RWorksheet_Ganon#4c.Rmd

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#1.

```r
library(readxl)
mpg <- read.csv("mpg.csv")
mpg
```

```
##       X manufacturer                model displ year cyl      trans drv cty
## 1     1         audi                   a4   1.8 1999   4   auto(l5)   f  18
## 2     2         audi                   a4   1.8 1999   4 manual(m5)   f  21
## 3     3         audi                   a4   2.0 2008   4 manual(m6)   f  20
## 4     4         audi                   a4   2.0 2008   4   auto(av)   f  21
## 5     5         audi                   a4   2.8 1999   6   auto(l5)   f  16
## 6     6         audi                   a4   2.8 1999   6 manual(m5)   f  18
## 7     7         audi                   a4   3.1 2008   6   auto(av)   f  18
## 8     8         audi           a4 quattro   1.8 1999   4 manual(m5)   4  18
## 9     9         audi           a4 quattro   1.8 1999   4   auto(l5)   4  16
## 10   10         audi           a4 quattro   2.0 2008   4 manual(m6)   4  20
## 11   11         audi           a4 quattro   2.0 2008   4   auto(s6)   4  19
## 12   12         audi           a4 quattro   2.8 1999   6   auto(l5)   4  15
## 13   13         audi           a4 quattro   2.8 1999   6 manual(m5)   4  17
## 14   14         audi           a4 quattro   3.1 2008   6   auto(s6)   4  17
## 15   15         audi           a4 quattro   3.1 2008   6 manual(m6)   4  15
## 16   16         audi           a6 quattro   2.8 1999   6   auto(l5)   4  15
## 17   17         audi           a6 quattro   3.1 2008   6   auto(s6)   4  17
## 18   18         audi           a6 quattro   4.2 2008   8   auto(s6)   4  16
## 19   19    chevrolet    c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14
## 20   20    chevrolet    c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  11
## 21   21    chevrolet    c1500 suburban 2wd   5.3 2008   8   auto(l4)   r  14
## 22   22    chevrolet    c1500 suburban 2wd   5.7 1999   8   auto(l4)   r  13
## 23   23    chevrolet    c1500 suburban 2wd   6.0 2008   8   auto(l4)   r  12
## 24   24    chevrolet             corvette   5.7 1999   8 manual(m6)   r  16
## 25   25    chevrolet             corvette   5.7 1999   8   auto(l4)   r  15
## 26   26    chevrolet             corvette   6.2 2008   8 manual(m6)   r  16
## 27   27    chevrolet             corvette   6.2 2008   8   auto(s6)   r  15
## 28   28    chevrolet             corvette   7.0 2008   8 manual(m6)   r  15
## 29   29    chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  14
## 30   30    chevrolet        k1500 tahoe 4wd   5.3 2008   8   auto(l4)   4  11
## 31   31    chevrolet        k1500 tahoe 4wd   5.7 1999   8   auto(l4)   4  11
## 32   32    chevrolet        k1500 tahoe 4wd   6.5 1999   8   auto(l4)   4  14
## 33   33    chevrolet               malibu   2.4 1999   4   auto(l4)   f  19
## 34   34    chevrolet               malibu   2.4 2008   4   auto(l4)   f  22
## 35   35    chevrolet               malibu   3.1 1999   6   auto(l4)   f  18
## 36   36    chevrolet               malibu   3.5 2008   6   auto(l4)   f  18
```

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## 37 37     chevrolet              malibu 3.6 2008 6   auto(s6) f 17
## 38 38         dodge         caravan 2wd 2.4 1999 4   auto(l3) f 18
## 39 39         dodge         caravan 2wd 3.0 1999 6   auto(l4) f 17
## 40 40         dodge         caravan 2wd 3.3 1999 6   auto(l4) f 16
## 41 41         dodge         caravan 2wd 3.3 1999 6   auto(l4) f 16
## 42 42         dodge         caravan 2wd 3.3 2008 6   auto(l4) f 17
## 43 43         dodge         caravan 2wd 3.3 2008 6   auto(l4) f 17
## 44 44         dodge         caravan 2wd 3.3 2008 6   auto(l4) f 11
## 45 45         dodge         caravan 2wd 3.8 1999 6   auto(l4) f 15
## 46 46         