RWorksheet_Bagilidad#4c

Ace Bagilidad BSIT 2-C

2023-11-22

1. Use the dataset mpg.

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

```
library(readr)

data_mpg <- read.csv("mpg.csv")
data_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
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## 35   35    chevrolet                malibu   3.1 1999   6   auto(l4)   f  18
## 36   36    chevrolet                malibu   3.5 2008   6   auto(l4)   f  18
## 37   37    chevrolet                malibu   3.6 2008   6   auto(s6)   f  17
## 38   38        dodge            caravan 2wd   2.4 1999   4   auto(l3)   f  18
## 39   39        dodge            caravan 2wd   3.0 1999   6   auto(l4)   f  17
## 40   40        dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16
## 41   41        dodge            caravan 2wd   3.3 1999   6   auto(l4)   f  16
## 42   42        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17
## 43   43        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  17
## 44   44        dodge            caravan 2wd   3.3 2008   6   auto(l4)   f  11
## 45   45        dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15
## 46   46        dodge            caravan 2wd   3.8 1999   6   auto(l4)   f  15
## 47   47        dodge            caravan 2wd   3.8 2008   6   auto(l6)   f  16
## 48   48        dodge            caravan 2wd   4.0 2008   6   auto(l6)   f  16
## 49   49        dodge      dakota pickup 4wd   3.7 2008   6 manual(m6)   4  15
## 50   50        dodge      dakota pickup 4wd   3.7 2008   6   auto(l4)   4  14
## 51   51        dodge      dakota pickup 4wd   3.9 1999   6   auto(l4)   4  13
## 52   52        dodge      dakota pickup 4wd   3.9 1999   6 manual(m5)   4  14
## 53   53        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14
## 54   54        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4  14
## 55   55        dodge      dakota pickup 4wd   4.7 2008   8   auto(l5)   4   9
## 56   56        dodge      dakota pickup 4wd   5.2 1999   8 manual(m5)   4  11
## 57   57        dodge      dakota pickup 4wd   5.2 1999   8   auto(l4)   4  11
## 58   58        dodge            durango 4wd   3.9 1999   6   auto(l4)   4  13
## 59   59        dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13
## 60   60        dodge            durango 4wd   4.7 2008   8   auto(l5)   4   9
## 61   61        dodge            durango 4wd   4.7 2008   8   auto(l5)   4  13
## 62   62        dodge            durango 4wd   5.2 1999   8   auto(l4)   4  11
## 63   63        dodge            durango 4wd   5.7 2008   8   auto(l5)   4  13
## 64   64        dodge            durango 4wd   5.9 1999   8   auto(l4)   4  11
## 65   65        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12
## 66   66        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4   9
## 67   67        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13
## 68   68        dodge    ram 1500 pickup 4wd   4.7 2008   8   auto(l5)   4  13
## 69   69        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4  12
## 70   70        dodge    ram 1500 pickup 4wd   4.7 2008   8 manual(m6)   4   9
## 71   71        dodge    ram 1500 pickup 4wd   5.2 1999   8   auto(l4)   4  11
## 72   72        dodge    ram 1500 pickup 4wd   5.2 1999   8 manual(m5)   4  11
## 73   73        dodge    ram 1500 pickup 4wd   5.7 2008   8   auto(l5)   4  13
## 74   74        dodge    ram 1500 pickup 4wd   5.9 1999   8   auto(l4)   4  11
## 75   75         ford         expedition 2wd   4.6 1999   8   auto(l4)   r  11
## 76   76         ford         expedition 2wd   5.4 1999   8   auto(l4)   r  11
## 77   77         ford         expedition 2wd   5.4 2008   8   auto(l6)   r  12
## 78   78         ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14
## 79   79         ford           explorer 4wd   4.0 1999   6 manual(m5)   4  15
## 80   80         ford           explorer 4wd   4.0 1999   6   auto(l5)   4  14
## 81   81         ford           explorer 4wd   4.0 2008   6   auto(l5)   4  13
## 82   82         ford           explorer 4wd   4.6 2008   8   auto(l6)   4  13
## 83   83         ford           explorer 4wd   5.0 1999   8   auto(l4)   4  13
## 84   84         ford        f150 pickup 4wd   4.2 1999   6   auto(l4)   4  14
## 85   85         ford        f150 pickup 4wd   4.2 1999   6 manual(m5)   4  14
## 86   86         ford        f150 pickup 4wd   4.6 1999   8 manual(m5)   4  13
## 87   87         ford        f150 pickup 4wd   4.6 1999   8   auto(l4)   4  13
## 88   88         ford        f150 pickup 4wd   4.6 2008   8   auto(l4)   4  13
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## 89   89         ford        f150 pickup 4wd   5.4 1999   8   auto(l4)   4  11
## 90   90         ford        f150 pickup 4wd   5.4 2008   8   auto(l4)   4  13
## 91   91         ford                mustang   3.8 1999   6 manual(m5)   r  18
## 92   92         ford                mustang   3.8 1999   6   auto(l4)   r  18
## 93   93         ford                mustang   4.0 2008   6 manual(m5)   r  17
## 94   94         ford                mustang   4.0 2008   6   auto(l5)   r  16
## 95   95         ford                mustang   4.6 1999   8   auto(l4)   r  15
## 96   96         ford                mustang   4.6 1999   8 manual(m5)   r  15
## 97   97         ford                mustang   4.6 2008   8 manual(m5)   r  15
## 98   98         ford                mustang   4.6 2008   8   auto(l5)   r  15
## 99   99         ford                mustang   5.4 2008   8 manual(m6)   r  14
## 100 100        honda                  civic   1.6 1999   4 manual(m5)   f  28
## 101 101        honda                  civic   1.6 1999   4   auto(l4)   f  24
## 102 102        honda                  civic   1.6 1999   4 manual(m5)   f  25
## 103 103        honda                  civic   1.6 1999   4 manual(m5)   f  23
## 104 104        honda                  civic   1.6 1999   4   auto(l4)   f  24
## 105 105        honda                  civic   1.8 2008   4 manual(m5)   f  26
## 106 106        honda                  civic   1.8 2008   4   auto(l5)   f  25
## 107 107        honda                  civic   1.8 2008   4   auto(l5)   f  24
## 108 108        honda                  civic   2.0 2008   4 manual(m6)   f  21
## 109 109      hyundai                 sonata   2.4 1999   4   auto(l4)   f  18
## 110 110      hyundai                 sonata   2.4 1999   4 manual(m5)   f  18
## 111 111      hyundai                 sonata   2.4 2008   4   auto(l4)   f  21
## 112 112      hyundai                 sonata   2.4 2008   4 manual(m5)   f  21
## 113 113      hyundai                 sonata   2.5 1999   6   auto(l4)   f  18
## 114 114      hyundai                 sonata   2.5 1999   6 manual(m5)   f  18
## 115 115      hyundai                 sonata   3.3 2008   6   auto(l5)   f  19
## 116 116      hyundai                tiburon   2.0 1999   4   auto(l4)   f  19
## 117 117      hyundai                tiburon   2.0 1999   4 manual(m5)   f  19
## 118 118      hyundai                tiburon   2.0 2008   4 manual(m5)   f  20
## 119 119      hyundai                tiburon   2.0 2008   4   auto(l4)   f  20
## 120 120      hyundai                tiburon   2.7 2008   6   auto(l4)   f  17
## 121 121      hyundai                tiburon   2.7 2008   6 manual(m6)   f  16
## 122 122      hyundai                tiburon   2.7 2008   6 manual(m5)   f  17
## 123 123         jeep     grand cherokee 4wd   3.0 2008   6   auto(l5)   4  17
## 124 124         jeep     grand cherokee 4wd   3.7 2008   6   auto(l5)   4  15
## 125 125         jeep     grand cherokee 4wd   4.0 1999   6   auto(l4)   4  15
## 126 126         jeep     grand cherokee 4wd   4.7 1999   8   auto(l4)   4  14
## 127 127         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4   9
## 128 128         jeep     grand cherokee 4wd   4.7 2008   8   auto(l5)   4  14
## 129 129         jeep     grand cherokee 4wd   5.7 2008   8   auto(l5)   4  13
## 130 130         jeep     grand cherokee 4wd   6.1 2008   8   auto(l5)   4  11
## 131 131   land rover            range rover   4.0 1999   8   auto(l4)   4  11
## 132 132   land rover            range rover   4.2 2008   8   auto(s6)   4  12
## 133 133   land rover            range rover   4.4 2008   8   auto(s6)   4  12
## 134 134   land rover            range rover   4.6 1999   8   auto(l4)   4  11
## 135 135      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11
## 136 136      lincoln          navigator 2wd   5.4 1999   8   auto(l4)   r  11
## 137 137      lincoln          navigator 2wd   5.4 2008   8   auto(l6)   r  12
## 138 138      mercury        mountaineer 4wd   4.0 1999   6   auto(l5)   4  14
## 139 139      mercury        mountaineer 4wd   4.0 2008   6   auto(l5)   4  13
## 140 140      mercury        mountaineer 4wd   4.6 2008   8   auto(l6)   4  13
## 141 141      mercury        mountaineer 4wd   5.0 1999   8   auto(l4)   4  13
## 142 142       nissan                 altima   2.4 1999   4 manual(m5)   f  21
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## 143 143       nissan                altima   2.4 1999   4   auto(l4)   f  19
## 144 144       nissan                altima   2.5 2008   4   auto(av)   f  23
## 145 145       nissan                altima   2.5 2008   4 manual(m6)   f  23
## 146 146       nissan                altima   3.5 2008   6 manual(m6)   f  19
## 147 147       nissan                altima   3.5 2008   6   auto(av)   f  19
## 148 148       nissan                maxima   3.0 1999   6   auto(l4)   f  18
## 149 149       nissan                maxima   3.0 1999   6 manual(m5)   f  19
## 150 150       nissan                maxima   3.5 2008   6   auto(av)   f  19
## 151 151       nissan         pathfinder 4wd   3.3 1999   6   auto(l4)   4  14
## 152 152       nissan         pathfinder 4wd   3.3 1999   6 manual(m5)   4  15
## 153 153       nissan         pathfinder 4wd   4.0 2008   6   auto(l5)   4  14
## 154 154       nissan         pathfinder 4wd   5.6 2008   8   auto(s5)   4  12
## 155 155      pontiac             grand prix   3.1 1999   6   auto(l4)   f  18
## 156 156      pontiac             grand prix   3.8 1999   6   auto(l4)   f  16
## 157 157      pontiac             grand prix   3.8 1999   6   auto(l4)   f  17
## 158 158      pontiac             grand prix   3.8 2008   6   auto(l4)   f  18
## 159 159      pontiac             grand prix   5.3 2008   8   auto(s4)   f  16
## 160 160       subaru           forester awd   2.5 1999   4 manual(m5)   4  18
## 161 161       subaru           forester awd   2.5 1999   4   auto(l4)   4  18
## 162 162       subaru           forester awd   2.5 2008   4 manual(m5)   4  20
## 163 163       subaru           forester awd   2.5 2008   4 manual(m5)   4  19
## 164 164       subaru           forester awd   2.5 2008   4   auto(l4)   4  20
## 165 165       subaru           forester awd   2.5 2008   4   auto(l4)   4  18
## 166 166       subaru            impreza awd   2.2 1999   4   auto(l4)   4  21
## 167 167       subaru            impreza awd   2.2 1999   4 manual(m5)   4  19
## 168 168       subaru            impreza awd   2.5 1999   4 manual(m5)   4  19
## 169 169       subaru            impreza awd   2.5 1999   4   auto(l4)   4  19
## 170 170       subaru            impreza awd   2.5 2008   4   auto(s4)   4  20
## 171 171       subaru            impreza awd   2.5 2008   4   auto(s4)   4  20
## 172 172       subaru            impreza awd   2.5 2008   4 manual(m5)   4  19
## 173 173       subaru            impreza awd   2.5 2008   4 manual(m5)   4  20
## 174 174       toyota            4runner 4wd   2.7 1999   4 manual(m5)   4  15
## 175 175       toyota            4runner 4wd   2.7 1999   4   auto(l4)   4  16
## 176 176       toyota            4runner 4wd   3.4 1999   6   auto(l4)   4  15
## 177 177       toyota            4runner 4wd   3.4 1999   6 manual(m5)   4  15
## 178 178       toyota            4runner 4wd   4.0 2008   6   auto(l5)   4  16
## 179 179       toyota            4runner 4wd   4.7 2008   8   auto(l5)   4  14
## 180 180       toyota                  camry   2.2 1999   4 manual(m5)   f  21
## 181 181       toyota                  camry   2.2 1999   4   auto(l4)   f  21
## 182 182       toyota                  camry   2.4 2008   4 manual(m5)   f  21
## 183 183       toyota                  camry   2.4 2008   4   auto(l5)   f  21
## 184 184       toyota                  camry   3.0 1999   6   auto(l4)   f  18
## 185 185       toyota                  camry   3.0 1999   6 manual(m5)   f  18
## 186 186       toyota                  camry   3.5 2008   6   auto(s6)   f  19
## 187 187       toyota           camry solara   2.2 1999   4   auto(l4)   f  21
## 188 188       toyota           camry solara   2.2 1999   4 manual(m5)   f  21
## 189 189       toyota           camry solara   2.4 2008   4 manual(m5)   f  21
## 190 190       toyota           camry solara   2.4 2008   4   auto(s5)   f  22
## 191 191       toyota           camry solara   3.0 1999   6   auto(l4)   f  18
## 192 192       toyota           camry solara   3.0 1999   6 manual(m5)   f  18
## 193 193       toyota           camry solara   3.3 2008   6   auto(s5)   f  18
## 194 194       toyota                corolla   1.8 1999   4   auto(l3)   f  24
## 195 195       toyota                corolla   1.8 1999   4   auto(l4)   f  24
## 196 196       toyota                corolla   1.8 1999   4 manual(m5)   f  26
```

