
## 29    5.3 2008   8  14  19
## 30    5.3 2008   8  11  14
## 31    5.7 1999   8  11  15
## 32    6.5 1999   8  14  17
## 33    2.4 1999   4  19  27
## 34    2.4 2008   4  22  30
## 35    3.1 1999   6  18  26
## 36    3.5 2008   6  18  29
## 37    3.6 2008   6  17  26
## 38    2.4 1999   4  18  24
## 39    3.0 1999   6  17  24
## 40    3.3 1999   6  16  22
## 41    3.3 1999   6  16  22
## 42    3.3 2008   6  17  24
## 43    3.3 2008   6  17  24
## 44    3.3 2008   6  11  17
```

```
## 45    3.8 1999   6  15  22
## 46    3.8 1999   6  15  21
## 47    3.8 2008   6  16  23
## 48    4.0 2008   6  16  23
## 49    3.7 2008   6  15  19
## 50    3.7 2008   6  14  18
## 51    3.9 1999   6  13  17
## 52    3.9 1999   6  14  17
## 53    4.7 2008   8  14  19
## 54    4.7 2008   8  14  19
## 55    4.7 2008   8   9  12
## 56    5.2 1999   8  11  17
## 57    5.2 1999   8  11  15
## 58    3.9 1999   6  13  17
## 59    4.7 2008   8  13  17
## 60    4.7 2008   8   9  12
## 61    4.7 2008   8  13  17
## 62    5.2 1999   8  11  16
## 63    5.7 2008   8  13  18
## 64    5.9 1999   8  11  15
## 65    4.7 2008   8  12  16
## 66    4.7 2008   8   9  12
## 67    4.7 2008   8  13  17
## 68    4.7 2008   8  13  17
## 69    4.7 2008   8  12  16
## 70    4.7 2008   8   9  12
## 71    5.2 1999   8  11  15
## 72    5.2 1999   8  11  16
## 73    5.7 2008   8  13  17
## 74    5.9 1999   8  11  15
## 75    4.6 1999   8  11  17
## 76    5.4 1999   8  11  17
## 77    5.4 2008   8  12  18
## 78    4.0 1999   6  14  17
## 79    4.0 1999   6  15  19
## 80    4.0 1999   6  14  17
## 81    4.0 2008   6  13  19
## 82    4.6 2008   8  13  19
## 83    5.0 1999   8  13  17
## 84    4.2 1999   6  14  17
## 85    4.2 1999   6  14  17
## 86    4.6 1999   8  13  16
## 87    4.6 1999   8  13  16
## 88    4.6 2008   8  13  17
## 89    5.4 1999   8  11  15
## 90    5.4 2008   8  13  17
## 91    3.8 1999   6  18  26
## 92    3.8 1999   6  18  25
## 93    4.0 2008   6  17  26
## 94    4.0 2008   6  16  24
## 95    4.6 1999   8  15  21
## 96    4.6 1999   8  15  22
## 97    4.6 2008   8  15  23
## 98    4.6 2008   8  15  22
```

```
## 99    5.4 2008   8  14  20
## 100   1.6 1999   4  28  33
## 101   1.6 1999   4  24  32
## 102   1.6 1999   4  25  32
## 103   1.6 1999   4  23  29
## 104   1.6 1999   4  24  32
## 105   1.8 2008   4  26  34
## 106   1.8 2008   4  25  36
## 107   1.8 2008   4  24  36
## 108   2.0 2008   4  21  29
## 109   2.4 1999   4  18  26
## 110   2.4 1999   4  18  27
## 111   2.4 2008   4  21  30
## 112   2.4 2008   4  21  31
## 113   2.5 1999   6  18  26
## 114   2.5 1999   6  18  26
## 115   3.3 2008   6  19  28
## 116   2.0 1999   4  19  26
## 117   2.0 1999   4  19  29
## 118   2.0 2008   4  20  28
## 119   2.0 2008   4  20  27
## 120   2.7 2008   6  17  24
## 121   2.7 2008   6  16  24
## 122   2.7 2008   6  17  24
## 123   3.0 2008   6  17  22
## 124   3.7 2008   6  15  19
## 125   4.0 1999   6  15  20
## 126   4.7 1999   8  14  17
## 127   4.7 2008   8   9  12
## 128   4.7 2008   8  14  19
## 129   5.7 2008   8  13  18
## 130   6.1 2008   8  11  14
## 131   4.0 1999   8  11  15
## 132   4.2 2008   8  12  18
## 133   4.4 2008   8  12  18
## 134   4.6 1999   8  11  15
## 135   5.4 1999   8  11  17
## 136   5.4 1999   8  11  16
## 137   5.4 2008   8  12  18
## 138   4.0 1999   6  14  17
## 139   4.0 2008   6  13  19
## 140   4.6 2008   8  13  19
## 141   5.0 1999   8  13  17
## 142   2.4 1999   4  21  29
## 143   2.4 1999   4  19  27
## 144   2.5 2008   4  23  31
## 145   2.5 2008   4  23  32
## 146   3.5 2008   6  19  27
## 147   3.5 2008   6  19  26
## 148   3.0 1999   6  18  26
## 149   3.0 1999   6  19  25
## 150   3.5 2008   6  19  25
## 151   3.3 1999   6  14  17
## 152   3.3 1999   6  15  17
```

```
## 153   4.0 2008   6  14  20
## 154   5.6 2008   8  12  18
## 155   3.1 1999   6  18  26
## 156   3.8 1999   6  16  26
## 157   3.8 1999   6  17  27
## 158   3.8 2008   6  18  28
## 159   5.3 2008   8  16  25
## 160   2.5 1999   4  18  25
## 161   2.5 1999   4  18  24
## 162   2.5 2008   4  20  27
## 163   2.5 2008   4  19  25
## 164   2.5 2008   4  20  26
## 165   2.5 2008   4  18  23
## 166   2.2 1999   4  21  26
## 167   2.2 1999   4  19  26
## 168   2.5 1999   4  19  26
## 169   2.5 1999   4  19  26
## 170   2.5 2008   4  20  25
## 171   2.5 2008   4  20  27
## 172   2.5 2008   4  19  25
## 173   2.5 2008   4  20  27
## 174   2.7 1999   4  15  20
## 175   2.7 1999   4  16  20
## 176   3.4 1999   6  15  19
## 177   3.4 1999   6  15  17
## 178   4.0 2008   6  16  20
## 179   4.7 2008   8  14  17
## 180   2.2 1999   4  21  29
## 181   2.2 1999   4  21  27
## 182   2.4 2008   4  21  31
## 183   2.4 2008   4  21  31
## 184   3.0 1999   6  18  26
## 185   3.0 1999   6  18  26
## 186   3.5 2008   6  19  28
## 187   2.2 1999   4  21  27
## 188   2.2 1999   4  21  29
## 189   2.4 2008   4  21  31
## 190   2.4 2008   4  22  31
## 191   3.0 1999   6  18  26
## 192   3.0 1999   6  18  26
## 193   3.3 2008   6  18  27
## 194   1.8 1999   4  24  30
## 195   1.8 1999   4  24  33
## 196   1.8 1999   4  26  35
## 197   1.8 2008   4  28  37
## 198   1.8 2008   4  26  35
## 199   4.7 1999   8  11  15
## 200   5.7 2008   8  13  18
## 201   2.7 1999   4  15  20
## 202   2.7 1999   4  16  20
## 203   2.7 2008   4  17  22
## 204   3.4 1999   6  15  17
## 205   3.4 1999   6  15  19
## 206   4.0 2008   6  15  18
```