dodge         caravan 2wd 3.8 1999 6   auto(l4) f 15
## 47 47         dodge         caravan 2wd 3.8 2008 6   auto(l6) f 16
## 48 48         dodge         caravan 2wd 4.0 2008 6   auto(l6) f 16
## 49 49         dodge   dakota pickup 4wd 3.7 2008 6 manual(m6) 4 15
## 50 50         dodge   dakota pickup 4wd 3.7 2008 6   auto(l4) 4 14
## 51 51         dodge   dakota pickup 4wd 3.9 1999 6   auto(l4) 4 13
## 52 52         dodge   dakota pickup 4wd 3.9 1999 6 manual(m5) 4 14
## 53 53         dodge   dakota pickup 4wd 4.7 2008 8   auto(l5) 4 14
## 54 54         dodge   dakota pickup 4wd 4.7 2008 8   auto(l5) 4 14
## 55 55         dodge   dakota pickup 4wd 4.7 2008 8   auto(l5) 4  9
## 56 56         dodge   dakota pickup 4wd 5.2 1999 8 manual(m5) 4 11
## 57 57         dodge   dakota pickup 4wd 5.2 1999 8   auto(l4) 4 11
## 58 58         dodge         durango 4wd 3.9 1999 6   auto(l4) 4 13
## 59 59         dodge         durango 4wd 4.7 2008 8   auto(l5) 4 13
## 60 60         dodge         durango 4wd 4.7 2008 8   auto(l5) 4  9
## 61 61         dodge         durango 4wd 4.7 2008 8   auto(l5) 4 13
## 62 62         dodge         durango 4wd 5.2 1999 8   auto(l4) 4 11
## 63 63         dodge         durango 4wd 5.7 2008 8   auto(l5) 4 13
## 64 64         dodge         durango 4wd 5.9 1999 8   auto(l4) 4 11
## 65 65         dodge ram 1500 pickup 4wd 4.7 2008 8 manual(m6) 4 12
## 66 66         dodge ram 1500 pickup 4wd 4.7 2008 8   auto(l5) 4  9
## 67 67         dodge ram 1500 pickup 4wd 4.7 2008 8   auto(l5) 4 13
## 68 68         dodge ram 1500 pickup 4wd 4.7 2008 8   auto(l5) 4 13
## 69 69         dodge ram 1500 pickup 4wd 4.7 2008 8 manual(m6) 4 12
## 70 70         dodge ram 1500 pickup 4wd 4.7 2008 8 manual(m6) 4  9
## 71 71         dodge ram 1500 pickup 4wd 5.2 1999 8   auto(l4) 4 11
## 72 72         dodge ram 1500 pickup 4wd 5.2 1999 8 manual(m5) 4 11
## 73 73         dodge ram 1500 pickup 4wd 5.7 2008 8   auto(l5) 4 13
## 74 74         dodge ram 1500 pickup 4wd 5.9 1999 8   auto(l4) 4 11
## 75 75          ford      expedition 2wd 4.6 1999 8   auto(l4) r 11
## 76 76          ford      expedition 2wd 5.4 1999 8   auto(l4) r 11
## 77 77          ford      expedition 2wd 5.4 2008 8   auto(l6) r 12
## 78 78          ford        explorer 4wd 4.0 1999 6   auto(l5) 4 14
## 79 79          ford        explorer 4wd 4.0 1999 6 manual(m5) 4 15
## 80 80          ford        explorer 4wd 4.0 1999 6   auto(l5) 4 14
## 81 81          ford        explorer 4wd 4.0 2008 6   auto(l5) 4 13
## 82 82          ford        explorer 4wd 4.6 2008 8   auto(l6) 4 13
## 83 83          ford        explorer 4wd 5.0 1999 8   auto(l4) 4 13
## 84 84          ford      f150 pickup 4wd 4.2 1999 6   auto(l4) 4 14
## 85 85          ford      f150 pickup 4wd 4.2 1999 6 manual(m5) 4 14
## 86 86          ford      f150 pickup 4wd 4.6 1999 8 manual(m5) 4 13
## 87 87          ford      f150 pickup 4wd 4.6 1999 8   auto(l4) 4 13
## 88 88          ford      f150 pickup 4wd 4.6 2008 8   auto(l4) 4 13
## 89 89          ford      f150 pickup 4wd 5.4 1999 8   auto(l4) 4 11
## 90 90          ford      f150 pickup 4wd 5.4 2008 8   auto(l4) 4 13
```

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## 91   91         ford             mustang 3.8 1999  6 manual(m5)  r  18