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## 197 197       toyota                corolla   1.8 2008   4 manual(m5)   f  28
## 198 198       toyota                corolla   1.8 2008   4   auto(l4)   f  26
## 199 199       toyota land cruiser wagon 4wd   4.7 1999   8   auto(l4)   4  11
## 200 200       toyota land cruiser wagon 4wd   5.7 2008   8   auto(s6)   4  13
## 201 201       toyota      toyota tacoma 4wd   2.7 1999   4 manual(m5)   4  15
## 202 202       toyota      toyota tacoma 4wd   2.7 1999   4   auto(l4)   4  16
## 203 203       toyota      toyota tacoma 4wd   2.7 2008   4 manual(m5)   4  17
## 204 204       toyota      toyota tacoma 4wd   3.4 1999   6 manual(m5)   4  15
## 205 205       toyota      toyota tacoma 4wd   3.4 1999   6   auto(l4)   4  15
## 206 206       toyota      toyota tacoma 4wd   4.0 2008   6 manual(m6)   4  15
## 207 207       toyota      toyota tacoma 4wd   4.0 2008   6   auto(l5)   4  16
## 208 208   volkswagen                   gti   2.0 1999   4 manual(m5)   f  21
## 209 209   volkswagen                   gti   2.0 1999   4   auto(l4)   f  19
## 210 210   volkswagen                   gti   2.0 2008   4 manual(m6)   f  21
## 211 211   volkswagen                   gti   2.0 2008   4   auto(s6)   f  22
## 212 212   volkswagen                   gti   2.8 1999   6 manual(m5)   f  17
## 213 213   volkswagen                 jetta   1.9 1999   4 manual(m5)   f  33
## 214 214   volkswagen                 jetta   2.0 1999   4 manual(m5)   f  21
## 215 215   volkswagen                 jetta   2.0 1999   4   auto(l4)   f  19
## 216 216   volkswagen                 jetta   2.0 2008   4   auto(s6)   f  22
## 217 217   volkswagen                 jetta   2.0 2008   4 manual(m6)   f  21
## 218 218   volkswagen                 jetta   2.5 2008   5   auto(s6)   f  21
## 219 219   volkswagen                 jetta   2.5 2008   5 manual(m5)   f  21
## 220 220   volkswagen                 jetta   2.8 1999   6   auto(l4)   f  16
## 221 221   volkswagen                 jetta   2.8 1999   6 manual(m5)   f  17
## 222 222   volkswagen            new beetle   1.9 1999   4 manual(m5)   f  35
## 223 223   volkswagen            new beetle   1.9 1999   4   auto(l4)   f  29
## 224 224   volkswagen            new beetle   2.0 1999   4 manual(m5)   f  21
## 225 225   volkswagen            new beetle   2.0 1999   4   auto(l4)   f  19
## 226 226   volkswagen            new beetle   2.5 2008   5 manual(m5)   f  20
## 227 227   volkswagen            new beetle   2.5 2008   5   auto(s6)   f  20
## 228 228   volkswagen                passat   1.8 1999   4 manual(m5)   f  21
## 229 229   volkswagen                passat   1.8 1999   4   auto(l5)   f  18
## 230 230   volkswagen                passat   2.0 2008   4   auto(s6)   f  19
## 231 231   volkswagen                passat   2.0 2008   4 manual(m6)   f  21
## 232 232   volkswagen                passat   2.8 1999   6   auto(l5)   f  16
## 233 233   volkswagen                passat   2.8 1999   6 manual(m5)   f  18
## 234 234   volkswagen                passat   3.6 2008   6   auto(s6)   f  17
##     hwy fl      class
## 1    29  p    compact
## 2    29  p    compact
## 3    31  p    compact
## 4    30  p    compact
## 5    26  p    compact
## 6    26  p    compact
## 7    27  p    compact
## 8    26  p    compact
## 9    25  p    compact
## 10   28  p    compact
## 11   27  p    compact
## 12   25  p    compact
## 13   25  p    compact
## 14   25  p    compact
## 15   25  p    compact
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## 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
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## 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
```

b. Which variables from mpg dataset are categorical?

From the data mpg, the categorical data are the following: 1. Transmission(trans)
2. Model
3. Displacement(displ)
4. Drive Train(drv)
5. class

```
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
```

```
data(mpg)
```

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

```
categorical_columns <- data_mpg %>% select_if(is.factor) %>% colnames()

# Print the categorical columns
print(categorical_columns)
```

```
## character(0)
```

c. Which are continuous variables?

2. Which manufacturer has the most models in this data set? Which model has the most variations? Show your answer. Ans. The manufacturer with the most model is: dodge The model with the most variations is: caravan 2wd

```
manufacturer_table <- table(data_mpg$manufacturer)


#getting the most model
maxModel_Manufacturer <- as.character(names(manufacturer_table))[which.max(manufacturer_table)]

cat("The manufacturer with the most model is: ",maxModel_Manufacturer,"\n")
```

```
## The manufacturer with the most model is:  dodge
```

```
model_table <- table(data_mpg$model)
maxVariation_Model <- as.character(names(model_table))[which.max(model_table)]

cat("The model with the most variations is: ",maxVariation_Model)
```

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

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

```r
library(dplyr)
models <- data.frame(Manufacturer = data_mpg$manufacturer,
                     Model = data_mpg$model)
models
```

```
##     Manufacturer                 Model
## 1           audi                    a4
## 2           audi                    a4
## 3           audi                    a4
## 4           audi                    a4
## 5           audi                    a4
## 6           audi                    a4
## 7           audi                    a4
## 8           audi             a4 quattro
## 9           audi             a4 quattro
## 10          audi             a4 quattro
## 11          audi             a4 quattro
## 12          audi             a4 quattro
## 13          audi             a4 quattro
## 14          audi             a4 quattro
## 15          audi             a4 quattro
## 16          audi             a6 quattro
## 17          audi             a6 quattro
## 18          audi             a6 quattro
## 19     chevrolet     c1500 suburban 2wd
## 20     chevrolet     c1500 suburban 2wd
## 21     chevrolet     c1500 suburban 2wd
## 22     chevrolet     c1500 suburban 2wd
## 23     chevrolet     c1500 suburban 2wd
## 24     chevrolet               corvette
## 25     chevrolet               corvette
## 26     chevrolet               corvette
## 27     chevrolet               corvette
## 28     chevrolet               corvette
## 29     chevrolet        k1500 tahoe 4wd
## 30     chevrolet        k1500 tahoe 4wd
## 31     chevrolet        k1500 tahoe 4wd
## 32     chevrolet        k1500 tahoe 4wd
## 33     chevrolet                 malibu
## 34     chevrolet                 malibu
## 35     chevrolet                 malibu
## 36     chevrolet                 malibu
## 37     chevrolet                 malibu
## 38         dodge            caravan 2wd
## 39         dodge            caravan 2wd
## 40         dodge            caravan 2wd
## 41         dodge            caravan 2wd
## 42         dodge            caravan 2wd
## 43         dodge            caravan 2wd
## 44         dodge            caravan 2wd
## 45         dodge            caravan 2wd
## 46         dodge            caravan 2wd
## 47         dodge            caravan 2wd
## 48         dodge            caravan 2wd
```

```
## 49         dodge      dakota pickup 4wd
## 50         dodge      dakota pickup 4wd
## 51         dodge      dakota pickup 4wd
## 52         dodge      dakota pickup 4wd
## 53         dodge      dakota pickup 4wd
## 54         dodge      dakota pickup 4wd
## 55         dodge      dakota pickup 4wd
## 56         dodge      dakota pickup 4wd
## 57         dodge      dakota pickup 4wd
## 58         dodge            durango 4wd
## 59         dodge            durango 4wd
## 60         dodge            durango 4wd
## 61         dodge            durango 4wd
## 62         dodge            durango 4wd
## 63         dodge            durango 4wd
## 64         dodge            durango 4wd
## 65         dodge    ram 1500 pickup 4wd
## 66         dodge    ram 1500 pickup 4wd
## 67         dodge    ram 1500 pickup 4wd
## 68         dodge    ram 1500 pickup 4wd
## 69         dodge    ram 1500 pickup 4wd
## 70         dodge    ram 1500 pickup 4wd
## 71         dodge    ram 1500 pickup 4wd
## 72         dodge    ram 1500 pickup 4wd
## 73         dodge    ram 1500 pickup 4wd
## 74         dodge    ram 1500 pickup 4wd
## 75          ford         expedition 2wd
## 76          ford         expedition 2wd
## 77          ford         expedition 2wd
## 78          ford           explorer 4wd
## 79          ford           explorer 4wd
## 80          ford           explorer 4wd
## 81          ford           explorer 4wd
## 82          ford           explorer 4wd
## 83          ford           explorer 4wd
## 84          ford        f150 pickup 4wd
## 85          ford        f150 pickup 4wd
## 86          ford        f150 pickup 4wd
## 87          ford        f150 pickup 4wd
## 88          ford        f150 pickup 4wd
## 89          ford        f150 pickup 4wd
## 90          ford        f150 pickup 4wd
## 91          ford                mustang
## 92          ford                mustang
## 93          ford                mustang
## 94          ford                mustang
## 95          ford                mustang
## 96          ford                mustang
## 97          ford                mustang
## 98          ford                mustang
## 99          ford                mustang
## 100        honda                  civic
## 101        honda                  civic
## 102        honda                  civic
```

