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(14)   f   18
## 36   36   chevrolet              malibu   3.5 2008   6   auto(14)   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(14)   f   17
## 40   40      dodge          caravan 2wd   3.3 1999   6   auto(14)   f   16
## 41   41      dodge          caravan 2wd   3.3 1999   6   auto(14)   f   16
## 42   42      dodge          caravan 2wd   3.3 2008   6   auto(14)   f   17
## 43   43      dodge          caravan 2wd   3.3 2008   6   auto(14)   f   17
## 44   44      dodge          caravan 2wd   3.3 2008   6   auto(14)   f   11
## 45   45      dodge          caravan 2wd   3.8 1999   6   auto(14)   f   15
## 46   46      dodge          caravan 2wd   3.8 1999   6   auto(14)   f   15
## 47   47      dodge          caravan 2wd   3.8 2008   6   auto(16)   f   16
## 48   48      dodge          caravan 2wd   4.0 2008   6   auto(16)   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(14)   4   14
## 51   51      dodge     dakota pickup 4wd   3.9 1999   6   auto(14)   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(15)   4   14
## 54   54      dodge     dakota pickup 4wd   4.7 2008   8   auto(15)   4   14
## 55   55      dodge     dakota pickup 4wd   4.7 2008   8   auto(15)   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(14)   4   11
## 58   58      dodge          durango 4wd   3.9 1999   6   auto(14)   4   13
## 59   59      dodge          durango 4wd   4.7 2008   8   auto(15)   4   13
## 60   60      dodge          durango 4wd   4.7 2008   8   auto(15)   4    9
## 61   61      dodge          durango 4wd   4.7 2008   8   auto(15)   4   13
## 62   62      dodge          durango 4wd   5.2 1999   8   auto(14)   4   11
## 63   63      dodge          durango 4wd   5.7 2008   8   auto(15)   4   13
## 64   64      dodge          durango 4wd   5.9 1999   8   auto(14)   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(15)   4    9
## 67   67      dodge   ram 1500 pickup 4wd   4.7 2008   8   auto(15)   4   13
## 68   68      dodge   ram 1500 pickup 4wd   4.7 2008   8   auto(15)   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(14)   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(15)   4   13
## 74   74      dodge   ram 1500 pickup 4wd   5.9 1999   8   auto(14)   4   11
## 75   75       ford       expedition 2wd   4.6 1999   8   auto(14)   r   11
## 76   76       ford       expedition 2wd   5.4 1999   8   auto(14)   r   11
## 77   77       ford       expedition 2wd   5.4 2008   8   auto(16)   r   12
## 78   78       ford         explorer 4wd   4.0 1999   6   auto(15)   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(15)   4   14
## 81   81       ford         explorer 4wd   4.0 2008   6   auto(15)   4   13
## 82   82       ford         explorer 4wd   4.6 2008   8   auto(16)   4   13
## 83   83       ford         explorer 4wd   5.0 1999   8   auto(14)   4   13
## 84   84       ford        f150 pickup 4wd   4.2 1999   6   auto(14)   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(14)   4   13
## 88   88       ford        f150 pickup 4wd   4.6 2008   8   auto(14)   4   13
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## 89   89        ford    f150 pickup 4wd  5.4 1999  8   auto(14)  4  11
## 90   90        ford    f150 pickup 4wd  5.4 2008  8   auto(14)  4  13
## 91   91        ford            mustang  3.8 1999  6 manual(m5)  r  18
## 92   92        ford            mustang  3.8 1999  6   auto(14)  r  18
## 93   93        ford            mustang  4.0 2008  6 manual(m5)  r  17
## 94   94        ford            mustang  4.0 2008  6   auto(15)  r  16
## 95   95        ford            mustang  4.6 1999  8   auto(14)  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(15)  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(14)  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(14)  f  24
## 105 105       honda              civic  1.8 2008  4 manual(m5)  f  26
## 106 106       honda              civic  1.8 2008  4   auto(15)  f  25
## 107 107       honda              civic  1.8 2008  4   auto(15)  f  24
## 108 108       honda              civic  2.0 2008  4 manual(m6)  f  21
## 109 109     hyundai             sonata  2.4 1999  4   auto(14)  f  18
## 110 110     hyundai             sonata  2.4 1999  4 manual(m5)  f  18
## 111 111     hyundai             sonata  2.4 2008  4   auto(14)  f  21
## 112 112     hyundai             sonata  2.4 2008  4 manual(m5)  f  21
## 113 113     hyundai             sonata  2.5 1999  6   auto(14)  f  18
## 114 114     hyundai             sonata  2.5 1999  6 manual(m5)  f  18
## 115 115     hyundai             sonata  3.3 2008  6   auto(15)  f  19
## 116 116     hyundai            tiburon  2.0 1999  4   auto(14)  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(14)  f  20
## 120 120     hyundai            tiburon  2.7 2008  6   auto(14)  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(15)  4  17
## 124 124        jeep  grand cherokee 4wd  3.7 2008  6   auto(15)  4  15
## 125 125        jeep  grand cherokee 4wd  4.0 1999  6   auto(14)  4  15
## 126 126        jeep  grand cherokee 4wd  4.7 1999  8   auto(14)  4  14
## 127 127        jeep  grand cherokee 4wd  4.7 2008  8   auto(15)  4   9
## 128 128        jeep  grand cherokee 4wd  4.7 2008  8   auto(15)  4  14
## 129 129        jeep  grand cherokee 4wd  5.7 2008  8   auto(15)  4  13
## 130 130        jeep  grand cherokee 4wd  6.1 2008  8   auto(15)  4  11
## 131 131  land rover         range rover  4.0 1999  8   auto(14)  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(14)  4  11
## 135 135     lincoln       navigator 2wd  5.4 1999  8   auto(14)  r  11
## 136 136     lincoln       navigator 2wd  5.4 1999  8   auto(14)  r  11
## 137 137     lincoln       navigator 2wd  5.4 2008  8   auto(16)  r  12
## 138 138     mercury    mountaineer 4wd  4.0 1999  6   auto(15)  4  14
## 139 139     mercury    mountaineer 4wd  4.0 2008  6   auto(15)  4  13
## 140 140     mercury    mountaineer 4wd  4.6 2008  8   auto(16)  4  13
## 141 141     mercury    mountaineer 4wd  5.0 1999  8   auto(14)  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. Fuel type(fl)

4. Drive Train(drv)

5. class
6. manufacturer

```
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? 1.X 2.engine displacement(displ) 3.year 4.cyl(number of cylinders) 5.city miles per gallon(cty) 6.highway miles per gallon(hwy)

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
```

```r
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
```

```r
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
```