## 92   92         ford             mustang 3.8 1999  6   auto(l4)  r  18
## 93   93         ford             mustang 4.0 2008  6 manual(m5)  r  17
## 94   94         ford             mustang 4.0 2008  6   auto(l5)  r  16
## 95   95         ford             mustang 4.6 1999  8   auto(l4)  r  15
## 96   96         ford             mustang 4.6 1999  8 manual(m5)  r  15
## 97   97         ford             mustang 4.6 2008  8 manual(m5)  r  15
## 98   98         ford             mustang 4.6 2008  8   auto(l5)  r  15
## 99   99         ford             mustang 5.4 2008  8 manual(m6)  r  14
## 100 100        honda               civic 1.6 1999  4 manual(m5)  f  28
## 101 101        honda               civic 1.6 1999  4   auto(l4)  f  24
## 102 102        honda               civic 1.6 1999  4 manual(m5)  f  25
## 103 103        honda               civic 1.6 1999  4 manual(m5)  f  23
## 104 104        honda               civic 1.6 1999  4   auto(l4)  f  24
## 105 105        honda               civic 1.8 2008  4 manual(m5)  f  26
## 106 106        honda               civic 1.8 2008  4   auto(l5)  f  25
## 107 107        honda               civic 1.8 2008  4   auto(l5)  f  24
## 108 108        honda               civic 2.0 2008  4 manual(m6)  f  21
## 109 109      hyundai              sonata 2.4 1999  4   auto(l4)  f  18
## 110 110      hyundai              sonata 2.4 1999  4 manual(m5)  f  18
## 111 111      hyundai              sonata 2.4 2008  4   auto(l4)  f  21
## 112 112      hyundai              sonata 2.4 2008  4 manual(m5)  f  21
## 113 113      hyundai              sonata 2.5 1999  6   auto(l4)  f  18
## 114 114      hyundai              sonata 2.5 1999  6 manual(m5)  f  18
## 115 115      hyundai              sonata 3.3 2008  6   auto(l5)  f  19
## 116 116      hyundai             tiburon 2.0 1999  4   auto(l4)  f  19
## 117 117      hyundai             tiburon 2.0 1999  4 manual(m5)  f  19
## 118 118      hyundai             tiburon 2.0 2008  4 manual(m5)  f  20
## 119 119      hyundai             tiburon 2.0 2008  4   auto(l4)  f  20
## 120 120      hyundai             tiburon 2.7 2008  6   auto(l4)  f  17
## 121 121      hyundai             tiburon 2.7 2008  6 manual(m6)  f  16
## 122 122      hyundai             tiburon 2.7 2008  6 manual(m5)  f  17
## 123 123         jeep grand cherokee 4wd 3.0 2008  6   auto(l5)  4  17
## 124 124         jeep grand cherokee 4wd 3.7 2008  6   auto(l5)  4  15
## 125 125         jeep grand cherokee 4wd 4.0 1999  6   auto(l4)  4  15
## 126 126         jeep grand cherokee 4wd 4.7 1999  8   auto(l4)  4  14
## 127 127         jeep grand cherokee 4wd 4.7 2008  8   auto(l5)  4   9
## 128 128         jeep grand cherokee 4wd 4.7 2008  8   auto(l5)  4  14
## 129 129         jeep grand cherokee 4wd 5.7 2008  8   auto(l5)  4  13
## 130 130         jeep grand cherokee 4wd 6.1 2008  8   auto(l5)  4  11
## 131 131   land rover         range rover 4.0 1999  8   auto(l4)  4  11
## 132 132   land rover         range rover 4.2 2008  8   auto(s6)  4  12
## 133 133   land rover         range rover 4.4 2008  8   auto(s6)  4  12
## 134 134   land rover         range rover 4.6 1999  8   auto(l4)  4  11
## 135 135      lincoln       navigator 2wd 5.4 1999  8   auto(l4)  r  11
## 136 136      lincoln       navigator 2wd 5.4 1999  8   auto(l4)  r  11
## 137 137      lincoln       navigator 2wd 5.4 2008  8   auto(l6)  r  12
## 138 138      mercury     mountaineer 4wd 4.0 1999  6   auto(l5)  4  14
## 139 139      mercury     mountaineer 4wd 4.0 2008  6   auto(l5)  4  13
## 140 140      mercury     mountaineer 4wd 4.6 2008  8   auto(l6)  4  13
## 141 141      mercury     mountaineer 4wd 5.0 1999  8   auto(l4)  4  13
## 142 142       nissan              altima 2.4 1999  4 manual(m5)  f  21
## 143 143       nissan              altima 2.4 1999  4   auto(l4)  f  19
## 144 144       nissan              altima 2.5 2008  4   auto(av)  f  23
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## 145 145       nissan              altima  2.5 2008  4 manual(m6)  f  23