```
## 103        honda                 civic
## 104        honda                 civic
## 105        honda                 civic
## 106        honda                 civic
## 107        honda                 civic
## 108        honda                 civic
## 109      hyundai                sonata
## 110      hyundai                sonata
## 111      hyundai                sonata
## 112      hyundai                sonata
## 113      hyundai                sonata
## 114      hyundai                sonata
## 115      hyundai                sonata
## 116      hyundai               tiburon
## 117      hyundai               tiburon
## 118      hyundai               tiburon
## 119      hyundai               tiburon
## 120      hyundai               tiburon
## 121      hyundai               tiburon
## 122      hyundai               tiburon
## 123         jeep     grand cherokee 4wd
## 124         jeep     grand cherokee 4wd
## 125         jeep     grand cherokee 4wd
## 126         jeep     grand cherokee 4wd
## 127         jeep     grand cherokee 4wd
## 128         jeep     grand cherokee 4wd
## 129         jeep     grand cherokee 4wd
## 130         jeep     grand cherokee 4wd
## 131   land rover            range rover
## 132   land rover            range rover
## 133   land rover            range rover
## 134   land rover            range rover
## 135      lincoln          navigator 2wd
## 136      lincoln          navigator 2wd
## 137      lincoln          navigator 2wd
## 138      mercury        mountaineer 4wd
## 139      mercury        mountaineer 4wd
## 140      mercury        mountaineer 4wd
## 141      mercury        mountaineer 4wd
## 142       nissan                altima
## 143       nissan                altima
## 144       nissan                altima
## 145       nissan                altima
## 146       nissan                altima
## 147       nissan                altima
## 148       nissan                maxima
## 149       nissan                maxima
## 150       nissan                maxima
## 151       nissan         pathfinder 4wd
## 152       nissan         pathfinder 4wd
## 153       nissan         pathfinder 4wd
## 154       nissan         pathfinder 4wd
## 155      pontiac             grand prix
## 156      pontiac             grand prix
```

```
## 157      pontiac             grand prix
## 158      pontiac             grand prix
## 159      pontiac             grand prix
## 160       subaru           forester awd
## 161       subaru           forester awd
## 162       subaru           forester awd
## 163       subaru           forester awd
## 164       subaru           forester awd
## 165       subaru           forester awd
## 166       subaru            impreza awd
## 167       subaru            impreza awd
## 168       subaru            impreza awd
## 169       subaru            impreza awd
## 170       subaru            impreza awd
## 171       subaru            impreza awd
## 172       subaru            impreza awd
## 173       subaru            impreza awd
## 174       toyota            4runner 4wd
## 175       toyota            4runner 4wd
## 176       toyota            4runner 4wd
## 177       toyota            4runner 4wd
## 178       toyota            4runner 4wd
## 179       toyota            4runner 4wd
## 180       toyota                   camry
## 181       toyota                   camry
## 182       toyota                   camry
## 183       toyota                   camry
## 184       toyota                   camry
## 185       toyota                   camry
## 186       toyota                   camry
## 187       toyota           camry solara
## 188       toyota           camry solara
## 189       toyota           camry solara
## 190       toyota           camry solara
## 191       toyota           camry solara
## 192       toyota           camry solara
## 193       toyota           camry solara
## 194       toyota                corolla
## 195       toyota                corolla
## 196       toyota                corolla
## 197       toyota                corolla
## 198       toyota                corolla
## 199       toyota land cruiser wagon 4wd
## 200       toyota land cruiser wagon 4wd
## 201       toyota      toyota tacoma 4wd
## 202       toyota      toyota tacoma 4wd
## 203       toyota      toyota tacoma 4wd
## 204       toyota      toyota tacoma 4wd
## 205       toyota      toyota tacoma 4wd
## 206       toyota      toyota tacoma 4wd
## 207       toyota      toyota tacoma 4wd
## 208   volkswagen                   gti
## 209   volkswagen                   gti
## 210   volkswagen                   gti
```

```
## 211   volkswagen                  gti
## 212   volkswagen                  gti
## 213   volkswagen                jetta
## 214   volkswagen                jetta
## 215   volkswagen                jetta
## 216   volkswagen                jetta
## 217   volkswagen                jetta
## 218   volkswagen                jetta
## 219   volkswagen                jetta
## 220   volkswagen                jetta
## 221   volkswagen                jetta
## 222   volkswagen            new beetle
## 223   volkswagen            new beetle
## 224   volkswagen            new beetle
## 225   volkswagen            new beetle
## 226   volkswagen            new beetle
## 227   volkswagen            new beetle
## 228   volkswagen                passat
## 229   volkswagen                passat
## 230   volkswagen                passat
## 231   volkswagen                passat
## 232   volkswagen                passat
## 233   volkswagen                passat
## 234   volkswagen                passat
```

```
unique_models <- unique(models)
unique_models
```

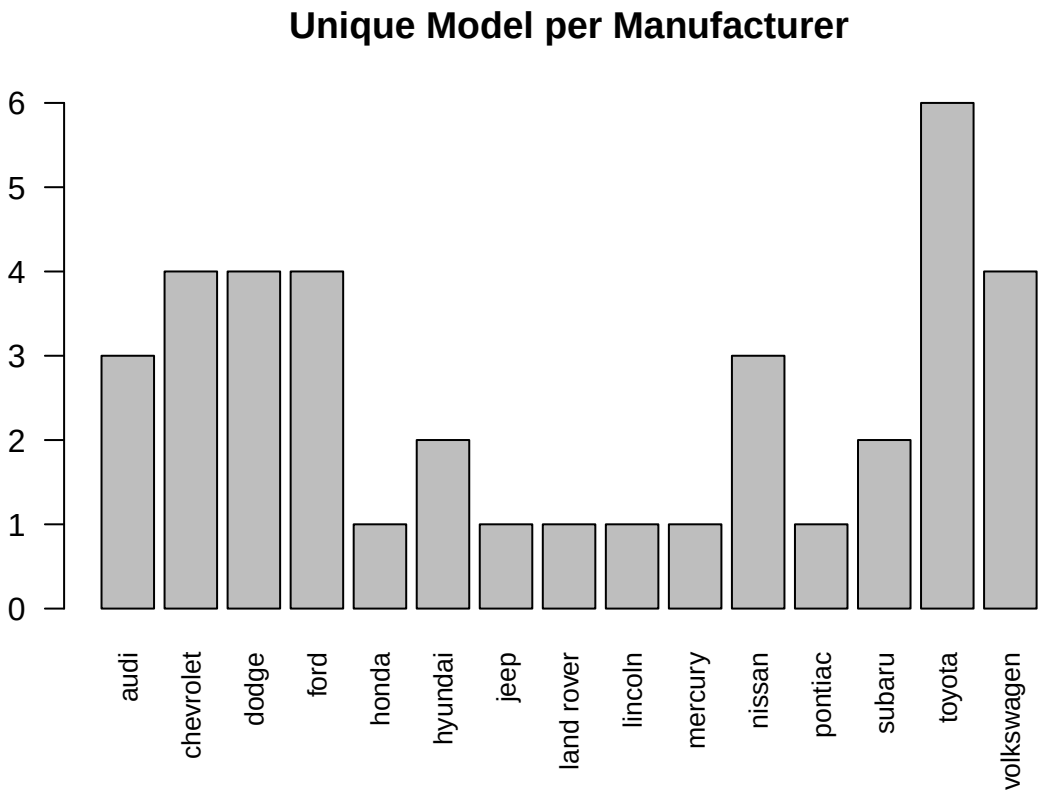
```
##     Manufacturer                 Model
## 1           audi                    a4
## 8           audi             a4 quattro
## 16          audi             a6 quattro
## 19     chevrolet     c1500 suburban 2wd
## 24     chevrolet              corvette
## 29     chevrolet        k1500 tahoe 4wd
## 33     chevrolet                malibu
## 38         dodge            caravan 2wd
## 49         dodge      dakota pickup 4wd
## 58         dodge            durango 4wd
## 65         dodge    ram 1500 pickup 4wd
## 75          ford         expedition 2wd
## 78          ford           explorer 4wd
## 84          ford        f150 pickup 4wd
## 91          ford                mustang
## 100        honda                  civic
## 109      hyundai                 sonata
## 116      hyundai               tiburon
## 123         jeep     grand cherokee 4wd
## 131   land rover            range rover
## 135      lincoln          navigator 2wd
## 138      mercury        mountaineer 4wd
## 142       nissan                altima
## 148       nissan                maxima
## 151       nissan         pathfinder 4wd
## 155      pontiac             grand prix
```

```
## 160       subaru           forester awd
## 166       subaru            impreza awd
## 174       toyota            4runner 4wd
## 180       toyota                 camry
## 187       toyota           camry solara
## 194       toyota                corolla
## 199       toyota land cruiser wagon 4wd
## 201       toyota      toyota tacoma 4wd
## 208   volkswagen                   gti
## 213   volkswagen                 jetta
## 222   volkswagen             new beetle
## 228   volkswagen                 passat
```

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

```
library(ggplot2)
factor_UniqueModels <- as.factor(unique_models$Manufacturer)
plotUnique_Models <- plot(as.factor(factor_UniqueModels),
                          main = "Unique Model per Manufacturer",

                          cex.names = 0.8,
                          las = 2)
```




```
plotUnique_Models
```

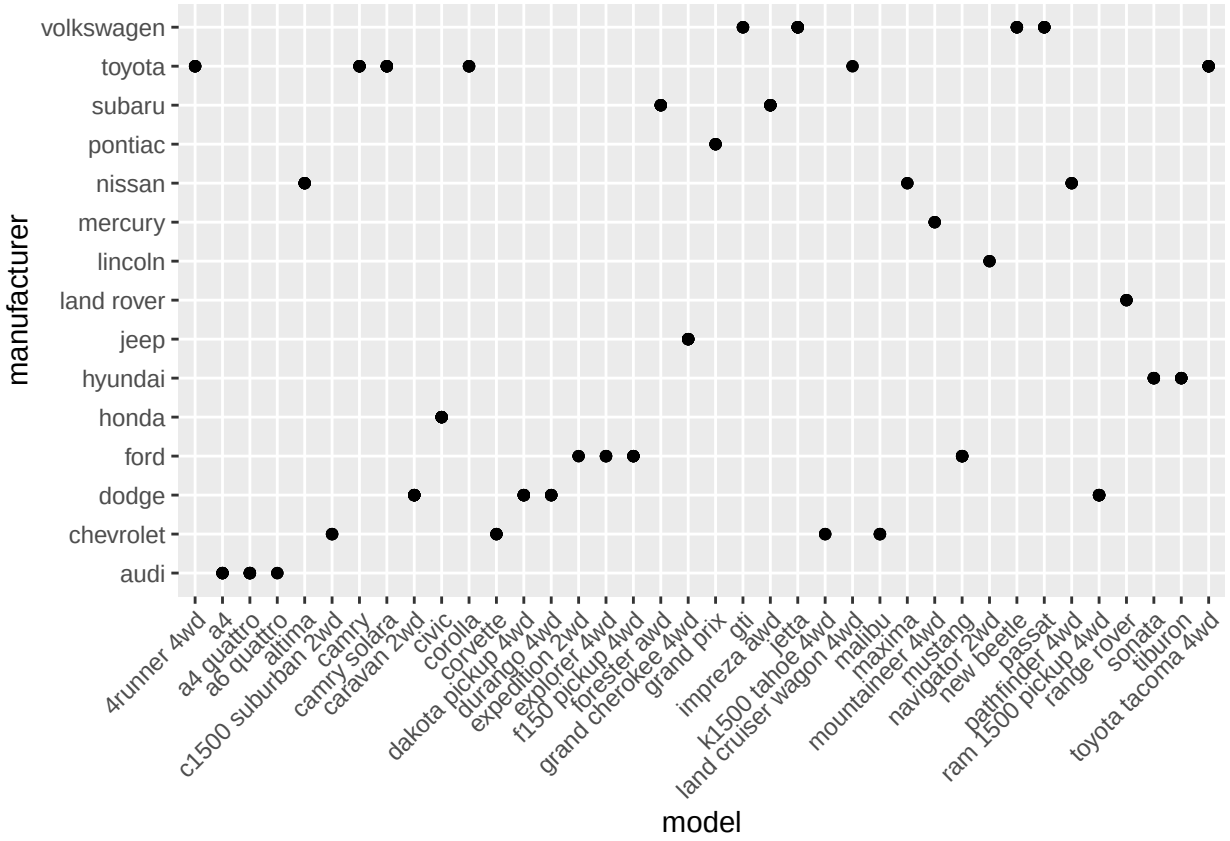
```
##       [,1]
##  [1,]  0.7
##  [2,]  1.9
##  [3,]  3.1
##  [4,]  4.3
```