```
## 207   4.0 2008   6  16  20
## 208   2.0 1999   4  21  29
## 209   2.0 1999   4  19  26
## 210   2.0 2008   4  21  29
## 211   2.0 2008   4  22  29
## 212   2.8 1999   6  17  24
## 213   1.9 1999   4  33  44
## 214   2.0 1999   4  21  29
## 215   2.0 1999   4  19  26
## 216   2.0 2008   4  22  29
## 217   2.0 2008   4  21  29
## 218   2.5 2008   5  21  29
## 219   2.5 2008   5  21  29
## 220   2.8 1999   6  16  23
## 221   2.8 1999   6  17  24
## 222   1.9 1999   4  35  44
## 223   1.9 1999   4  29  41
## 224   2.0 1999   4  21  29
## 225   2.0 1999   4  19  26
## 226   2.5 2008   5  20  28
## 227   2.5 2008   5  20  29
## 228   1.8 1999   4  21  29
## 229   1.8 1999   4  18  29
## 230   2.0 2008   4  19  28
## 231   2.0 2008   4  21  29
## 232   2.8 1999   6  16  26
## 233   2.8 1999   6  18  26
## 234   3.6 2008   6  17  26
```

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

```
maxmod <- table(mpg$manufacturer)
maxmod
```

```
##
##       audi  chevrolet      dodge       ford      honda    hyundai       jeep
##         18         19         37         25          9         14          8
## land rover    lincoln    mercury     nissan    pontiac     subaru     toyota
##          4          3          4         13          5         14         34
## volkswagen
##         27
```

```
#dodge has most model


maxvarofmod <- table(mpg$model)
maxvarofmod
```

```
##
##            4runner 4wd                   a4            a4 quattro
##                      6                    7                     8
##             a6 quattro                altima     c1500 suburban 2wd
##                      3                    6                     5
##                  camry           camry solara            caravan 2wd
##                      7                    7                    11
```

```
##                   civic                 corolla               corvette
##                       9                       5                       5
##      dakota pickup 4wd             durango 4wd         expedition 2wd
##                       9                       7                       3
##           explorer 4wd         f150 pickup 4wd           forester awd
##                       6                       7                       6
##     grand cherokee 4wd              grand prix                     gti
##                       8                       5                       5
##            impreza awd                   jetta        k1500 tahoe 4wd
##                       8                       9                       4
## land cruiser wagon 4wd                  malibu                  maxima
##                       2                       5                       3
##        mountaineer 4wd                 mustang          navigator 2wd
##                       4                       9                       3
##             new beetle                  passat         pathfinder 4wd
##                       6                       7                       4
##    ram 1500 pickup 4wd             range rover                  sonata
##                      10                       4                       7
##                 tiburon      toyota tacoma 4wd
##                       7                       7
```

```
#caravan 2wd has the most Variations
```

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
```

```
manufacturer_groups <- mpg %>%
  group_by(mpg$manufacturer) %>%
  summarise(unique_models = toString(unique(model)))
manufacturer_groups
```

```
## # A tibble: 15 x 2
##    `mpg$manufacturer` unique_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 pic~
##  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 w~
## 15 volkswagen         gti, jetta, new beetle, passat
```

```
manufacturer_counts <- mpg %>%
  group_by(manufacturer) %>%
  summarise(unique_model_count = n_distinct(model))
manufacturer_counts
```

```
## # A tibble: 15 x 2
##    manufacturer unique_model_count
##    <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
```

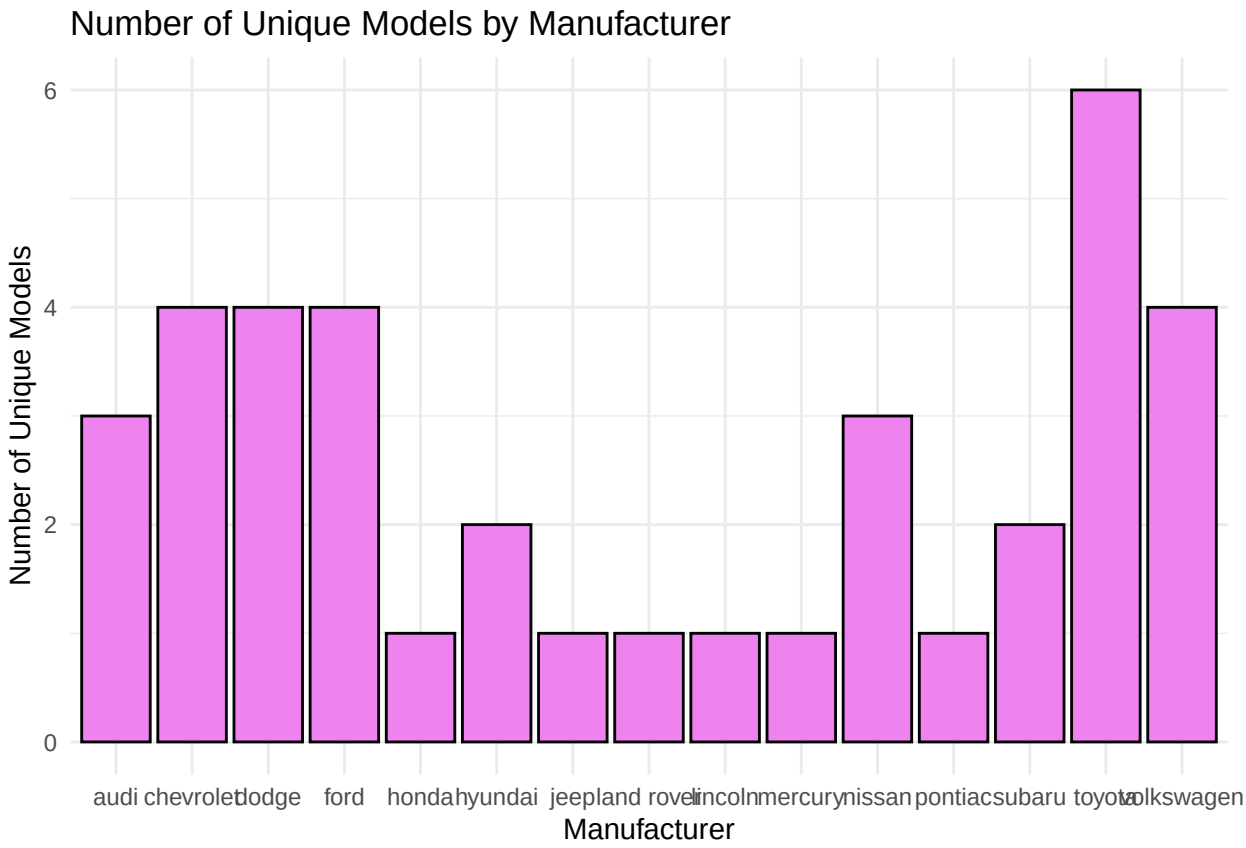
2b. Graph the result by using plot() and ggplot(). Write the codes and its result.

```
par(mfrow = c(1,2))

barplot(manufacturer_counts$unique_model_count, names.arg = manufacturer_counts$manufacturer,
        col = "violet", border = "black", main = "Number of Unique Models by Manufacturer",
        xlab = "Manufacturer", ylab = "Number of Unique Models",
        las = 2)

library(ggplot2)
```

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

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

```
ggplotofUMM <- ggplot(manufacturer_counts, aes(x = manufacturer, y = unique_model_count)) +
  geom_bar(stat = "identity", fill = "violet", color = "black") +
  labs(title = "Number of Unique Models by Manufacturer",
       x = "Manufacturer",
       y = "Number of Unique Models") +
  theme_minimal()
ggplotofUMM

par(mfrow = c(1,1))
```