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```
## 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.

```r
library(ggplot2)
factor_UniqueModels <- as.factor(unique_models$Manufacturer)
plotUnique_Models <- plot(as.factor(factor_UniqueModels),
                          main = "Unique Model per Manufacturer",
                          xlab = "Manufacturer",
                          ylab = "Number of Unique Models",
                          cex.names = 0.6,
                          las = 2)
```

Unique Model per Manufacturer
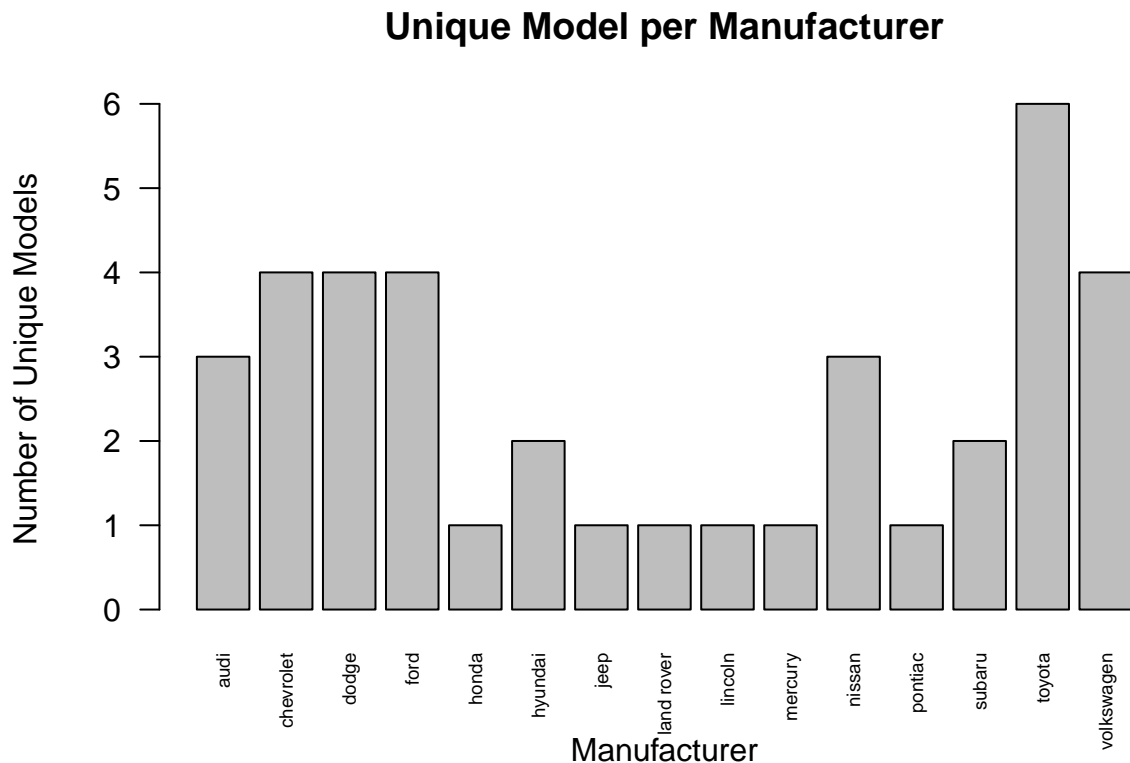
```
plotUnique_Models
```

```
##          [,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 model and the manufacturer. 2a.What does ggplot(mpg, aes(model, manufacturer)) + geom_point() show? ans. With the model on the x-axis of the chart and the manufacturer on the y-axis, it generates a scatterplot for the mpg dataset.

```
library(ggplot2)

ggplot(data_mpg,
       aes(model,manufacturer)) +
  geom_point() +
  theme(plot.title = element_text(hjust = 0.5),
        axis.text.x = element_text(angle = 45, hjust = 1))
```
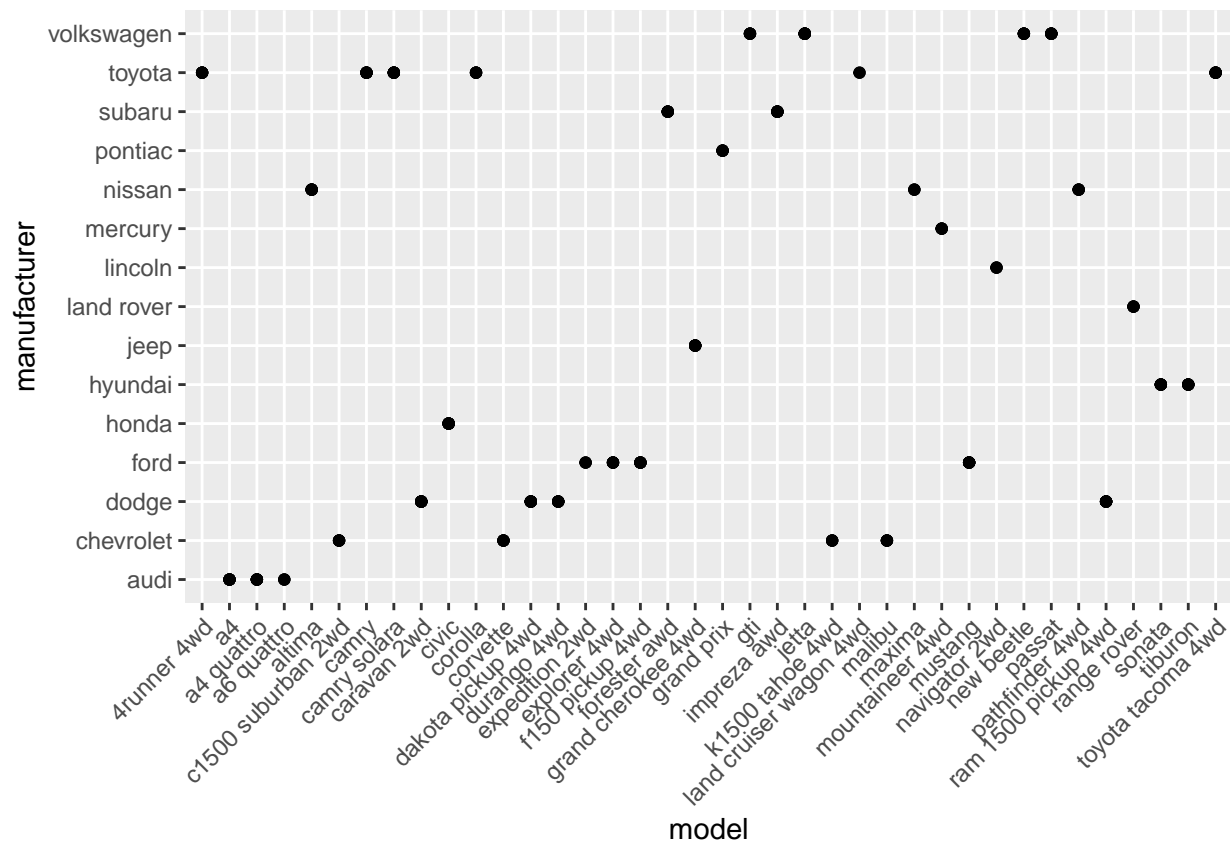
2b. For you, is it useful? If not, how could you modify the data to make it more informative? ans. Yes. It's very useful to know how many models each manufacturer produces. To make it more interesting, I can put color codes on each point based on the classes variable.

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
```

```r
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))
```