```
##  [5,]  5.5
##  [6,]  6.7
##  [7,]  7.9
##  [8,]  9.1
##  [9,] 10.3
## [10,] 11.5
## [11,] 12.7
## [12,] 13.9
## [13,] 15.1
## [14,] 16.3
## [15,] 17.5
```

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

```
library(ggplot2)

ggplot(mpg, aes(model,manufacturer)) + geom_point() + theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))
```



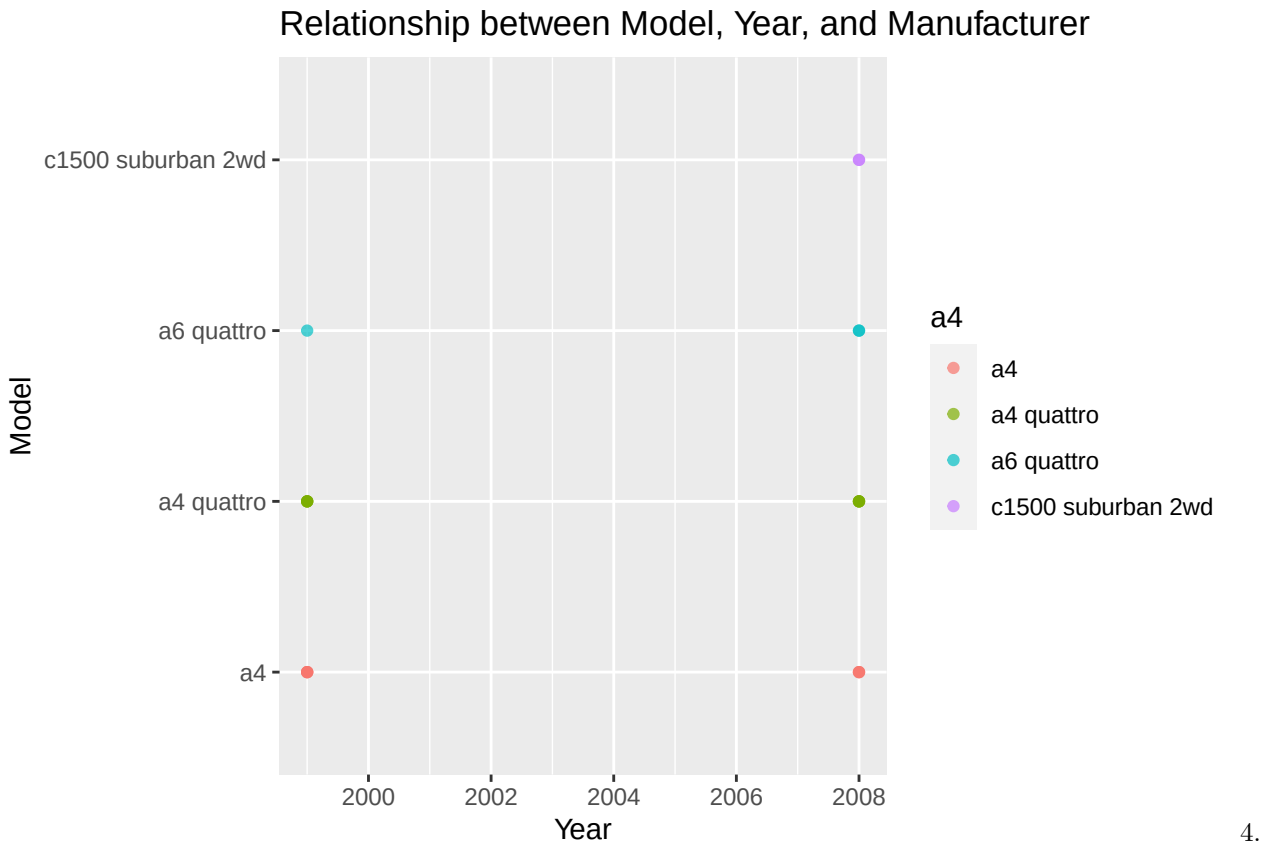
2b. For you, is it useful? If not, how could you modify the data to make it more informative? ans. Yes. It's very useful to know how many models each manufacturer produces. To make it more interesting, I can put color codes on each point based on the classes variable and add a label using the cty variable.

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

```
data_mpg_20 <- head(data_mpg,20)
data_mpg_20
```

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

```
ggplot(data = data_mpg_20,
       aes(x= year, y=model,
       color = as.factor(model))) + geom_point(alpha = 0.7)+ labs(title = "Relationship between Model, Y
       x = "Year",
       y = "Model",
       color = as.factor(data_mpg_20$model))
```



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

```
library(dplyr)

#group the number of cars per model

grouped_data <- data_mpg %>% group_by(model) %>% summarise(count = n())
grouped_data
```

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

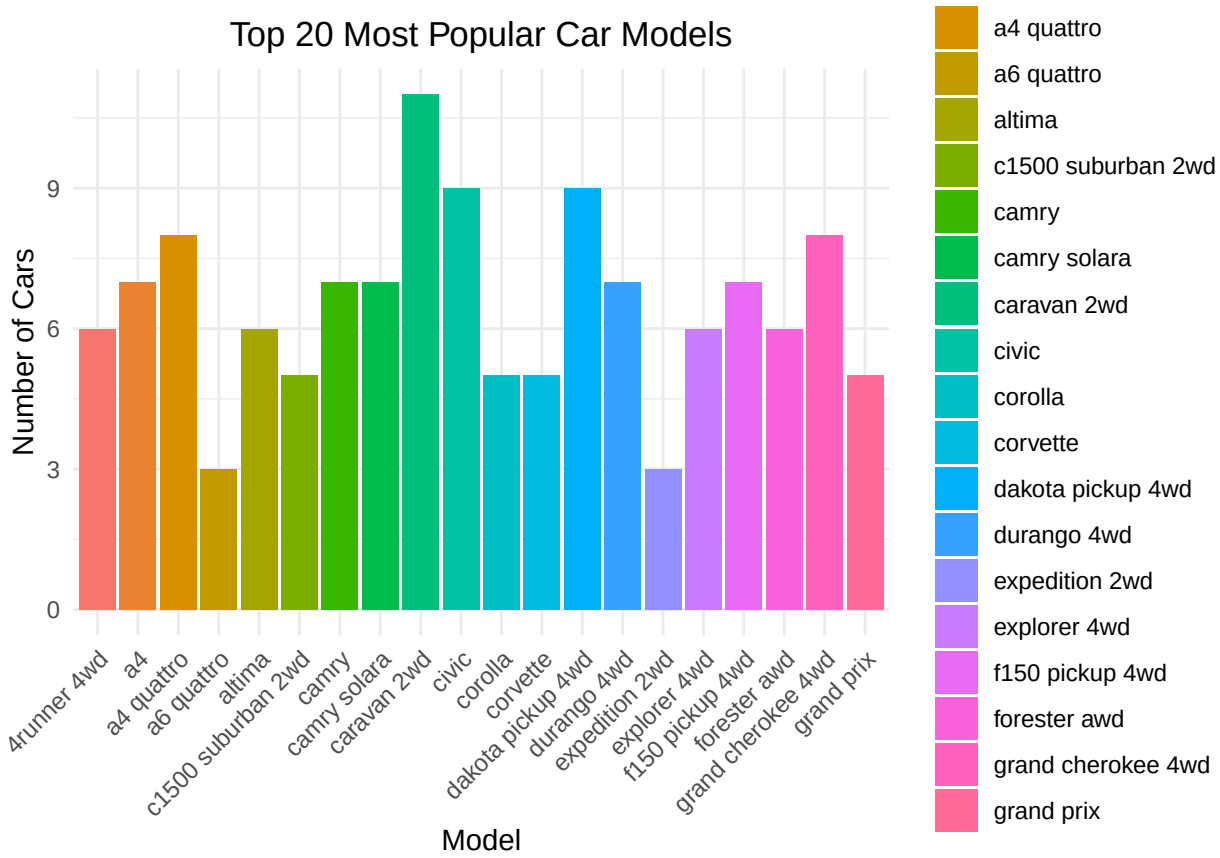
4a. Plot using geom_bar() using the top 20 observations only. The graphs shoude have a title, labels and colors. Show code and results.

```
observation_20 <- head(grouped_data,20)
observation_20
```

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

```r
observation_plot <- ggplot(observation_20,
       aes(x = model,
           y = count,
           fill = model)) +
  geom_bar(stat = "identity") +
   labs(title = "Top 20 Most Popular Car Models",
       x = "Model",
       y = "Number of Cars") +
   theme_minimal() +
  theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))

observation_plot
```



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

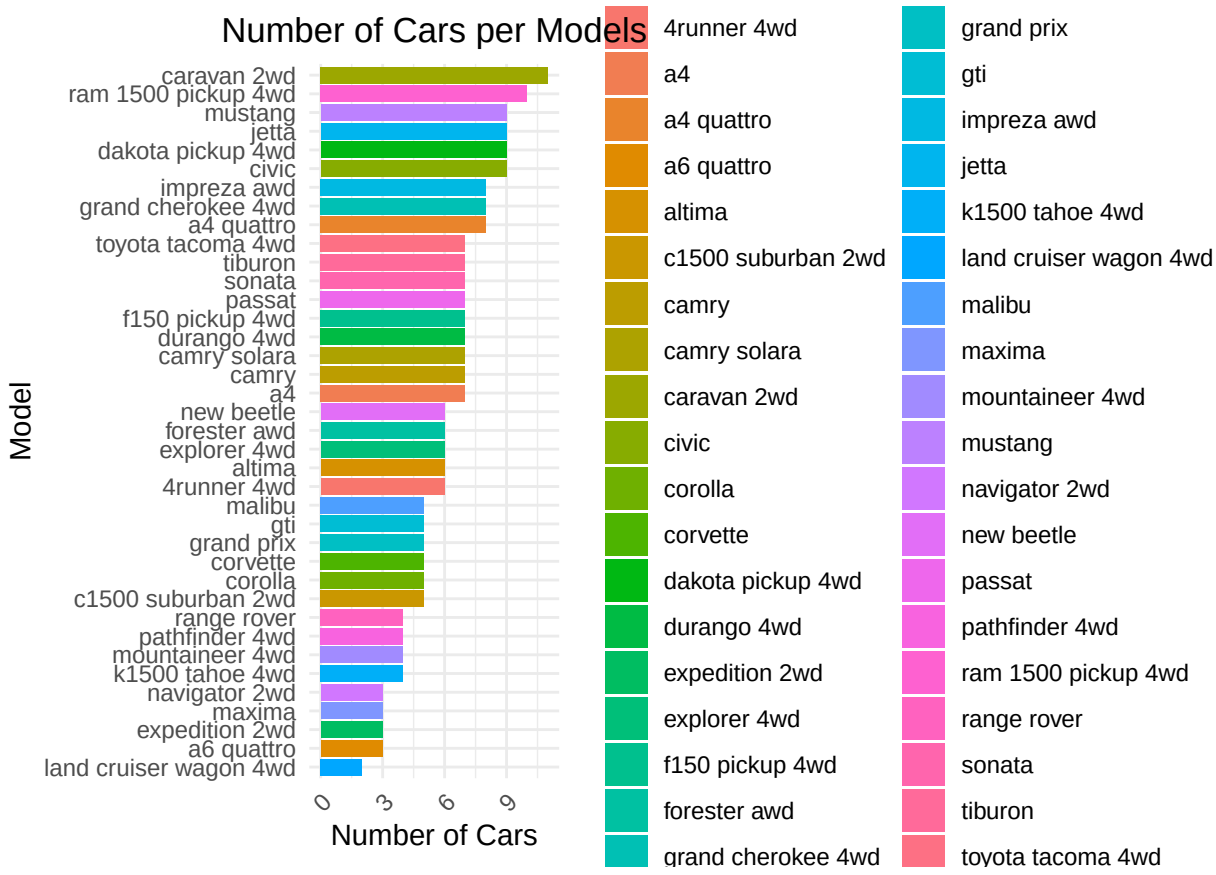
```
observation_20 <- head(grouped_data,20)
observation_20
```

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

```
observation_plot <- ggplot(grouped_data,
       aes(x = reorder(model, count),
           y = count,
           fill = model)) +
  geom_bar(stat = "identity") +
  coord_flip()+

  labs(title = "Number of Cars per Models",
       x = "Model",
       y = "Number of Cars") +
  theme_minimal() +
  theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))

observation_plot
```



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".