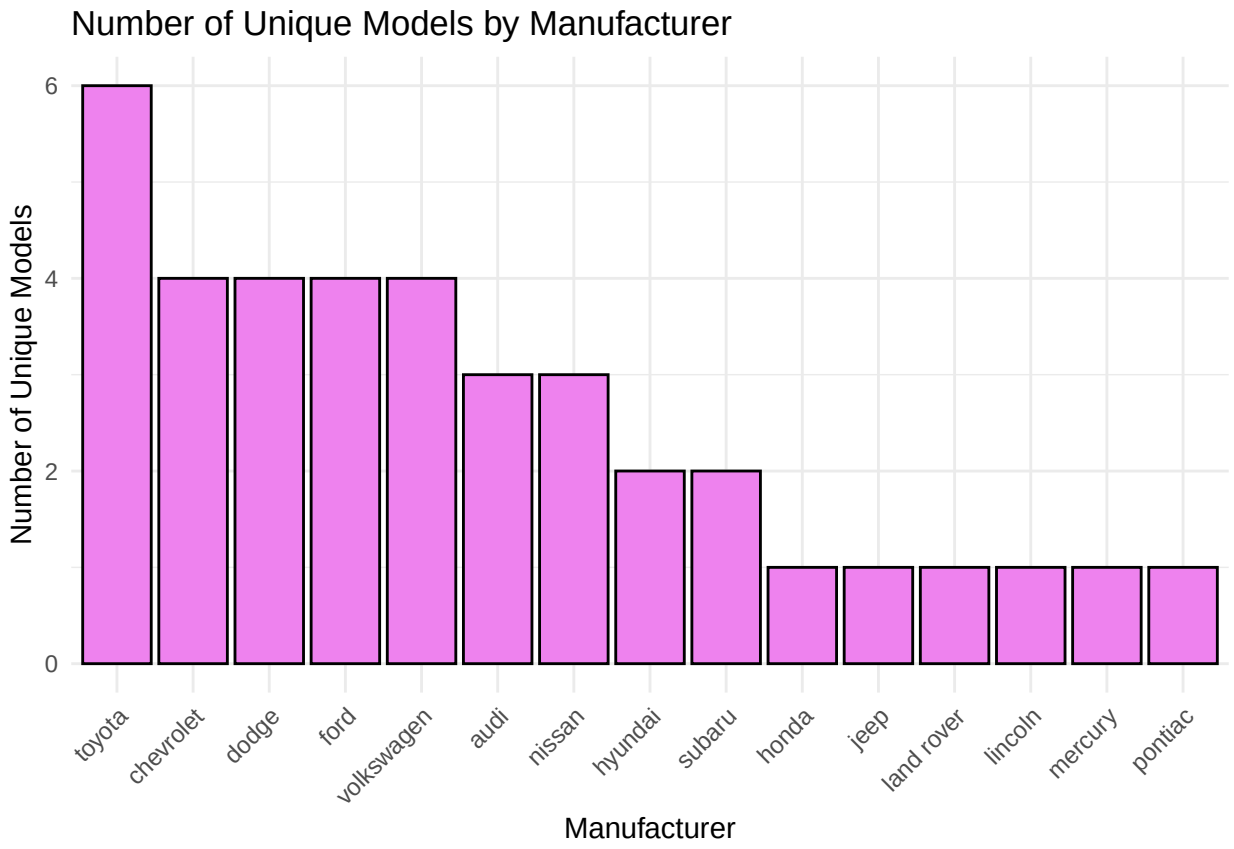

3. Same dataset will be used. You are going to show the relationship of the modeland the manufacturer.

```
manufacturer_model_counts <- mpg %>%
  group_by(mpg$manufacturer, mpg$model) %>%
  summarise(count = n(), .groups = "drop")

manufacturer_model_counts
```

```
## # A tibble: 38 x 3
##    `mpg$manufacturer` `mpg$model`        count
##    <chr>              <chr>              <int>
##  1 audi               a4                     7
##  2 audi               a4 quattro             8
##  3 audi               a6 quattro             3
##  4 chevrolet          c1500 suburban 2wd     5
##  5 chevrolet          corvette               5
##  6 chevrolet          k1500 tahoe 4wd        4
##  7 chevrolet          malibu                 5
##  8 dodge              caravan 2wd           11
##  9 dodge              dakota pickup 4wd      9
## 10 dodge              durango 4wd            7
## # i 28 more rows
```

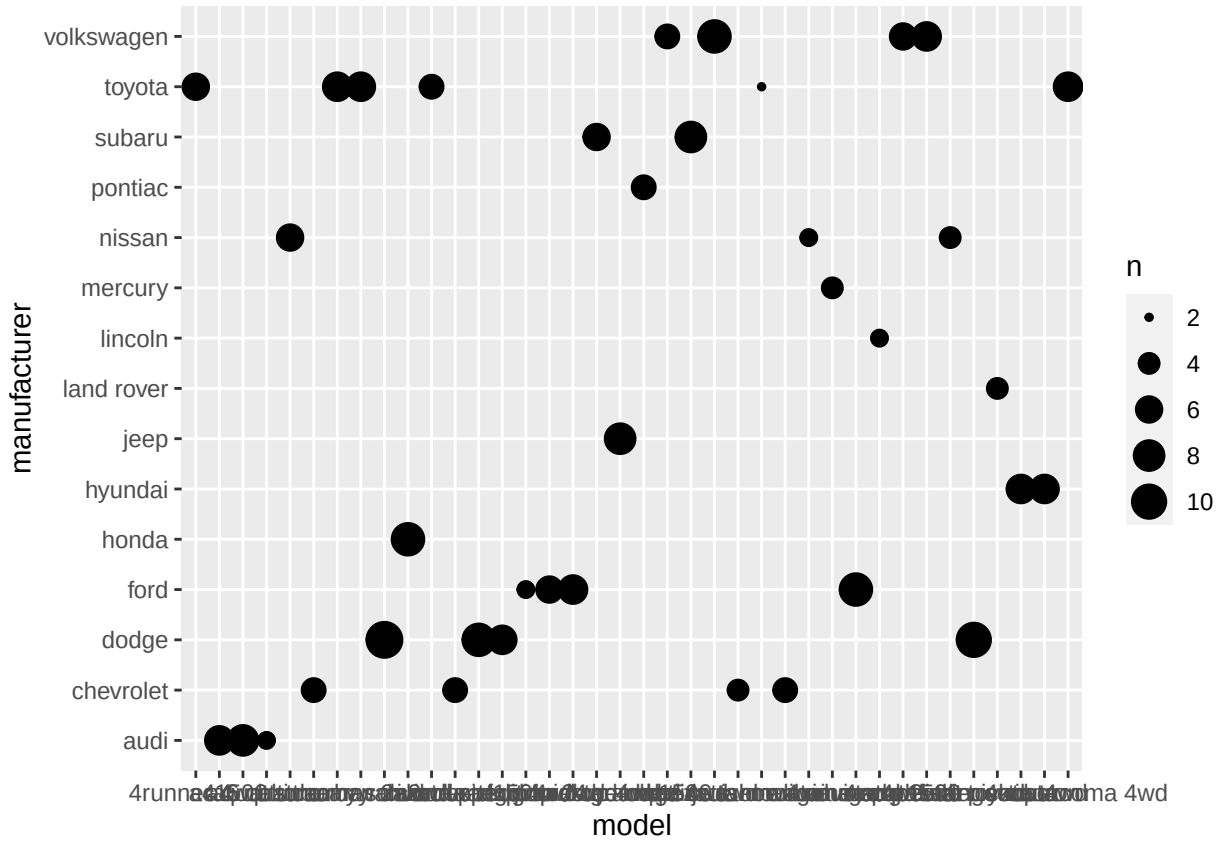
```
ggplot(manufacturer_counts, aes(x = reorder(manufacturer, -unique_model_count), y = unique_model_count)
  geom_bar(stat = "identity", fill = "violet", color = "black") +
  labs(title = "Number of Unique Models by Manufacturer",
       x = "Manufacturer",
       y = "Number of Unique Models") +
```

```
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



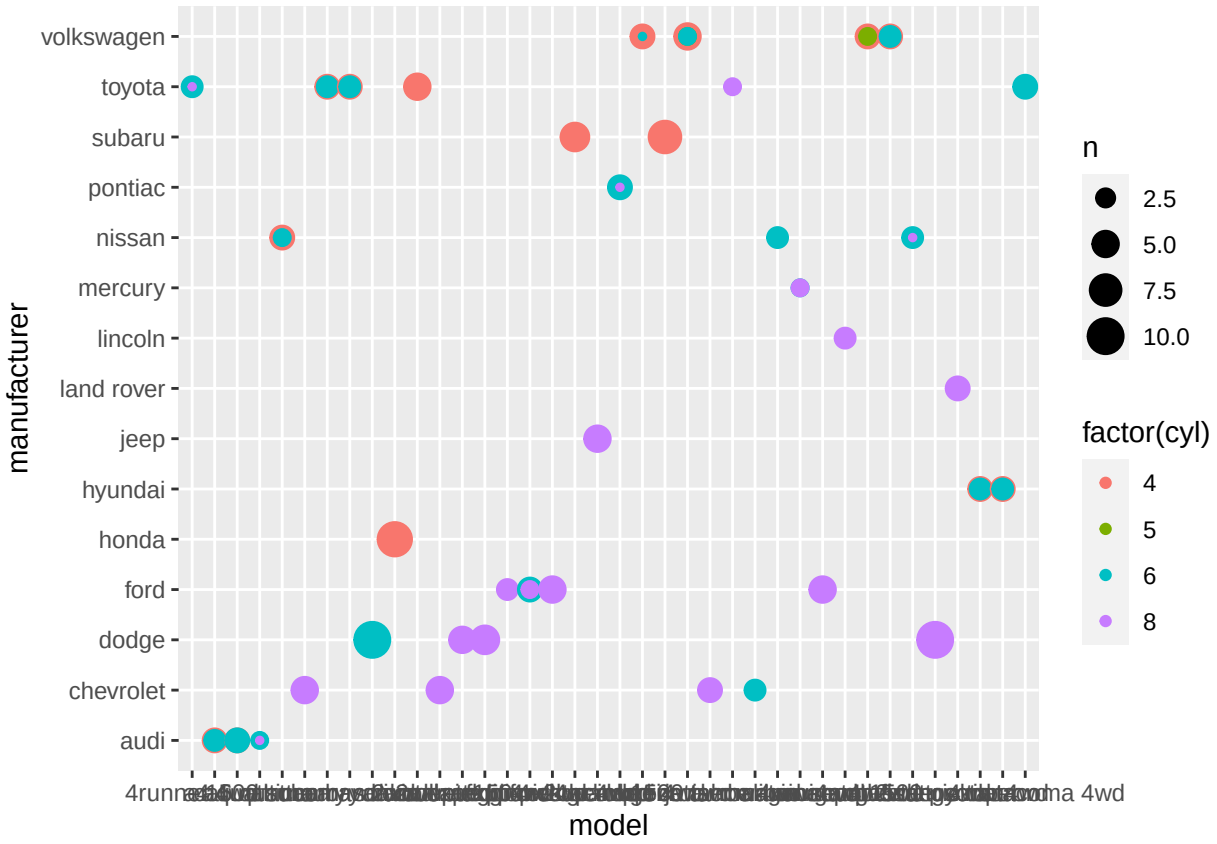

3a. What does ggplot(mpg, aes(model, manufacturer)) + geom_point() show?