## 146 146       nissan              altima  3.5 2008  6 manual(m6)  f  19
## 147 147       nissan              altima  3.5 2008  6    auto(av)  f  19
## 148 148       nissan              maxima  3.0 1999  6    auto(l4)  f  18
## 149 149       nissan              maxima  3.0 1999  6 manual(m5)  f  19
## 150 150       nissan              maxima  3.5 2008  6    auto(av)  f  19
## 151 151       nissan       pathfinder 4wd  3.3 1999  6    auto(l4)  4  14
## 152 152       nissan       pathfinder 4wd  3.3 1999  6 manual(m5)  4  15
## 153 153       nissan       pathfinder 4wd  4.0 2008  6    auto(l5)  4  14
## 154 154       nissan       pathfinder 4wd  5.6 2008  8    auto(s5)  4  12
## 155 155      pontiac          grand prix  3.1 1999  6    auto(l4)  f  18
## 156 156      pontiac          grand prix  3.8 1999  6    auto(l4)  f  16
## 157 157      pontiac          grand prix  3.8 1999  6    auto(l4)  f  17
## 158 158      pontiac          grand prix  3.8 2008  6    auto(l4)  f  18
## 159 159      pontiac          grand prix  5.3 2008  8    auto(s4)  f  16
## 160 160       subaru        forester awd  2.5 1999  4 manual(m5)  4  18
## 161 161       subaru        forester awd  2.5 1999  4    auto(l4)  4  18
## 162 162       subaru        forester awd  2.5 2008  4 manual(m5)  4  20
## 163 163       subaru        forester awd  2.5 2008  4 manual(m5)  4  19
## 164 164       subaru        forester awd  2.5 2008  4    auto(l4)  4  20
## 165 165       subaru        forester awd  2.5 2008  4    auto(l4)  4  18
## 166 166       subaru         impreza awd  2.2 1999  4    auto(l4)  4  21
## 167 167       subaru         impreza awd  2.2 1999  4 manual(m5)  4  19
## 168 168       subaru         impreza awd  2.5 1999  4 manual(m5)  4  19
## 169 169       subaru         impreza awd  2.5 1999  4    auto(l4)  4  19
## 170 170       subaru         impreza awd  2.5 2008  4    auto(s4)  4  20
## 171 171       subaru         impreza awd  2.5 2008  4    auto(s4)  4  20
## 172 172       subaru         impreza awd  2.5 2008  4 manual(m5)  4  19
## 173 173       subaru         impreza awd  2.5 2008  4 manual(m5)  4  20
## 174 174       toyota         4runner 4wd  2.7 1999  4 manual(m5)  4  15
## 175 175       toyota         4runner 4wd  2.7 1999  4    auto(l4)  4  16
## 176 176       toyota         4runner 4wd  3.4 1999  6    auto(l4)  4  15
## 177 177       toyota         4runner 4wd  3.4 1999  6 manual(m5)  4  15
## 178 178       toyota         4runner 4wd  4.0 2008  6    auto(l5)  4  16
## 179 179       toyota         4runner 4wd  4.7 2008  8    auto(l5)  4  14
## 180 180       toyota               camry  2.2 1999  4 manual(m5)  f  21
## 181 181       toyota               camry  2.2 1999  4    auto(l4)  f  21
## 182 182       toyota               camry  2.4 2008  4 manual(m5)  f  21
## 183 183       toyota               camry  2.4 2008  4    auto(l5)  f  21
## 184 184       toyota               camry  3.0 1999  6    auto(l4)  f  18
## 185 185       toyota               camry  3.0 1999  6 manual(m5)  f  18
## 186 186       toyota               camry  3.5 2008  6    auto(s6)  f  19
## 187 187       toyota        camry solara  2.2 1999  4    auto(l4)  f  21
## 188 188       toyota        camry solara  2.2 1999  4 manual(m5)  f  21
## 189 189       toyota        camry solara  2.4 2008  4 manual(m5)  f  21
## 190 190       toyota        camry solara  2.4 2008  4    auto(s5)  f  22
## 191 191       toyota        camry solara  3.0 1999  6    auto(l4)  f  18
## 192 192       toyota        camry solara  3.0 1999  6 manual(m5)  f  18
## 193 193       toyota        camry solara  3.3 2008  6    auto(s5)  f  18
## 194 194       toyota             corolla  1.8 1999  4    auto(l3)  f  24
## 195 195       toyota             corolla  1.8 1999  4    auto(l4)  f  24
## 196 196       toyota             corolla  1.8 1999  4 manual(m5)  f  26
## 197 197       toyota             corolla  1.8 2008  4 manual(m5)  f  28
## 198 198       toyota             corolla  1.8 2008  4    auto(l4)  f  26
```