```
relationship_cyl_displ <- data.frame(Cylinder = data_mpg$cyl,
                                     Engine_Displacement = data_mpg$displ)
relationship_cyl_displ
```

```
##     Cylinder Engine_Displacement
## 1          4                 1.8
## 2          4                 1.8
```

```
## 3          4                2.0
## 4          4                2.0
## 5          6                2.8
## 6          6                2.8
## 7          6                3.1
## 8          4                1.8
## 9          4                1.8
## 10         4                2.0
## 11         4                2.0
## 12         6                2.8
## 13         6                2.8
## 14         6                3.1
## 15         6                3.1
## 16         6                2.8
## 17         6                3.1
## 18         8                4.2
## 19         8                5.3
## 20         8                5.3
## 21         8                5.3
## 22         8                5.7
## 23         8                6.0
## 24         8                5.7
## 25         8                5.7
## 26         8                6.2
## 27         8                6.2
## 28         8                7.0
## 29         8                5.3
## 30         8                5.3
## 31         8                5.7
## 32         8                6.5
## 33         4                2.4
## 34         4                2.4
## 35         6                3.1
## 36         6                3.5
## 37         6                3.6
## 38         4                2.4
## 39         6                3.0
## 40         6                3.3
## 41         6                3.3
## 42         6                3.3
## 43         6                3.3
## 44         6                3.3
## 45         6                3.8
## 46         6                3.8
## 47         6                3.8
## 48         6                4.0
## 49         6                3.7
## 50         6                3.7
## 51         6                3.9
## 52         6                3.9
## 53         8                4.7
## 54         8                4.7
## 55         8                4.7
## 56         8                5.2
```

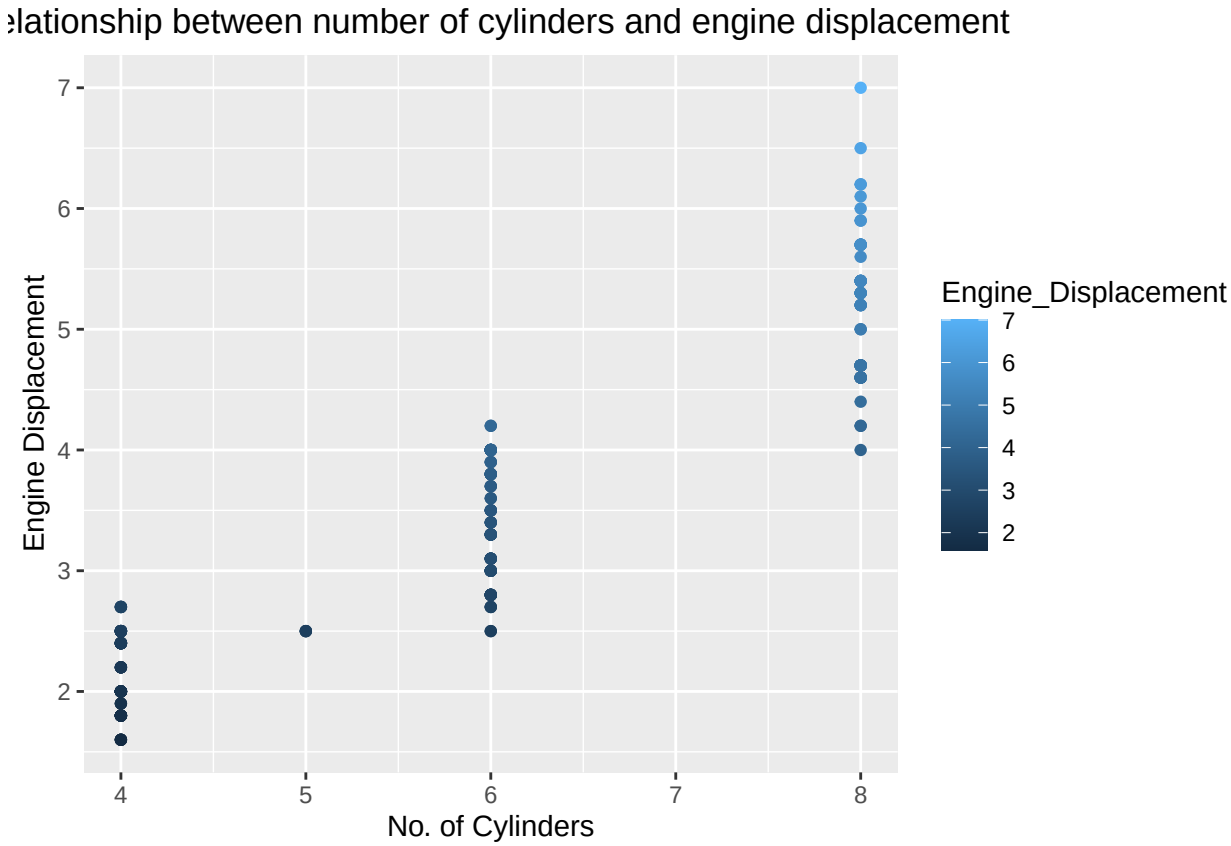
```
## 57          8               5.2
## 58          6               3.9
## 59          8               4.7
## 60          8               4.7
## 61          8               4.7
## 62          8               5.2
## 63          8               5.7
## 64          8               5.9
## 65          8               4.7
## 66          8               4.7
## 67          8               4.7
## 68          8               4.7
## 69          8               4.7
## 70          8               4.7
## 71          8               5.2
## 72          8               5.2
## 73          8               5.7
## 74          8               5.9
## 75          8               4.6
## 76          8               5.4
## 77          8               5.4
## 78          6               4.0
## 79          6               4.0
## 80          6               4.0
## 81          6               4.0
## 82          8               4.6
## 83          8               5.0
## 84          6               4.2
## 85          6               4.2
## 86          8               4.6
## 87          8               4.6
## 88          8               4.6
## 89          8               5.4
## 90          8               5.4
## 91          6               3.8
## 92          6               3.8
## 93          6               4.0
## 94          6               4.0
## 95          8               4.6
## 96          8               4.6
## 97          8               4.6
## 98          8               4.6
## 99          8               5.4
## 100         4               1.6
## 101         4               1.6
## 102         4               1.6
## 103         4               1.6
## 104         4               1.6
## 105         4               1.8
## 106         4               1.8
## 107         4               1.8
## 108         4               2.0
## 109         4               2.4
## 110         4               2.4
```

```
## 111        4               2.4
## 112        4               2.4
## 113        6               2.5
## 114        6               2.5
## 115        6               3.3
## 116        4               2.0
## 117        4               2.0
## 118        4               2.0
## 119        4               2.0
## 120        6               2.7
## 121        6               2.7
## 122        6               2.7
## 123        6               3.0
## 124        6               3.7
## 125        6               4.0
## 126        8               4.7
## 127        8               4.7
## 128        8               4.7
## 129        8               5.7
## 130        8               6.1
## 131        8               4.0
## 132        8               4.2
## 133        8               4.4
## 134        8               4.6
## 135        8               5.4
## 136        8               5.4
## 137        8               5.4
## 138        6               4.0
## 139        6               4.0
## 140        8               4.6
## 141        8               5.0
## 142        4               2.4
## 143        4               2.4
## 144        4               2.5
## 145        4               2.5
## 146        6               3.5
## 147        6               3.5
## 148        6               3.0
## 149        6               3.0
## 150        6               3.5
## 151        6               3.3
## 152        6               3.3
## 153        6               4.0
## 154        8               5.6
## 155        6               3.1
## 156        6               3.8
## 157        6               3.8
## 158        6               3.8
## 159        8               5.3
## 160        4               2.5
## 161        4               2.5
## 162        4               2.5
## 163        4               2.5
## 164        4               2.5
```

```
## 165        4                2.5
## 166        4                2.2
## 167        4                2.2
## 168        4                2.5
## 169        4                2.5
## 170        4                2.5
## 171        4                2.5
## 172        4                2.5
## 173        4                2.5
## 174        4                2.7
## 175        4                2.7
## 176        6                3.4
## 177        6                3.4
## 178        6                4.0
## 179        8                4.7
## 180        4                2.2
## 181        4                2.2
## 182        4                2.4
## 183        4                2.4
## 184        6                3.0
## 185        6                3.0
## 186        6                3.5
## 187        4                2.2
## 188        4                2.2
## 189        4                2.4
## 190        4                2.4
## 191        6                3.0
## 192        6                3.0
## 193        6                3.3
## 194        4                1.8
## 195        4                1.8
## 196        4                1.8
## 197        4                1.8
## 198        4                1.8
## 199        8                4.7
## 200        8                5.7
## 201        4                2.7
## 202        4                2.7
## 203        4                2.7
## 204        6                3.4
## 205        6                3.4
## 206        6                4.0
## 207        6                4.0
## 208        4                2.0
## 209        4                2.0
## 210        4                2.0
## 211        4                2.0
## 212        6                2.8
## 213        4                1.9
## 214        4                2.0
## 215        4                2.0
## 216        4                2.0
## 217        4                2.0
## 218        5                2.5
```

```
## 219          5                 2.5
## 220          6                 2.8
## 221          6                 2.8
## 222          4                 1.9
## 223          4                 1.9
## 224          4                 2.0
## 225          4                 2.0
## 226          5                 2.5
## 227          5                 2.5
## 228          4                 1.8
## 229          4                 1.8
## 230          4                 2.0
## 231          4                 2.0
## 232          6                 2.8
## 233          6                 2.8
## 234          6                 3.6
```