```
ggplot(mpg, aes(model, manufacturer)) +
  geom_count()
```



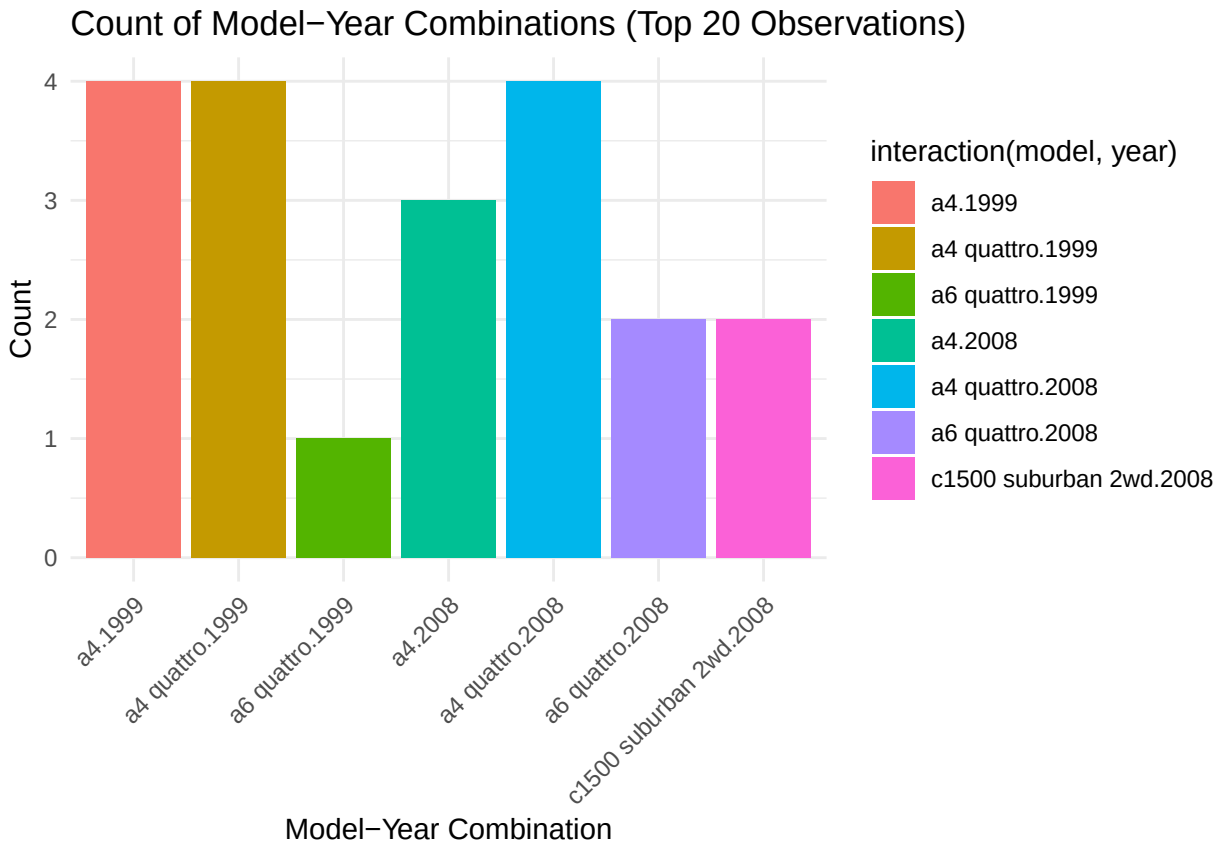

3b. For you, is it useful? If not, how could you modify the data to make it more informative?

```
# not really. I would add color

ggplot(mpg, aes(model, manufacturer, color = factor(cyl))) +
  geom_count()
```




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

```
top_20 <- head(mpg, 20)

ggplot(top_20, aes(x = interaction(model, year), fill = interaction(model, year))) +
  geom_bar() +
  labs(title = "Count of Model-Year Combinations (Top 20 Observations)",
       x = "Model-Year Combination",
       y = "Count") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