Relationship between Model, Year, and Manufacturer
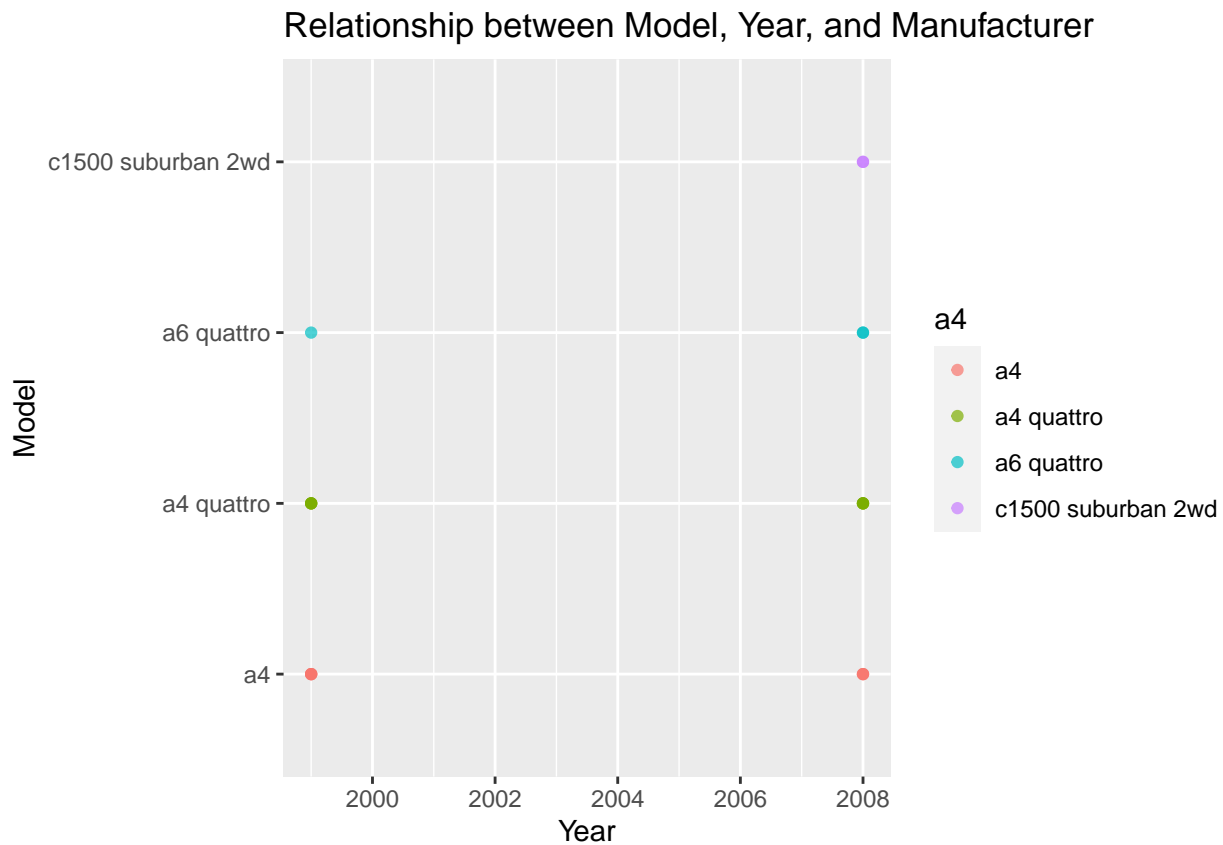
Using the pipe (%>%), group the model and get the number of cars per model. Show codes and its result

```r
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.

```r
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
```

Top 20 Most Popular Car Models
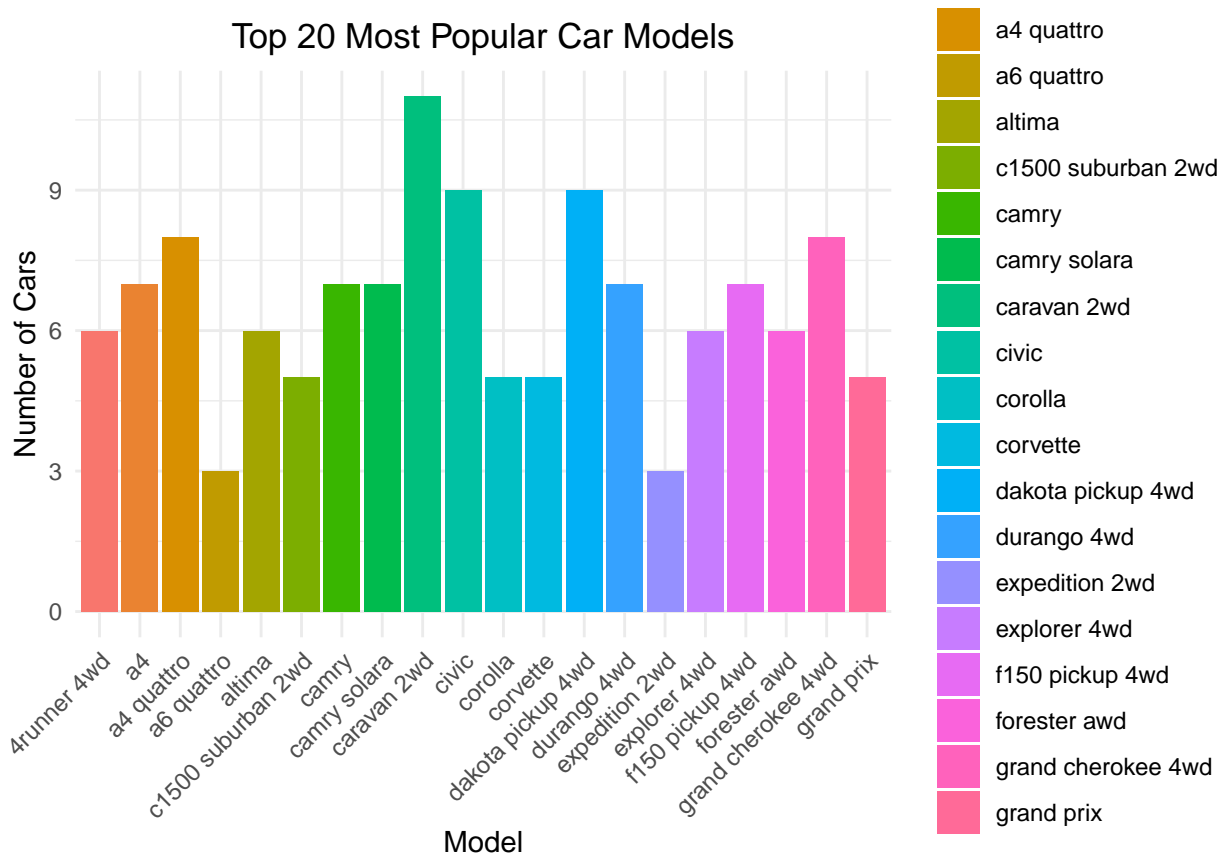
4b. Plot using the geom_bar() + coord_flip() just like what is shown below. Show codes and its result.