```
relationship_plot <- ggplot(relationship_cyl_displ,
                            aes(x = Cylinder, y = Engine_Displacement, color = Engine_Displacement))+
                              geom_point(aes(fill = Engine_Displacement))+
                              labs(title = "Relationship between number of cylinders and engine displac
                                   x = "No. of Cylinders",
                                   y = "Engine Displacement")+
                              theme(plot.title = element_text(hjust = 0.5))
relationship_plot
```

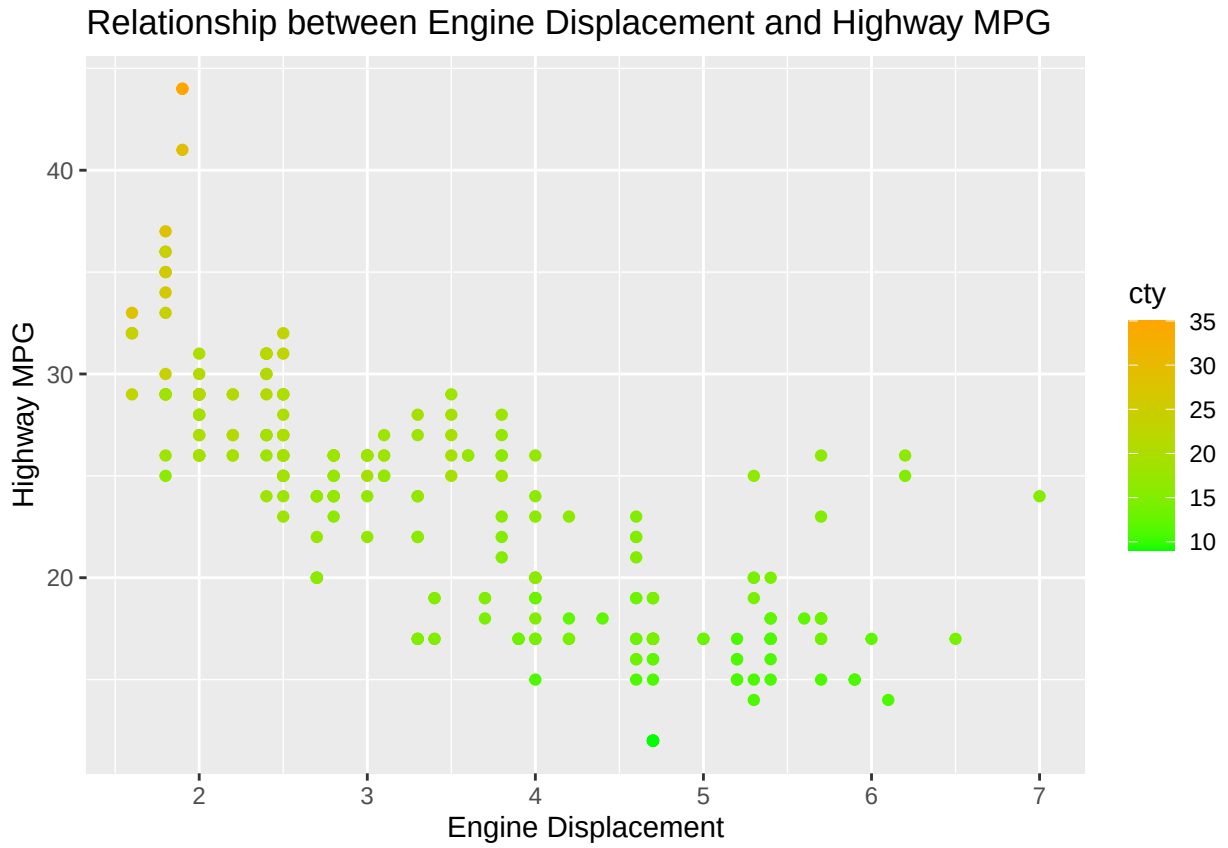


5a. How would you describe its relationship? Show the codes and its result. Ans. When the number of cylinder increases the displacement also increases.

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?

```
relationship_displ_cyl <- ggplot(data_mpg,
                                 aes(x = displ,
                                     y = hwy,
                                     color = cty)) +
  geom_point() +
  labs(title = "Relationship between Engine Displacement and Highway MPG",
       x = "Engine Displacement",
       y = "Highway MPG") +
  scale_color_gradient(low = "green",
                       high = "orange")


relationship_displ_cyl
```



6.

```
library(readr)
traffic_data <- read_csv("/cloud/project/RWorksheets_Bagilidad#4/RWorksheets#4C/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.
```

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

```
observation_traffic <- colnames(traffic_data)

length_traffic <- length(observation_traffic)

cat("The number of observations are: ",length_traffic)
```

```
## The number of observations are:  4
```

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

```
junction_sub1 <- subset(traffic_data, Junction == 1)
junction_sub1
```

```
## # A tibble: 14,592 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 14,582 more rows
```

```
junctions_sub2 <- subset(traffic_data, Junction == 2)
junctions_sub2
```

```
## # A tibble: 14,592 x 4
##    DateTime            Junction Vehicles          ID
##    <dttm>                 <dbl>    <dbl>       <dbl>
##  1 2015-11-01 00:00:00        2        6 20151101002
##  2 2015-11-01 01:00:00        2        6 20151101012
##  3 2015-11-01 02:00:00        2        5 20151101022
##  4 2015-11-01 03:00:00        2        6 20151101032
##  5 2015-11-01 04:00:00        2        7 20151101042
##  6 2015-11-01 05:00:00        2        2 20151101052
##  7 2015-11-01 06:00:00        2        4 20151101062
##  8 2015-11-01 07:00:00        2        4 20151101072
##  9 2015-11-01 08:00:00        2        3 20151101082
## 10 2015-11-01 09:00:00        2        3 20151101092
## # i 14,582 more rows
```

```
junctions_sub3 <- subset(traffic_data, Junction == 3)
junctions_sub3
```

```
## # A tibble: 14,592 x 4
##    DateTime            Junction Vehicles          ID
```

```
##    <dttm>                <dbl>    <dbl>       <dbl>
##  1 2015-11-01 00:00:00       3        9 20151101003
##  2 2015-11-01 01:00:00       3        7 20151101013
##  3 2015-11-01 02:00:00       3        5 20151101023
##  4 2015-11-01 03:00:00       3        1 20151101033
##  5 2015-11-01 04:00:00       3        2 20151101043
##  6 2015-11-01 05:00:00       3        2 20151101053
##  7 2015-11-01 06:00:00       3        3 20151101063
##  8 2015-11-01 07:00:00       3        4 20151101073
##  9 2015-11-01 08:00:00       3        3 20151101083
## 10 2015-11-01 09:00:00       3        6 20151101093
## # i 14,582 more rows
```

```
junctions_sub4 <- subset(traffic_data, Junction == 4)
junctions_sub4
```

```
## # A tibble: 4,344 x 4
##    DateTime            Junction Vehicles          ID
##    <dttm>                 <dbl>    <dbl>       <dbl>
##  1 2017-01-01 00:00:00        4        3 20170101004
##  2 2017-01-01 01:00:00        4        1 20170101014
##  3 2017-01-01 02:00:00        4        4 20170101024
##  4 2017-01-01 03:00:00        4        4 20170101034
##  5 2017-01-01 04:00:00        4        2 20170101044
##  6 2017-01-01 05:00:00        4        1 20170101054
##  7 2017-01-01 06:00:00        4        1 20170101064
##  8 2017-01-01 07:00:00        4        4 20170101074
##  9 2017-01-01 08:00:00        4        4 20170101084
## 10 2017-01-01 09:00:00        4        2 20170101094
## # i 4,334 more rows
```

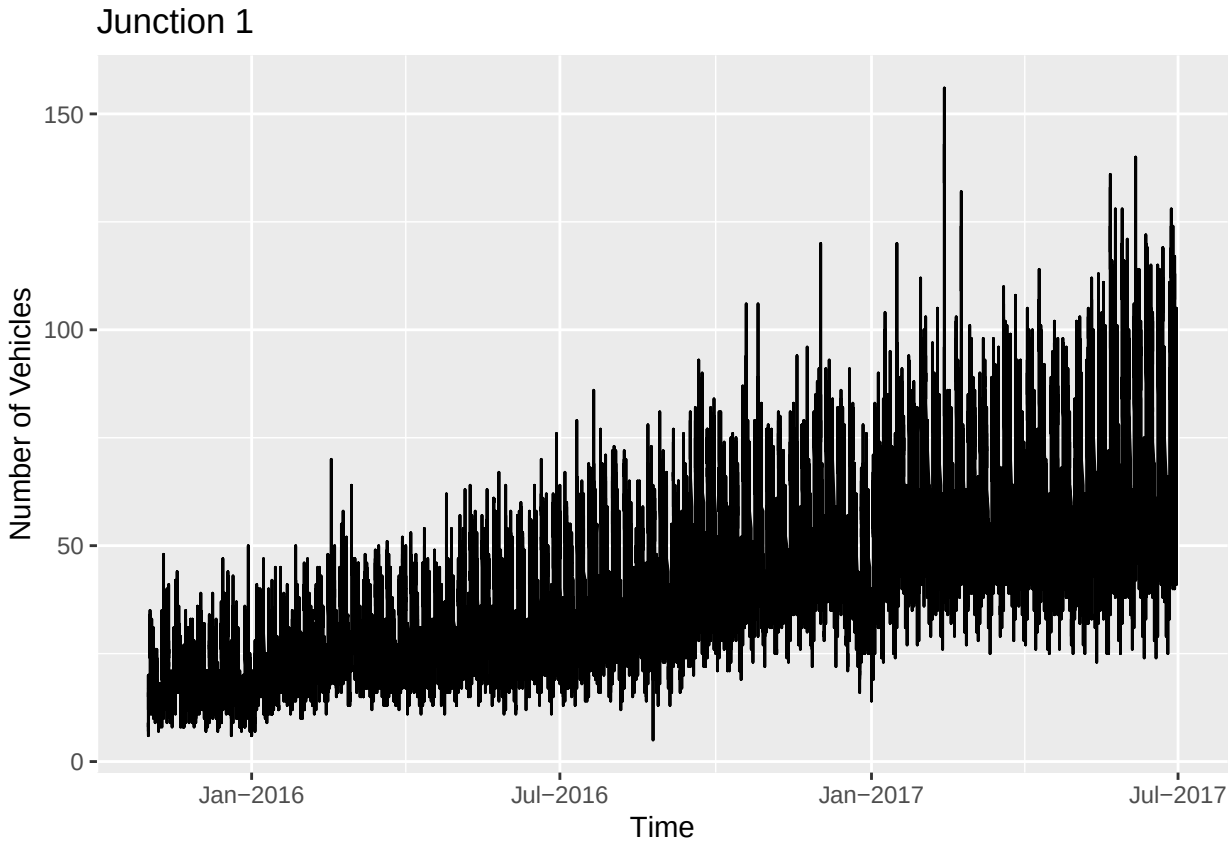
6c. Plot each junction in a using geom_line(). Show your solution and output.

```
par(mfrow = c(1,4))
junctionPlot_1 <- ggplot(junction_sub1,
                         aes(x = as.Date(junction_sub1$DateTime),
                             y = Vehicles)) +

  geom_line() +
  scale_x_date(date_labels = "%b-%Y") + theme(legend.position = "none") +
  labs(title = "Junction 1", x = "Time", y = "Number of Vehicles")