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

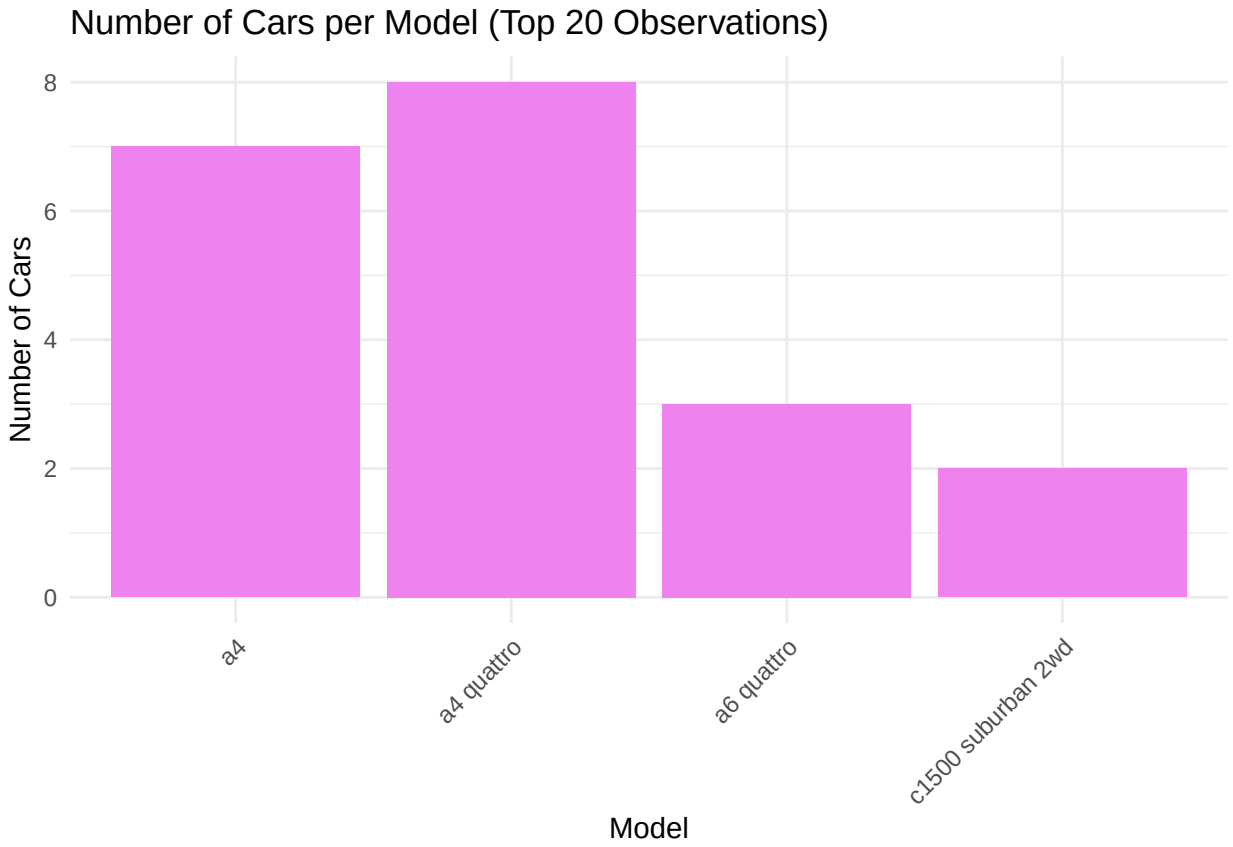
```
cars_per_model <- mpg %>%
  group_by(model) %>%
  summarise(number_of_cars = n())

cars_per_model
```

```
## # A tibble: 38 x 2
##    model              number_of_cars
##    <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. Plot using geom_bar() using the top 20 observations only. The graphs shoudl have a title, labels and colors. Show code and results.

```
top_20 <- head(mpg, 20)
```

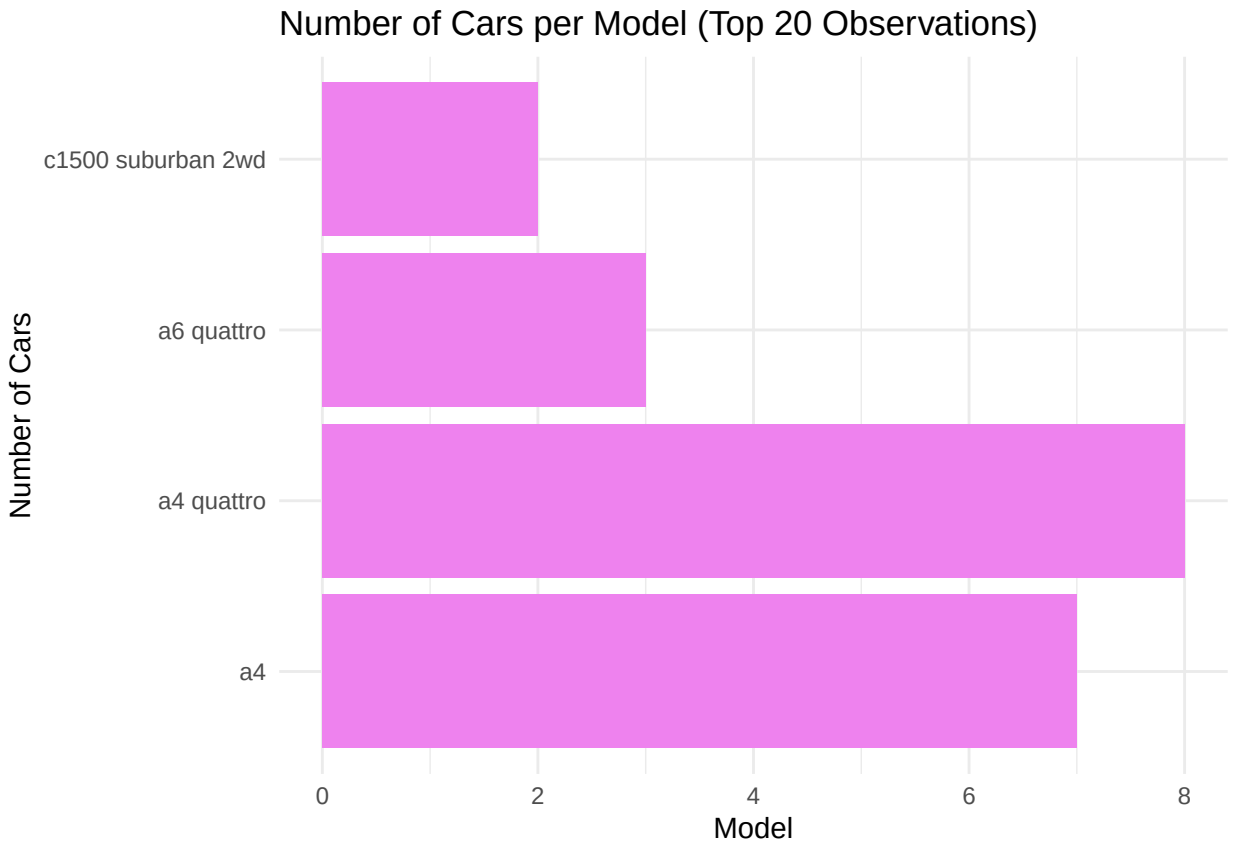
```r
cars_per_model <- top_20 %>%
  group_by(model) %>%
  summarise(number_of_cars = n())

ggplot(cars_per_model, aes(x = model, y = number_of_cars)) +
  geom_bar(stat = "identity", fill = "violet") +
  labs(title = "Number of Cars per Model (Top 20 Observations)",
       x = "Model",
       y = "Number of Cars") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