```
observation_plot <- ggplot(observation_20,
        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
```

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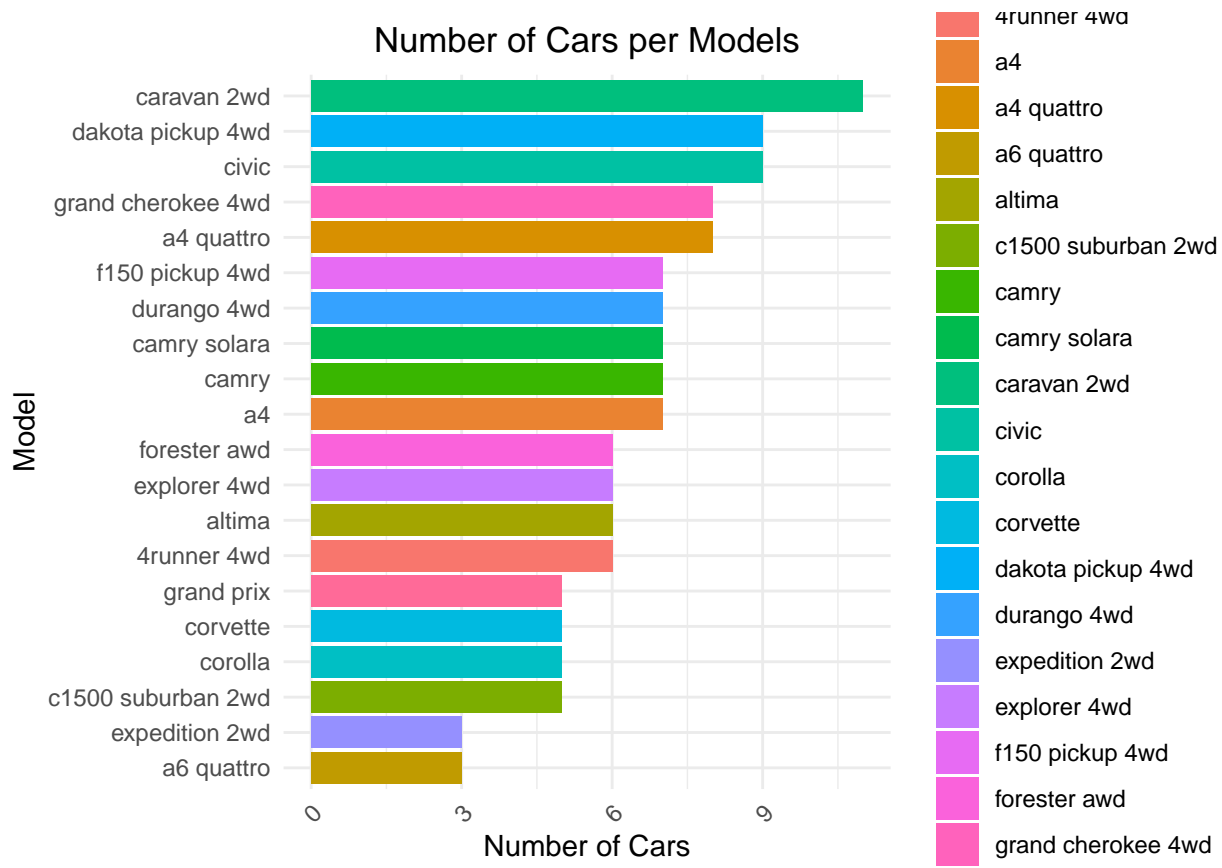
5.Plot the relationship between cyl - number of cylinders and displ - engine displacement using geom_point with aesthetic color = engine displacement. Title should be "Relationship between No. of Cylinders and Engine Displacement".