junctionPlot_1
```

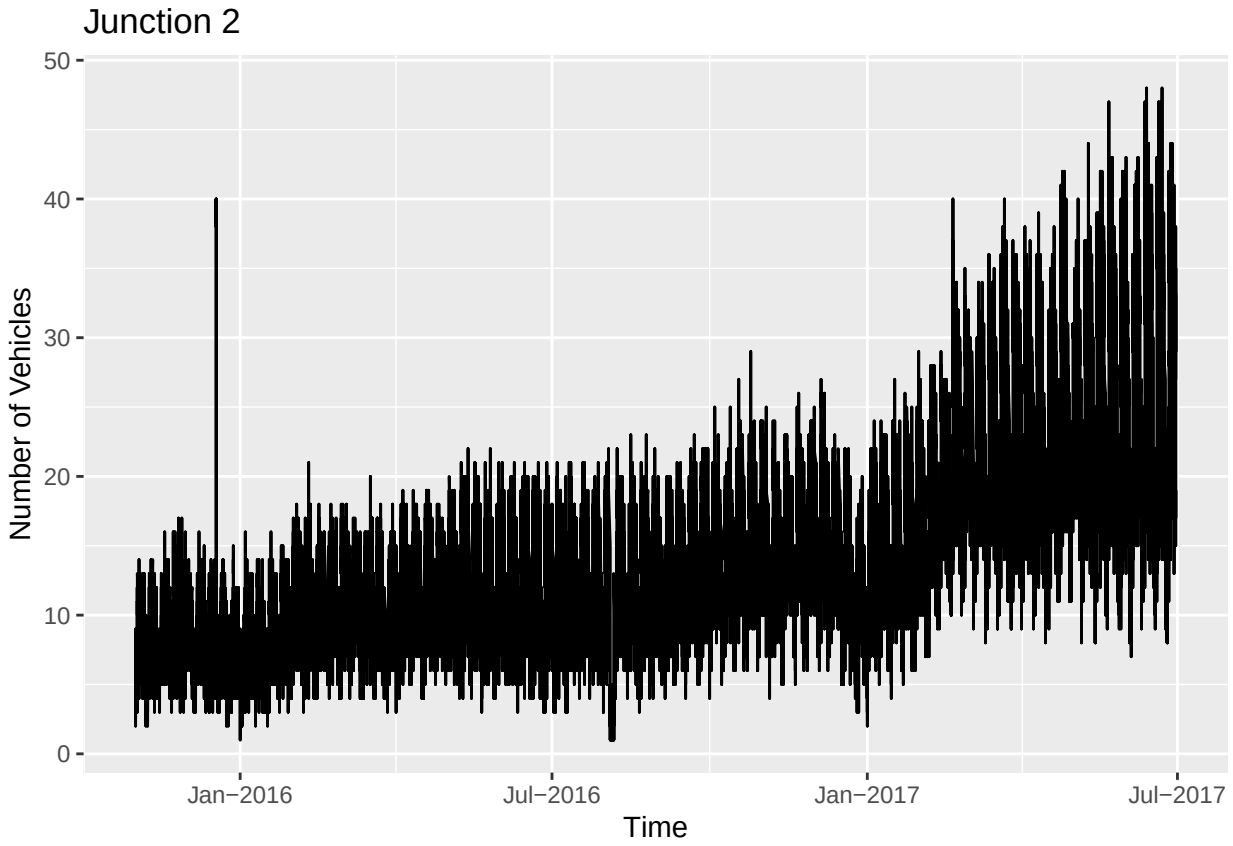
```
## Warning: Use of `junction_sub1$DateTime` is discouraged.
## i Use `DateTime` instead.
```




```
junctionPlot_2 <- ggplot(junctions_sub2,
                         aes(x = as.Date(junctions_sub2$DateTime),
                             y = Vehicles)) +
  geom_line() +
  scale_x_date(date_labels = "%b-%Y") + theme(legend.position = "none") +
  labs(title = "Junction 2", x = "Time", y = "Number of Vehicles")

junctionPlot_2
```

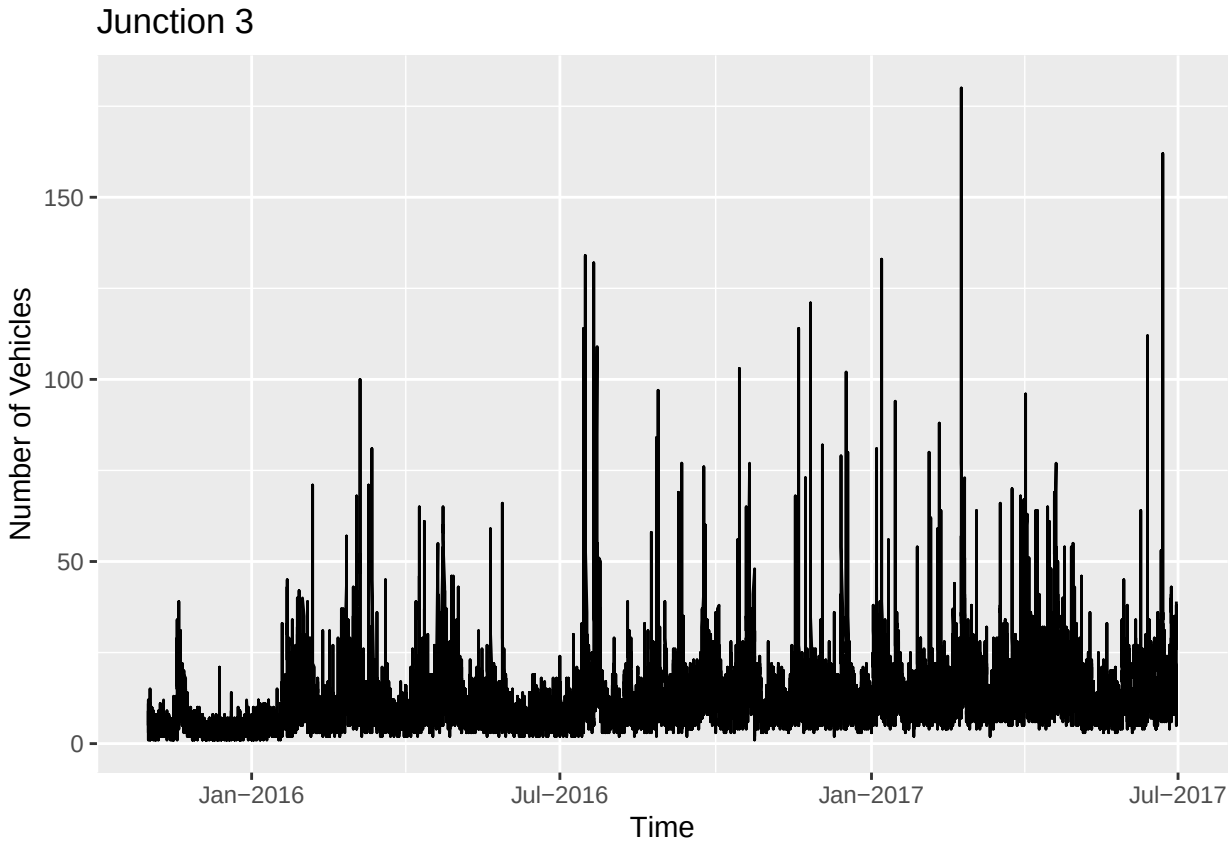
```
## Warning: Use of `junctions_sub2$DateTime` is discouraged.
## i Use `DateTime` instead.
```




```
junctionPlot_3 <- ggplot(junctions_sub3,
                         aes(x = as.Date(junctions_sub3$DateTime),
                             y = Vehicles)) +
  geom_line() +
  scale_x_date(date_labels = "%b-%Y") + theme(legend.position = "none") +
  labs(title = "Junction 3", x = "Time", y = "Number of Vehicles")

junctionPlot_3
```

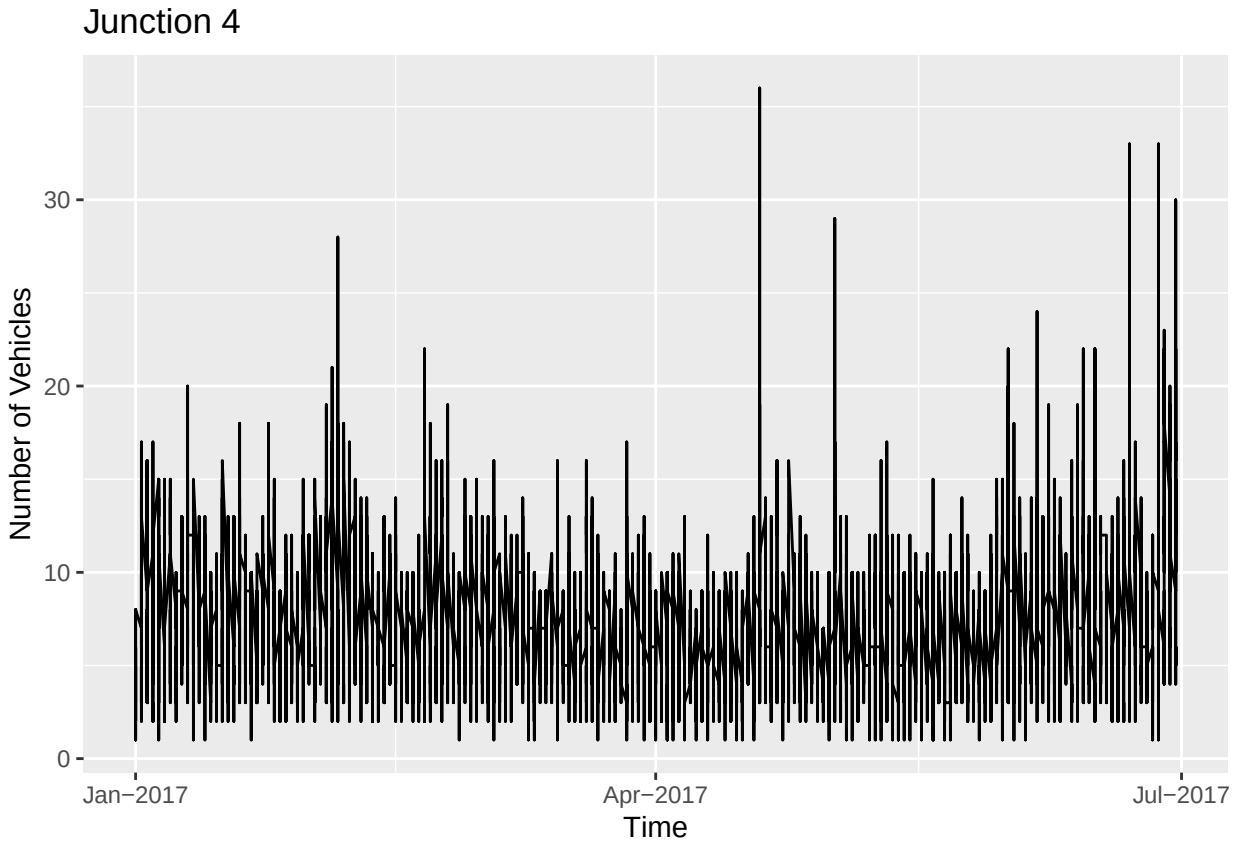
```
## Warning: Use of `junctions_sub3$DateTime` is discouraged.
## i Use `DateTime` instead.
```




```
junctionPlot_4 <- ggplot(junctions_sub4,
                         aes(x = as.Date(junctions_sub4$DateTime),
                             y = Vehicles)) +
  geom_line() +
  scale_x_date(date_labels = "%b-%Y") + theme(legend.position = "none") +
  labs(title = "Junction 4", x = "Time", y = "Number of Vehicles")

junctionPlot_4
```

```
## Warning: Use of `junctions_sub4$DateTime` is discouraged.
## i Use `DateTime` instead.
```



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

```
library(readxl)
alexa_file_1 <- read_excel("/cloud/project/RWorksheets_Bagilidad#4/RWorksheets#4C/alexa_file (1).xlsx")
```

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

```
observation_alex <- nrow(alexa_file_1)


cat("Numbers of Observations: ", observation_alex,"\n")
```

```
## Numbers of Observations:  3150
```

```
columns_alex <- ncol(alexa_file_1)


cat("Numbers of Columns: ", columns_alex)
```

```
## Numbers of Columns:  5
```

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