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

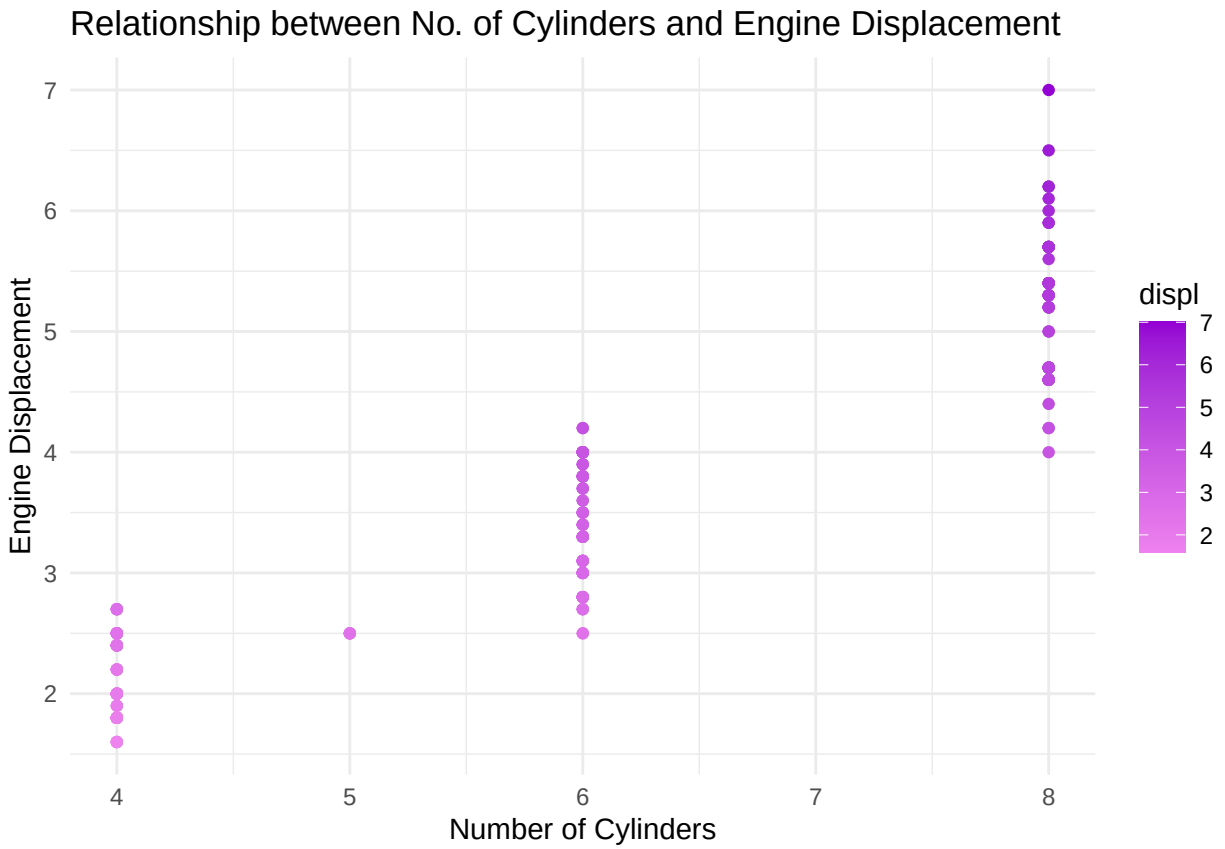
```r
top_20 <- head(mpg, 20)

cars_per_model <- top_20 %>%
  group_by(model) %>%
  summarise(number_of_cars = n())

# Plot the result using geom_bar() with coord_flip()
ggplot(cars_per_model, aes(x = model, y = number_of_cars)) +
  geom_bar(stat = "identity", fill = "violet") +
  labs(title = "Number of Cars per Model (Top 20 Observations)",
       x = "Number of Cars",
       y = "Model") +
  theme_minimal() +
```

```
  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".

```
ggplot(mpg, aes(x = cyl, y = displ, color = displ)) +
  geom_point() +
  scale_color_gradient(low = "violet", high = "darkviolet") +
  labs(title = "Relationship between No. of Cylinders and Engine Displacement",
       x = "Number of Cylinders",
       y = "Engine Displacement") +
  theme_minimal()
```

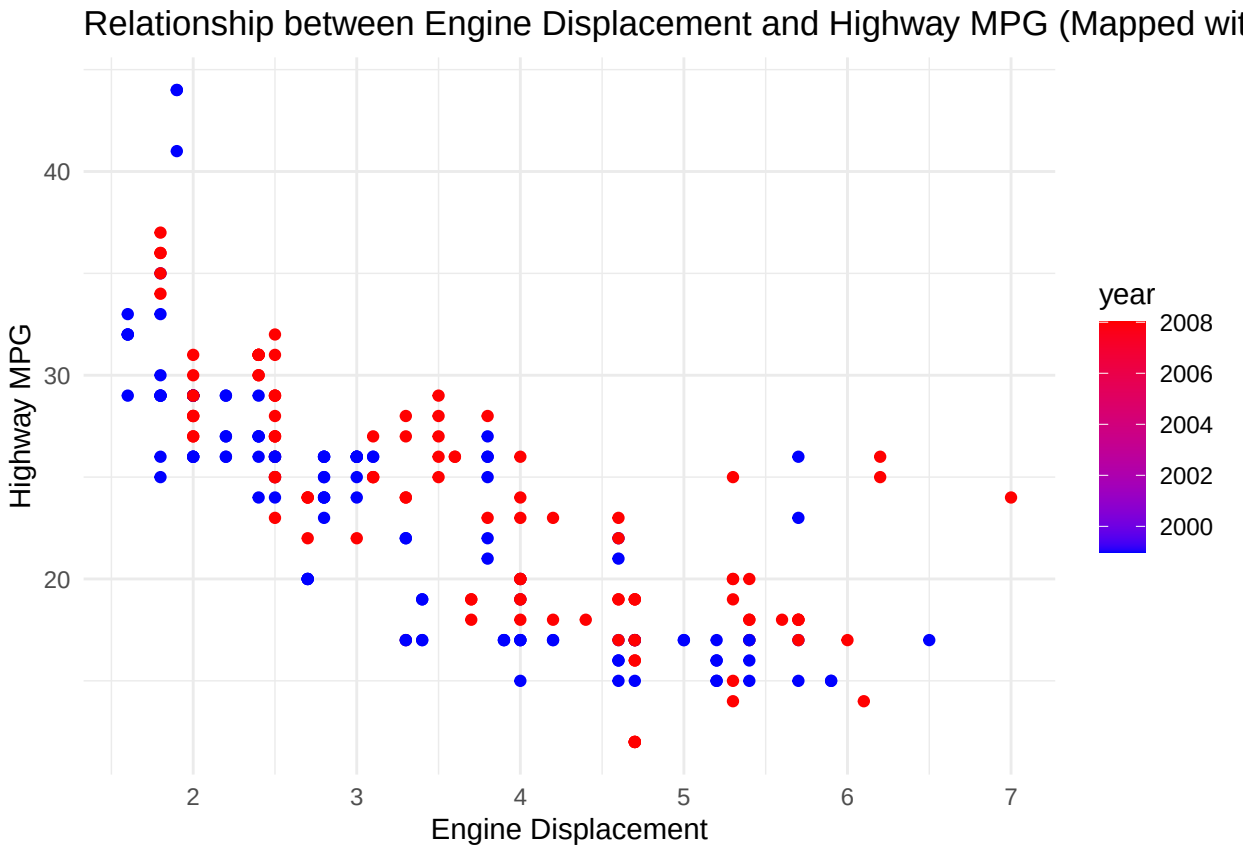



5a. How would you describe its relationship? Show the codes and its result

```
# number of cylenders increases the displacement also increases
```

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?

```
ggplot(mpg, aes(x = displ, y = hwy, color = year)) +
  geom_point() +
  labs(title = "Relationship between Engine Displacement and Highway MPG (Mapped with Year)",
       x = "Engine Displacement",
       y = "Highway MPG") +
  theme_minimal() +
  scale_color_gradient(low = "blue", high = "red")
```




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

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

```
library(readr)
traffic <- 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.
```

```
varoftraffic <- colnames(traffic)

lengthVT <- length(varoftraffic)