```
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()+
                            labs(title = "Relationship between number of cylinders and engine displac
                                 x = "No. of Cylinders",
                                 y = "Engine Displacement")+
  scale_color_gradient(low = "green",
high = "orange")+
                            theme(plot.title = element_text(hjust = 0.5))
relationship_plot
```

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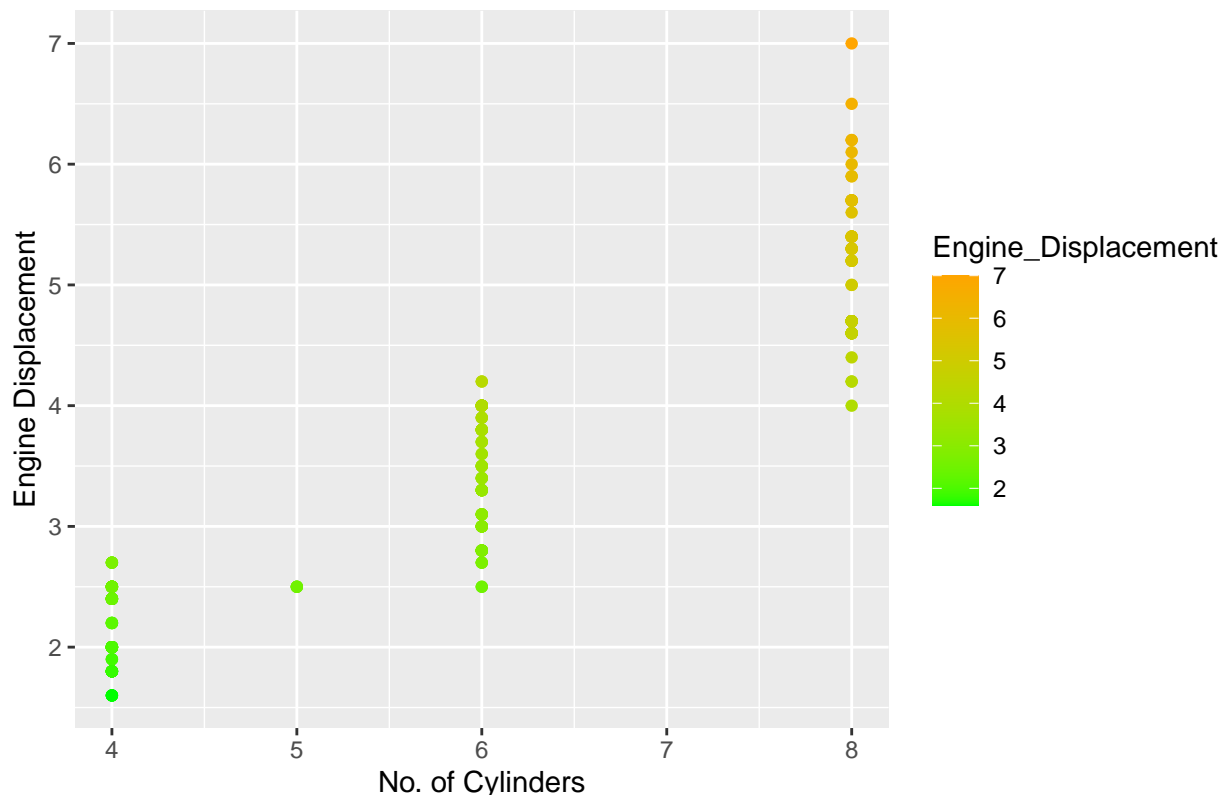
5a. How would you describe its relationship? Show the codes and its result. Ans. When the number of cylinder increases the displacement also increases.

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?

ans. Based on a color mapping to the city miles per gallon (cty), this output allows us to visually analyze the relationship between various city fuel economy levels and engine displacement (displ), as well as the highway miles per gallon (hwy), which helps us understand how fuel-efficient vehicles with various engine sizes are.