```
library(dplyr)
groupVar_alexa <- alexa_file_1 %>%
  group_by(variation) %>%
  summarise(Count_total = n())
groupVar_alexa
```

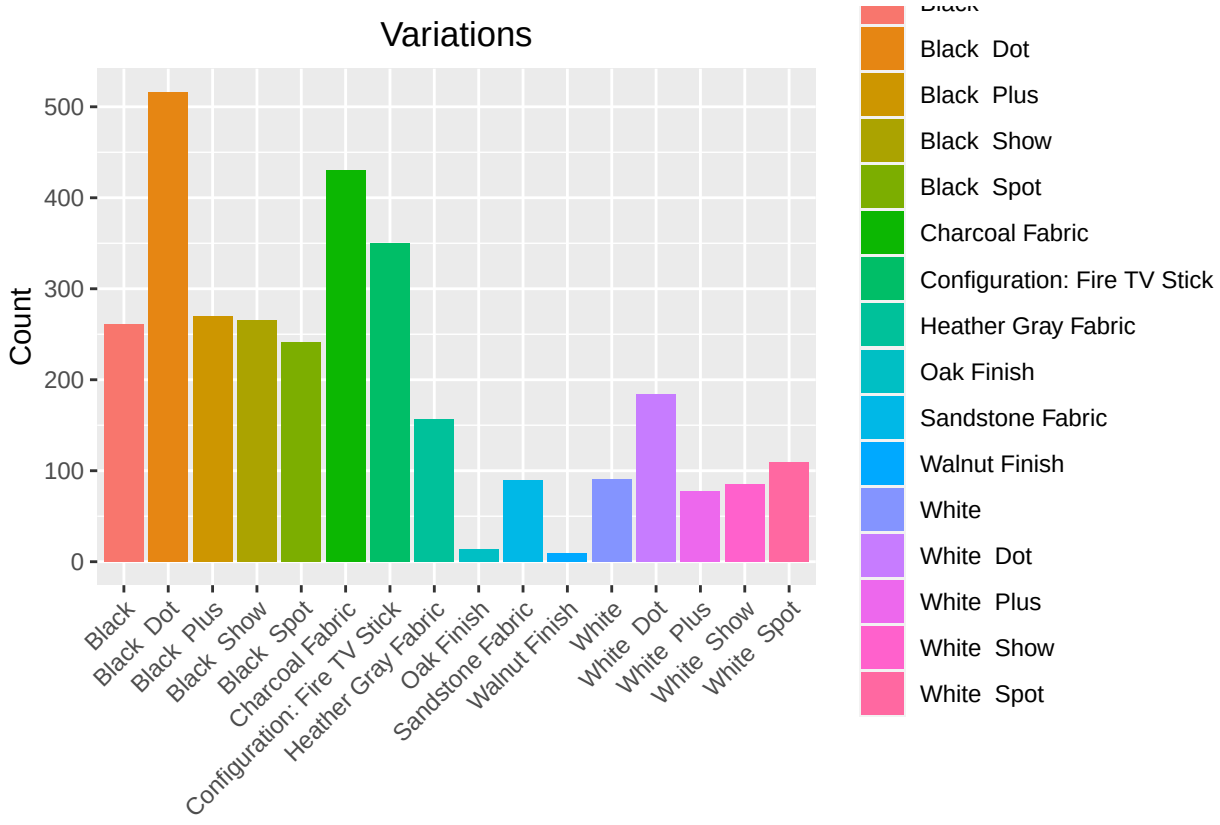
```
## # A tibble: 16 x 2
```

```
##    variation                       Count_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.

```
alexaPlot <- ggplot(alexa_file_1,
                    aes(x = variation,fill = variation))+
  geom_bar() +
  labs(title = "Variations",
       x = "Variation",
       y = "Count") +
  theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))

alexaPlot
```



7d. d. 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(dplyr)

alexa_file_1$date <- as.Date(alexa_file_1$date)

alexa_file_1$month <- format(alexa_file_1$date, "%m")


alexa_fileMonth <-alexa_file_1%>%
  count(month)
alexa_fileMonth
```

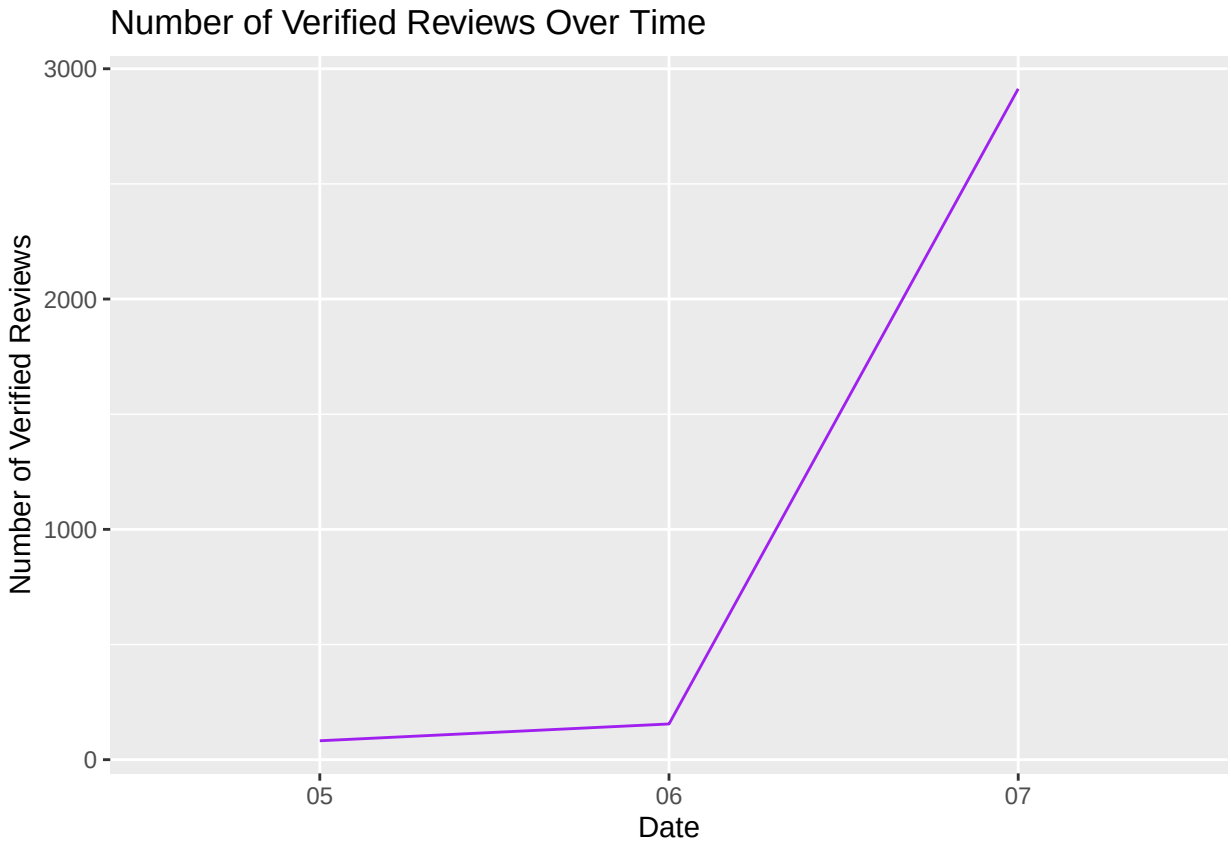
```
## # A tibble: 3 x 2
##   month     n
##   <chr> <int>
## 1 05       82
## 2 06      155
## 3 07     2913
```

```
alexa_file_monthly_reviews <- table(alexa_fileMonth)
alexa_file_monthly_reviews
```

```
##       n
## month 82 155 2913
##    05  1   0    0
##    06  0   1    0
##    07  0   0    1
```

```
alexa_file_plot <- ggplot(alexa_fileMonth, aes(x = month, y = n, group = 1)) +
  geom_line(color = "purple") +
  labs(title = "Number of Verified Reviews Over Time",
       x = "Date",
       y = "Number of Verified Reviews")

alexa_file_plot
```



e. 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.

```
alexa_variationRatings <- alexa_file_1 %>%
  group_by(variation) %>%
  summarise(average_rating = mean(rating))

alexa_variationRatings
```

```
## # A tibble: 16 x 2
##    variation                    average_rating
##    <chr>                                 <dbl>
##  1 Black                                  4.23
##  2 Black  Dot                             4.45
##  3 Black  Plus                            4.37
##  4 Black  Show                            4.49
##  5 Black  Spot                            4.31
##  6 Charcoal Fabric                        4.73
##  7 Configuration: Fire TV Stick           4.59
##  8 Heather Gray Fabric                    4.69
```

```
##  9 Oak Finish                              4.86
## 10 Sandstone Fabric                        4.36
## 11 Walnut Finish                           4.89
## 12 White                                   4.14
## 13 White  Dot                              4.42
## 14 White  Plus                             4.36
## 15 White  Show                             4.28
## 16 White  Spot                             4.31
```

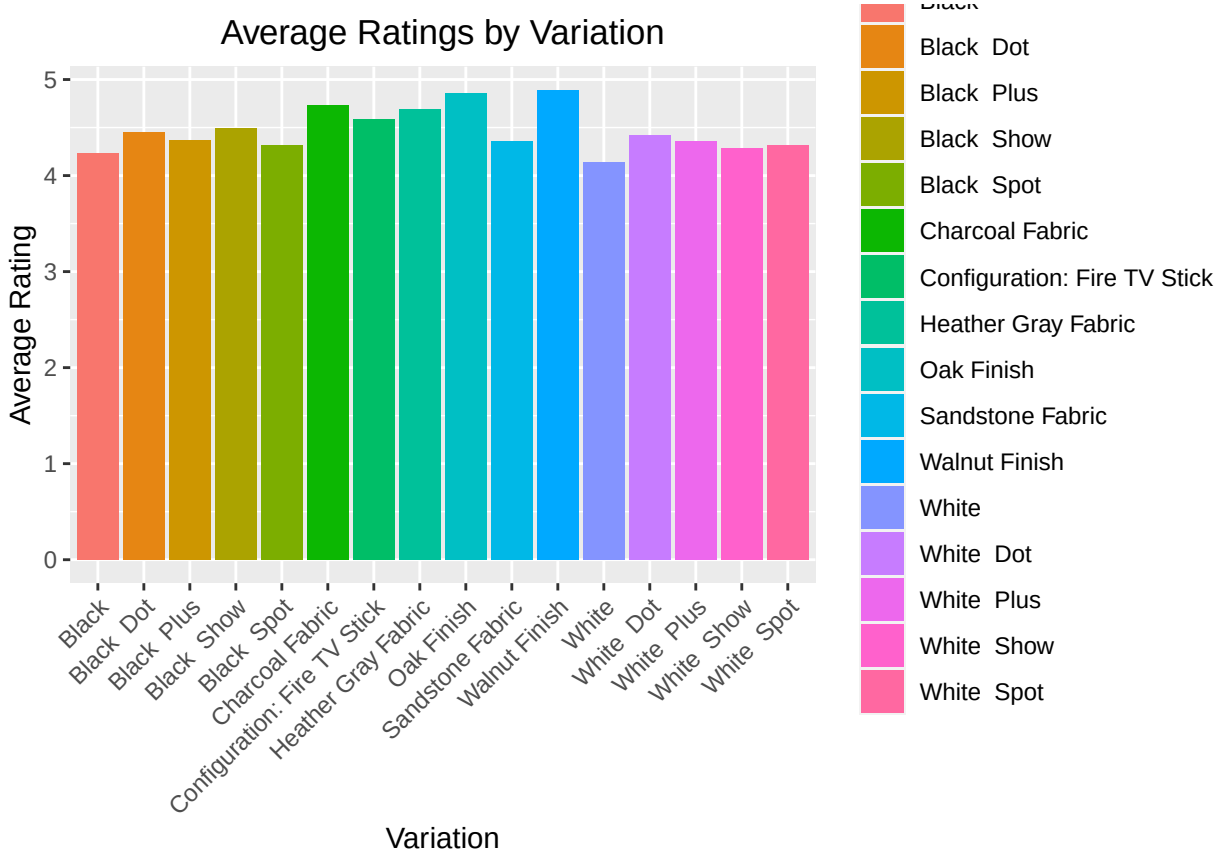
```
topRatings <- alexa_variationRatings %>%
  filter(average_rating == max(average_rating))

topRatings
```

```
## # A tibble: 1 x 2
##   variation     average_rating
##   <chr>                  <dbl>
## 1 Walnut Finish           4.89
```

```
# The walnut finish variation has the highest rating

ggplot(alexa_variationRatings,
       aes(x = variation,
       y = average_rating,
       fill = variation)) +
  geom_bar(stat = "identity") +
  labs(title = "Average Ratings by Variation",
       x = "Variation",
       y = "Average Rating")+
  theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))
```


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