# Number of Variables is 4
```

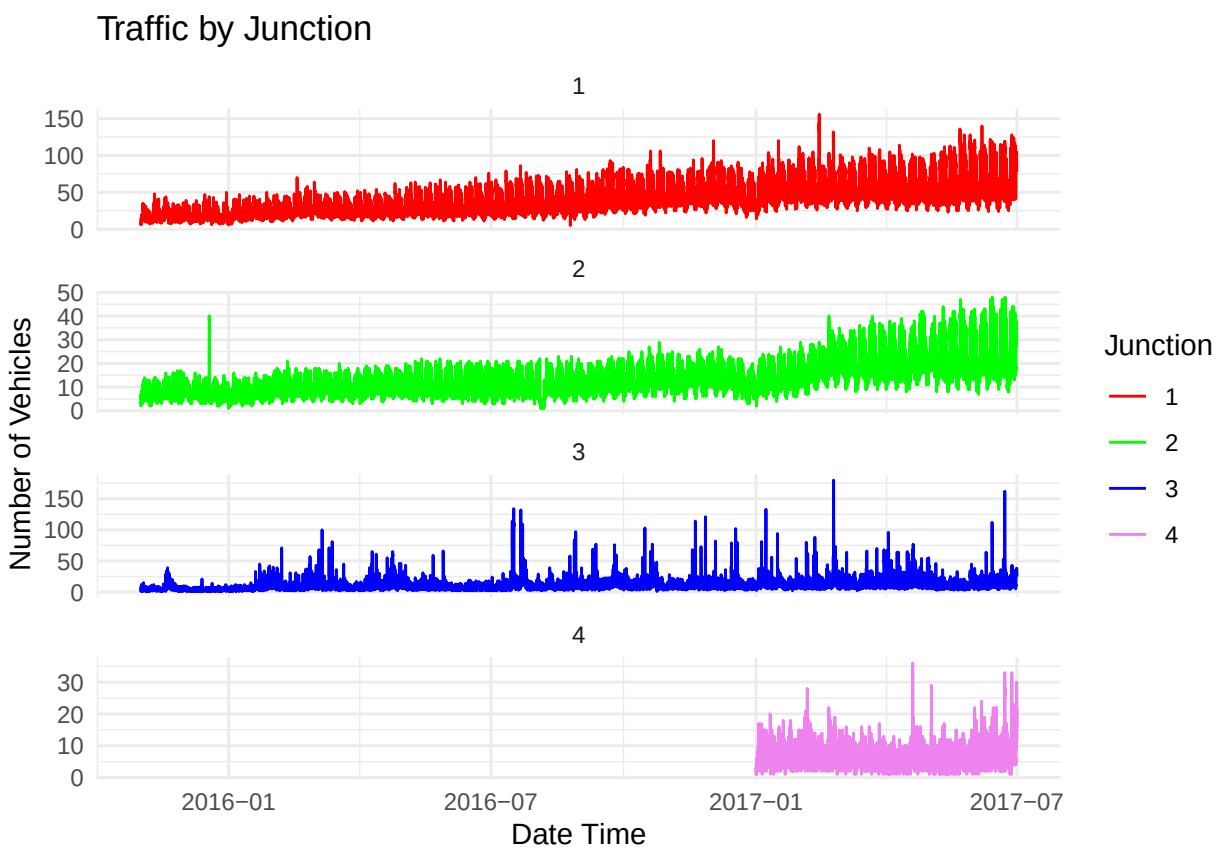
6b. subset the traffic dataset into junctions. What is the R codes and its output?

```
selected_junctions <- c(1, 2, 3, 4)

junction_data <- traffic[traffic$Junction %in% selected_junctions, ]
junction_data
```

```
## # 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
```

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

```r
library(ggplot2)

ggplot(traffic, aes(x = DateTime, y = Vehicles, color = as.factor(Junction))) +
  geom_line() +
  scale_color_manual(values = c("red", "green", "blue", "violet")) +  # Adjust with your colors
  labs(title = "Traffic by Junction",
       x = "Date Time",
       y = "Number of Vehicles") +
  theme_minimal() +
  facet_wrap(~Junction, scales = "free_y", ncol = 1) +
  guides(color = guide_legend(title = "Junction"))
```



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

```
library(readxl)
alexa_file <- read_excel("alexa_file.xlsx")
```

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

```
obsofalex <- nrow(alexa_file)
obsofalex
```

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

```
colofalex <- ncol(alexa_file)
colofalex
```

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

```
cat("Number of Observations:", obsofalex, "\n")
```

```
## Number of Observations: 3150
```

```
cat("Number of Columns:", colofalex, "\n")
```

```
## Number of Columns: 5
```

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

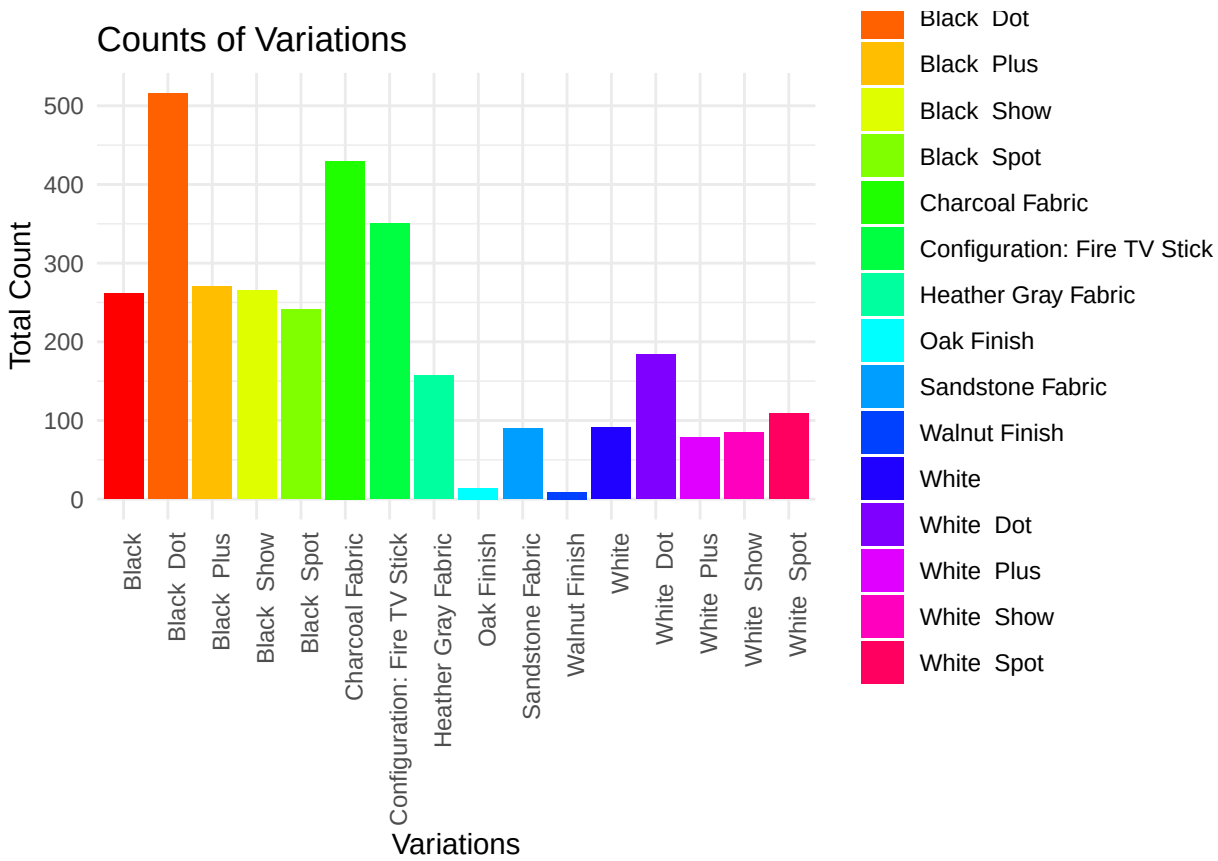
```
library(dplyr)

groupofVar <- alexa_file %>%
  group_by(variation) %>%
  summarise(total_count = n())
groupofVar
```

```
## # A tibble: 16 x 2
##    variation                    total_count
##    <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.

```
result <- alexa_file %>%
  group_by(variation) %>%
```