```
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
```

Relationship between Engine Displacement and Highway MPG
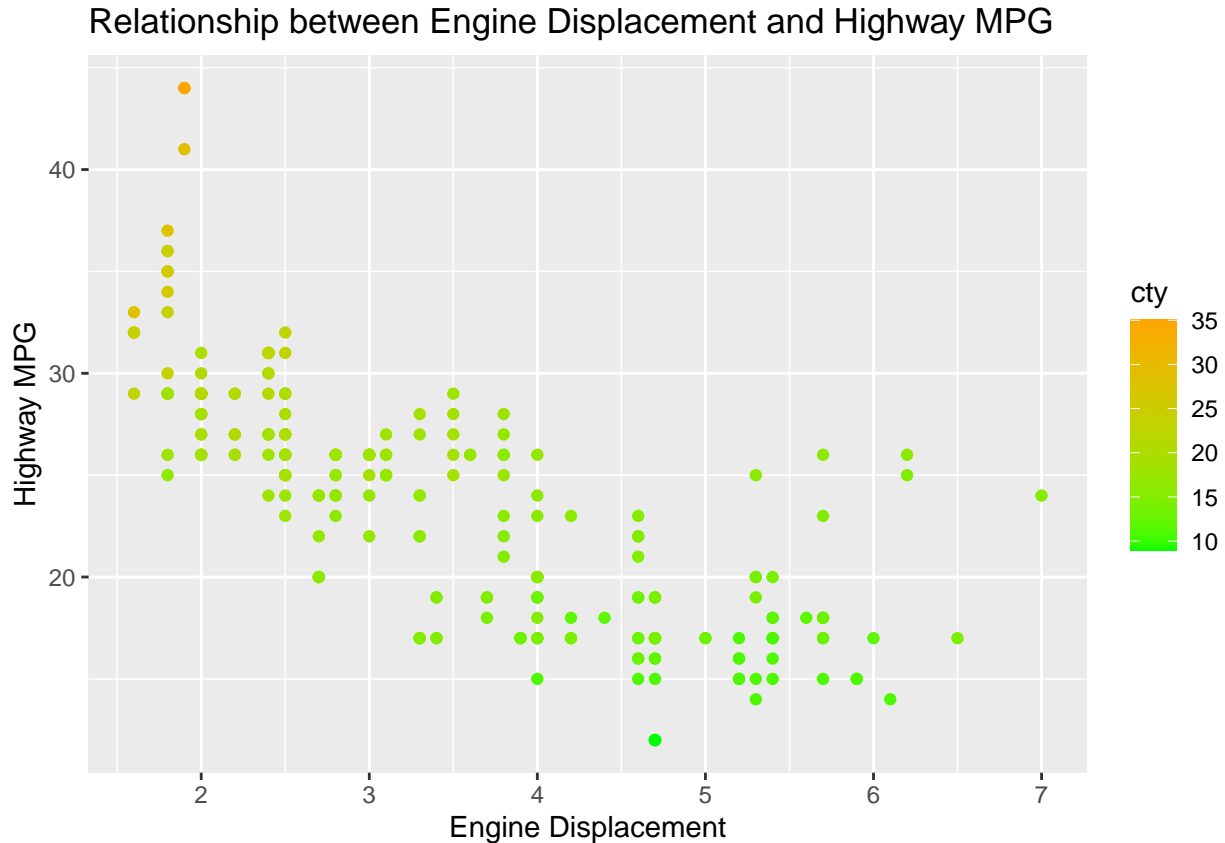
6. Import the traffic.csv onto your R environment.

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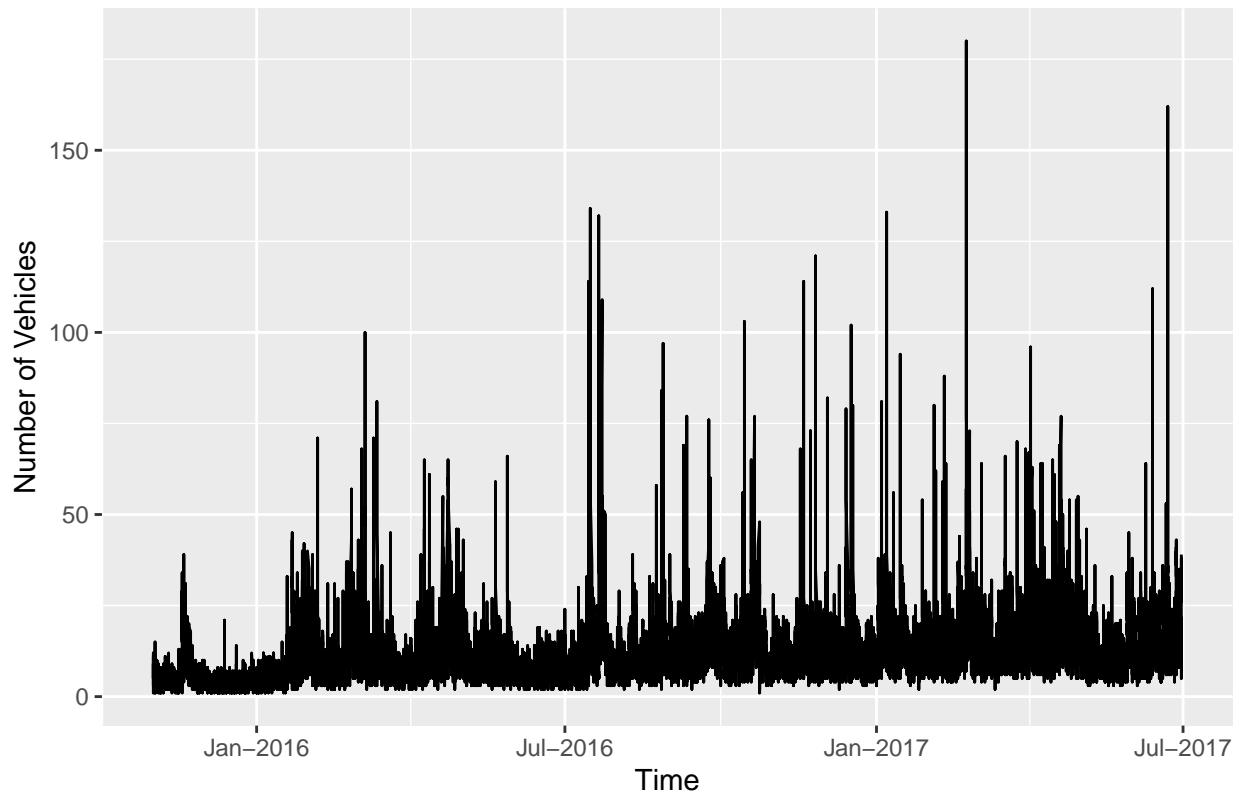
```
## Warning: Use of `junction_sub1$DateTime` is discouraged.
## i Use `DateTime` instead.
```

31
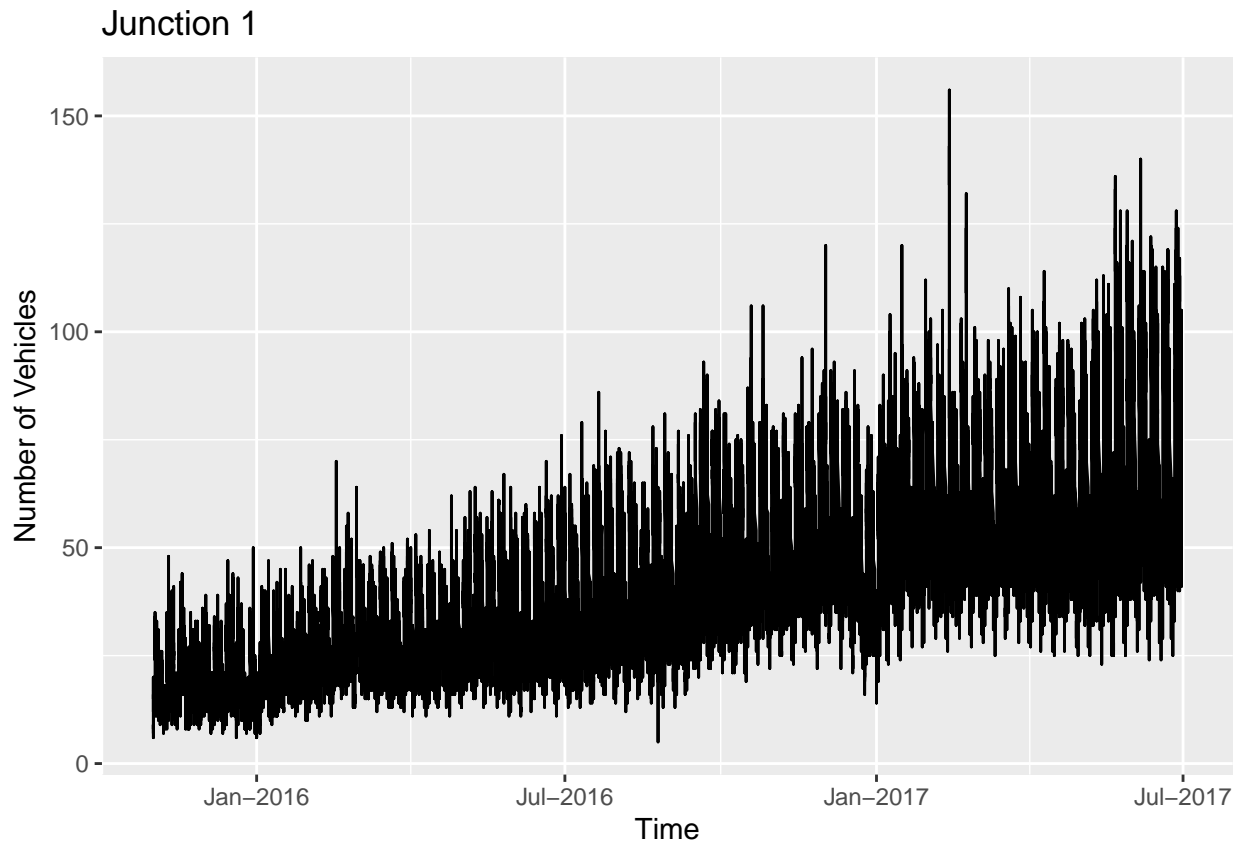
## Junction 1


```
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.
```
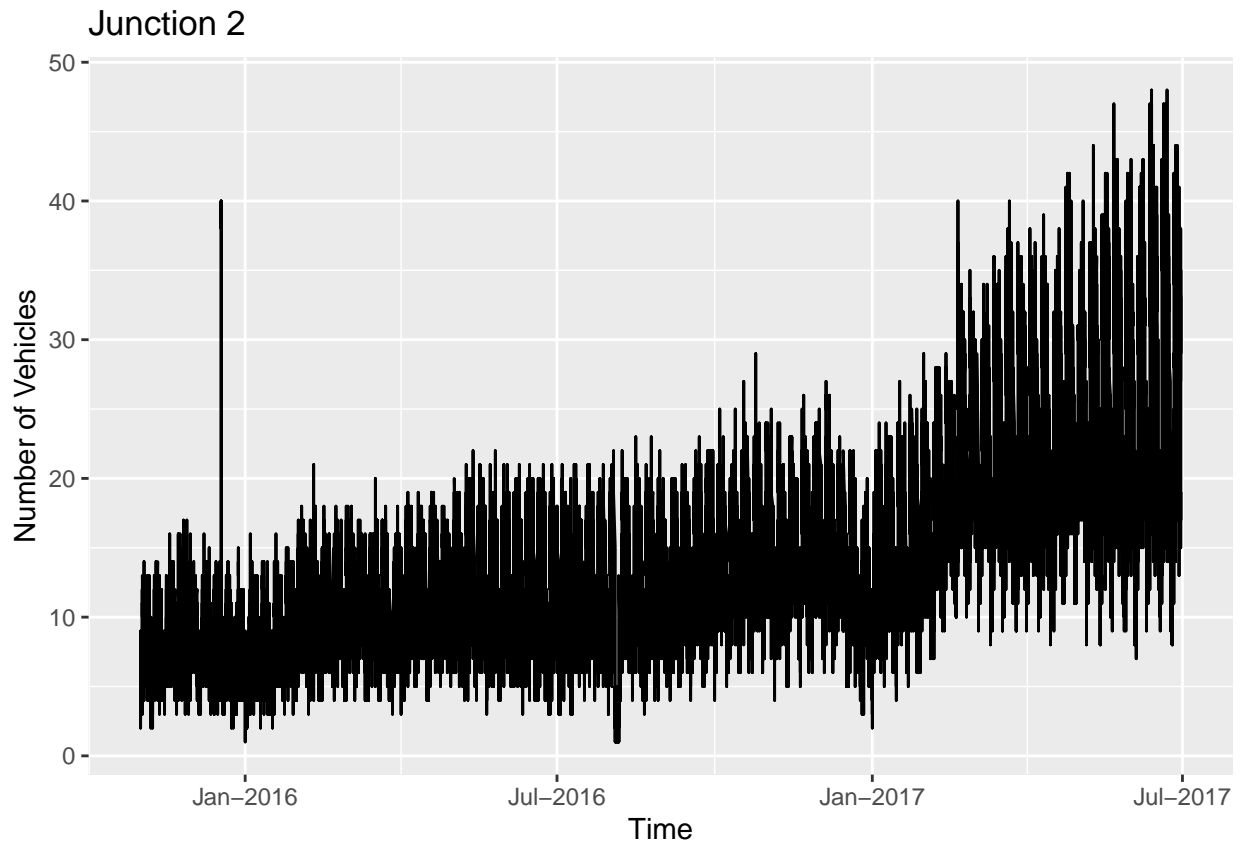
Junction 2


```
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.
```

Junction 3


```
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.
```

Junction 4
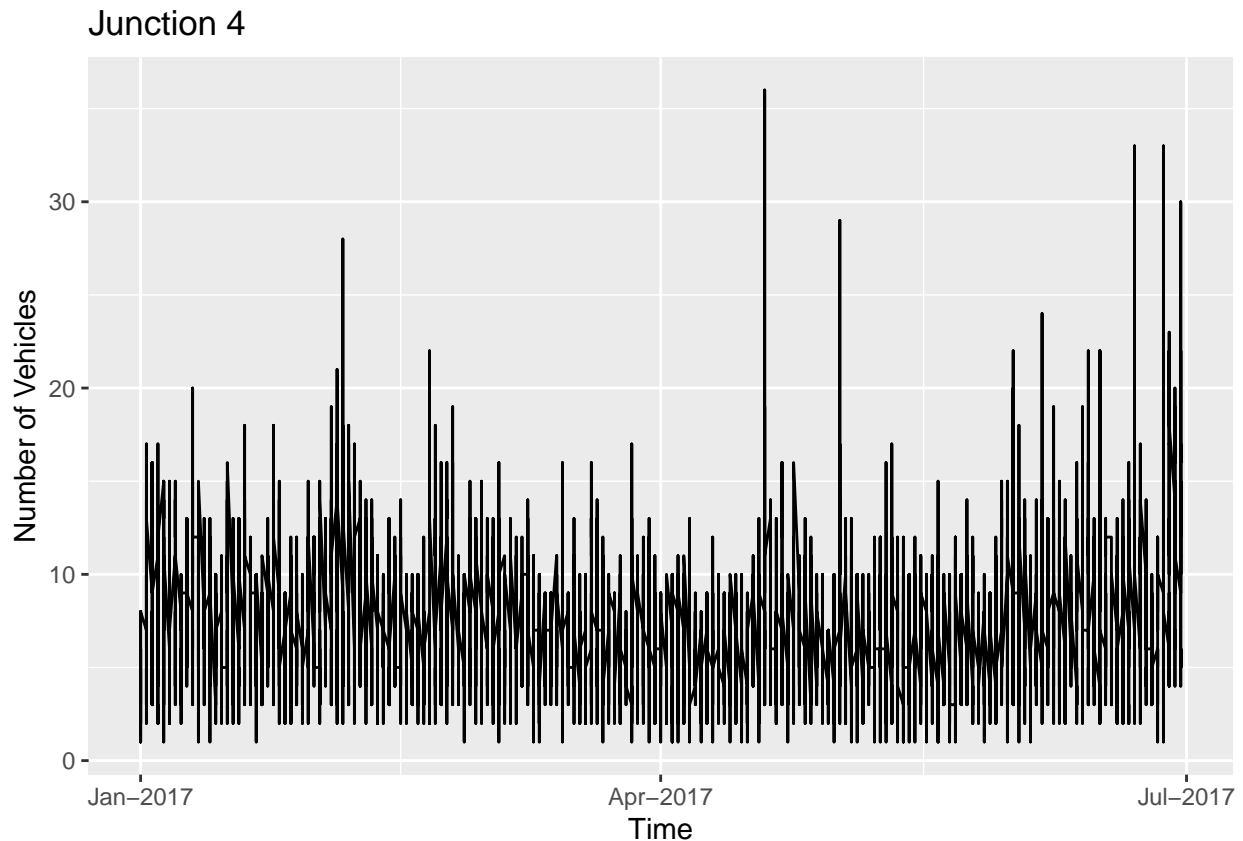
7. From alexa_file.xlsx, import it to your environment.

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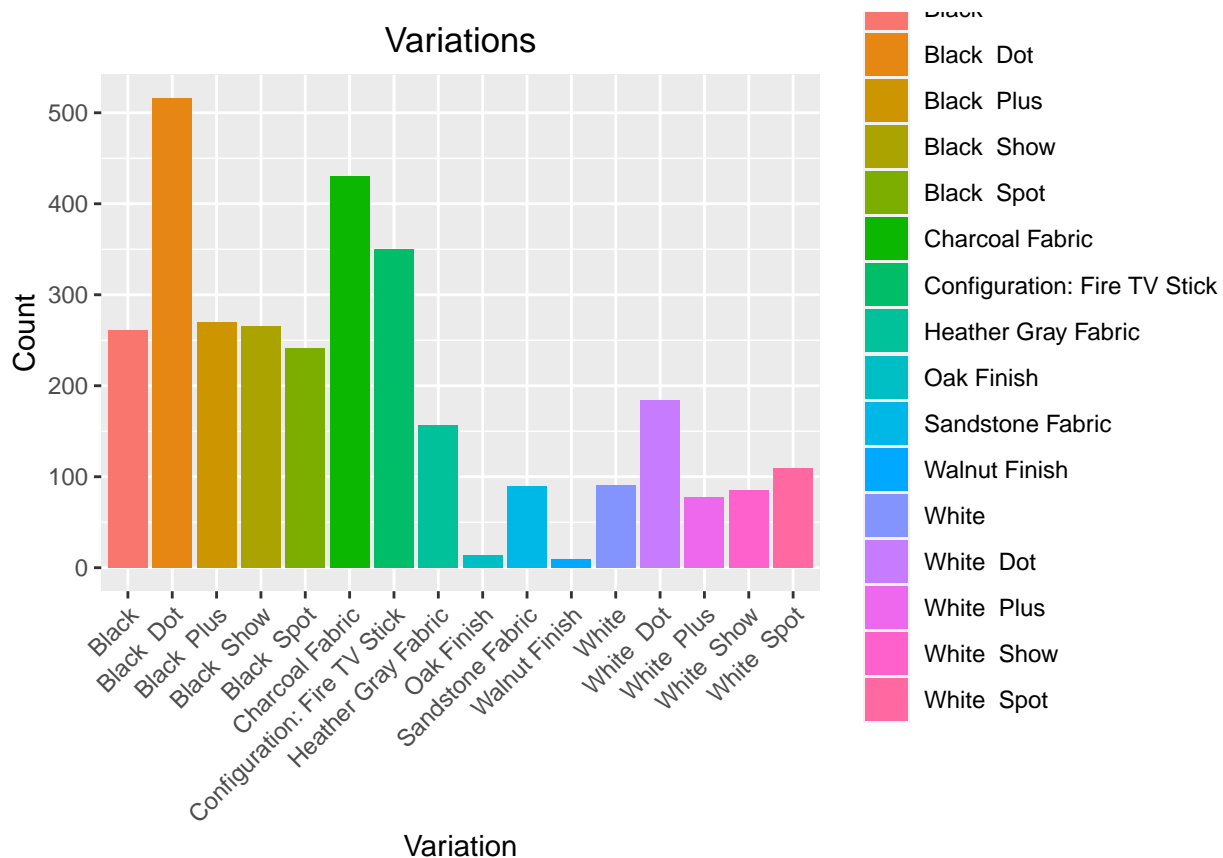
7c. Plot the variations using the ggplot() function. What did you observe? Complete the details of the graph. Show solution and answer.