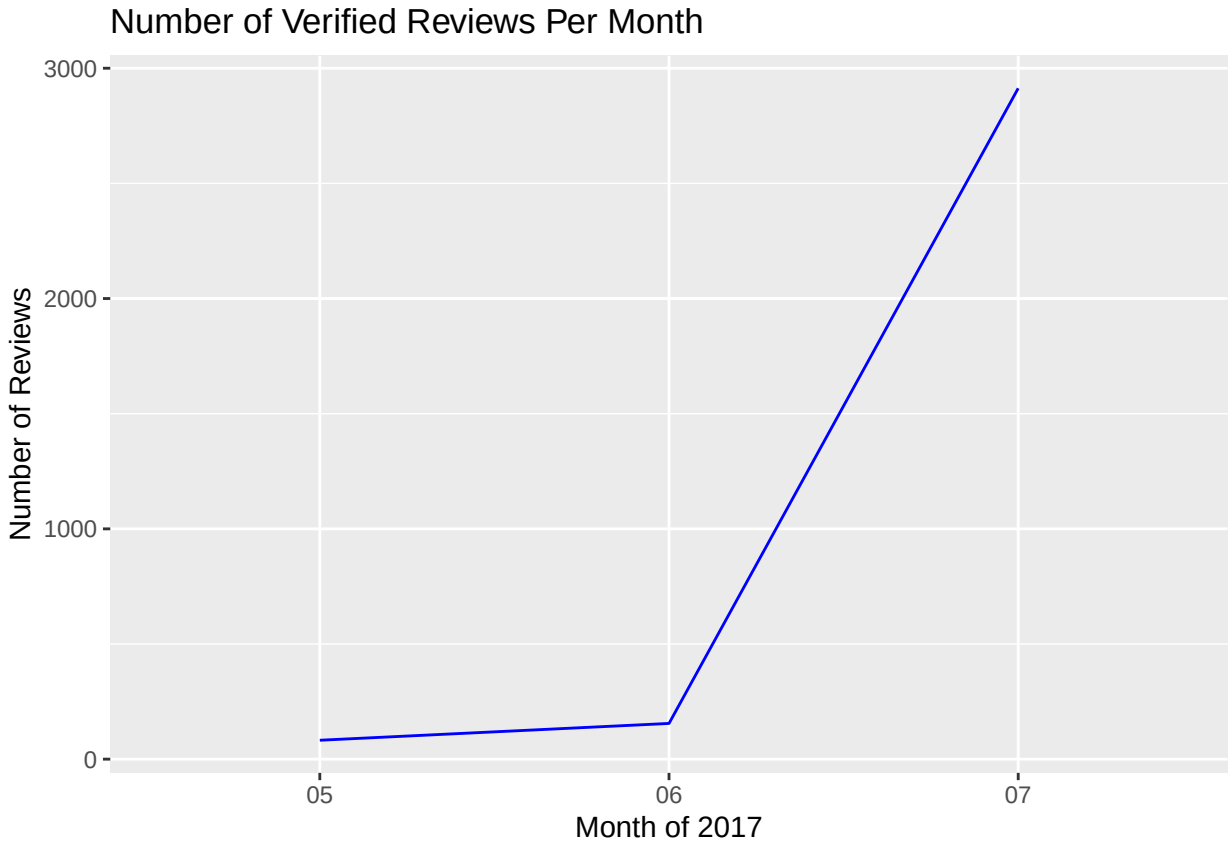
```
  summarise(total_count = n())

plotofVar <- ggplot(result, aes(x = variation, y = total_count, fill = variation)) +
  geom_bar(stat = "identity") +
  scale_fill_manual(values = rainbow(n = nrow(result))) +  # Rainbow colors
  labs(title = "Counts of Variations",
       x = "Variations",
       y = "Total Count") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))

plotofVar
```




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.

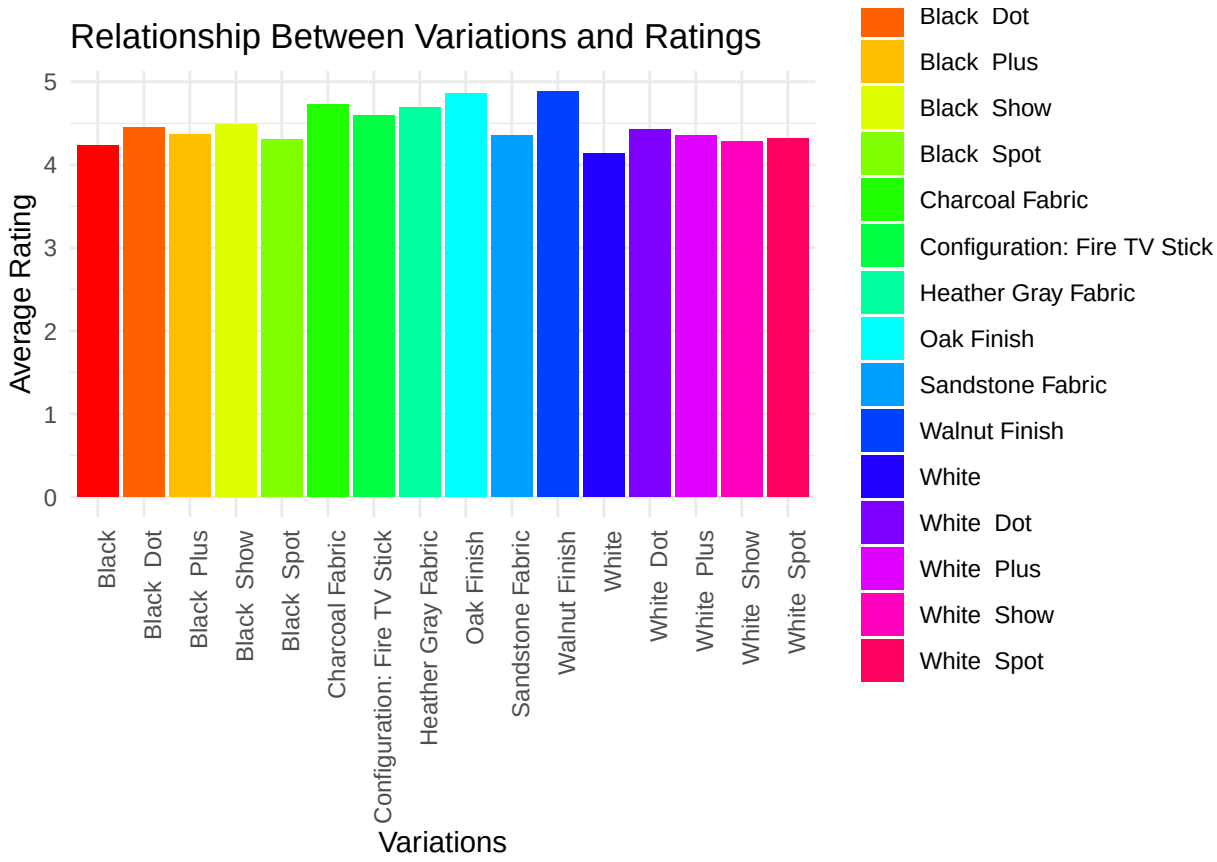
```
alexa_file$date <- as.Date(alexa_file$date)

alexa_file$month <- format(alexa_file$date, "%m")

countsss <- alexa_file %>%
  group_by(month) %>%
  summarise(num_reviews = n())

monthly_review_counts <- table(countsss)

ggplot(countsss, aes(x = month, y = num_reviews, group = 1)) +
```

```
  geom_line(color = "blue") +
  labs(title = "Number of Verified Reviews Per Month",
       x = "Month of 2017", y = "Number of Reviews")
```




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.

```
ggplot(alexa_file, aes(x = variation, y = rating, fill = variation)) +
  geom_bar(stat = "summary", fun = "mean", position = "dodge") +
  scale_fill_manual(values = rainbow(n = length(unique(alexa_file$variation)))) +  # Rainbow colors
  labs(title = "Relationship Between Variations and Ratings",
       x = "Variations",
       y = "Average Rating") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
```




```
variation_ratings <- alexa_file %>%
  group_by(variation) %>%
  summarise(avg_rating = mean(rating, na.rm = TRUE))

topvar <- variation_ratings %>%
  filter(avg_rating == max(avg_rating)) %>%
  pull(variation)

cat("Variation with the Highest Average Rating:", topvar, "\n")
```

```
## Variation with the Highest Average Rating: Walnut Finish
```