```
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
```

Variations

Variation

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.

```r
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
```

```r
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
```

Number of Verified Reviews Over Time
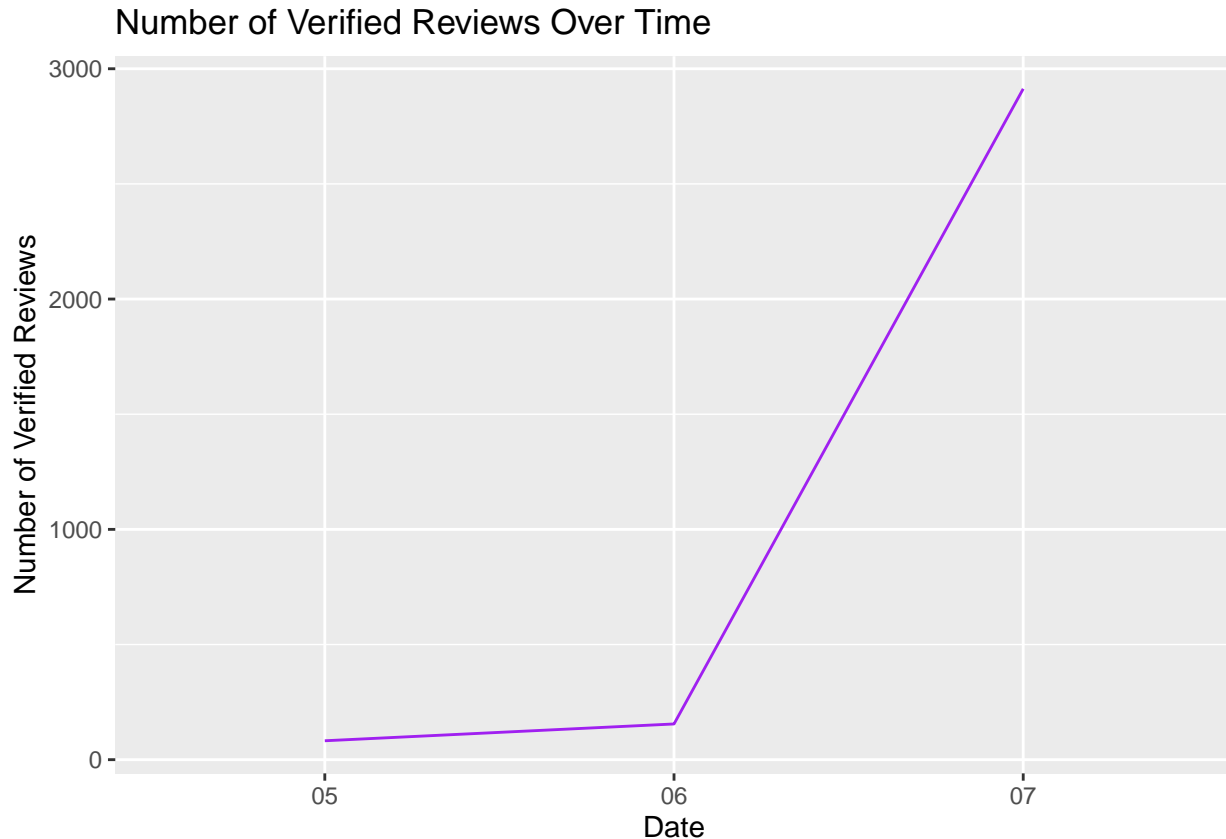
e. Get the relationship of variations and ratings. Which variations got the most highest in rating? Plot a graph to show its relationship. Show your solution and answer.

```
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