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## 199 199         toyota land cruiser wagon 4wd 4.7 1999 8   auto(l4) 4 11
## 200 200         toyota land cruiser wagon 4wd 5.7 2008 8   auto(s6) 4 13
## 201 201         toyota     toyota tacoma 4wd 2.7 1999 4 manual(m5) 4 15
## 202 202         toyota     toyota tacoma 4wd 2.7 1999 4   auto(l4) 4 16
## 203 203         toyota     toyota tacoma 4wd 2.7 2008 4 manual(m5) 4 17
## 204 204         toyota     toyota tacoma 4wd 3.4 1999 6 manual(m5) 4 15
## 205 205         toyota     toyota tacoma 4wd 3.4 1999 6   auto(l4) 4 15
## 206 206         toyota     toyota tacoma 4wd 4.0 2008 6 manual(m6) 4 15
## 207 207         toyota     toyota tacoma 4wd 4.0 2008 6   auto(l5) 4 16
## 208 208     volkswagen               gti 2.0 1999 4 manual(m5) f 21
## 209 209     volkswagen               gti 2.0 1999 4   auto(l4) f 19
## 210 210     volkswagen               gti 2.0 2008 4 manual(m6) f 21
## 211 211     volkswagen               gti 2.0 2008 4   auto(s6) f 22
## 212 212     volkswagen               gti 2.8 1999 6 manual(m5) f 17
## 213 213     volkswagen             jetta 1.9 1999 4 manual(m5) f 33
## 214 214     volkswagen             jetta 2.0 1999 4 manual(m5) f 21
## 215 215     volkswagen             jetta 2.0 1999 4   auto(l4) f 19
## 216 216     volkswagen             jetta 2.0 2008 4   auto(s6) f 22
## 217 217     volkswagen             jetta 2.0 2008 4 manual(m6) f 21
## 218 218     volkswagen             jetta 2.5 2008 5   auto(s6) f 21
## 219 219     volkswagen             jetta 2.5 2008 5 manual(m5) f 21
## 220 220     volkswagen             jetta 2.8 1999 6   auto(l4) f 16
## 221 221     volkswagen             jetta 2.8 1999 6 manual(m5) f 17
## 222 222     volkswagen         new beetle 1.9 1999 4 manual(m5) f 35
## 223 223     volkswagen         new beetle 1.9 1999 4   auto(l4) f 29
## 224 224     volkswagen         new beetle 2.0 1999 4 manual(m5) f 21
## 225 225     volkswagen         new beetle 2.0 1999 4   auto(l4) f 19
## 226 226     volkswagen         new beetle 2.5 2008 5 manual(m5) f 20
## 227 227     volkswagen         new beetle 2.5 2008 5   auto(s6) f 20
## 228 228     volkswagen            passat 1.8 1999 4 manual(m5) f 21
## 229 229     volkswagen            passat 1.8 1999 4   auto(l5) f 18
## 230 230     volkswagen            passat 2.0 2008 4   auto(s6) f 19
## 231 231     volkswagen            passat 2.0 2008 4 manual(m6) f 21
## 232 232     volkswagen            passat 2.8 1999 6   auto(l5) f 16
## 233 233     volkswagen            passat 2.8 1999 6 manual(m5) f 18
## 234 234     volkswagen            passat 3.6 2008 6   auto(s6) f 17
##      hwy fl     class
## 1     29  p   compact
## 2     29  p   compact
## 3     31  p   compact
## 4     30  p   compact
## 5     26  p   compact
## 6     26  p   compact
## 7     27  p   compact
## 8     26  p   compact
## 9     25  p   compact
## 10    28  p   compact
## 11    27  p   compact
## 12    25  p   compact
## 13    25  p   compact
## 14    25  p   compact
## 15    25  p   compact
## 16    24  p   midsize
## 17    25  p   midsize
```

```
## 18   23   p    midsize
## 19   20   r        suv
## 20   15   e        suv
## 21   20   r        suv
## 22   17   r        suv
## 23   17   r        suv
## 24   26   p    2seater
## 25   23   p    2seater
## 26   26   p    2seater
## 27   25   p    2seater
## 28   24   p    2seater
## 29   19   r        suv
## 30   14   e        suv
## 31   15   r        suv
## 32   17   d        suv
## 33   27   r    midsize
## 34   30   r    midsize
## 35   26   r    midsize
## 36   29   r    midsize
## 37   26   r    midsize
## 38   24   r    minivan
## 39   24   r    minivan
## 40   22   r    minivan
## 41   22   r    minivan
## 42   24   r    minivan
## 43   24   r    minivan
## 44   17   e    minivan
## 45   22   r    minivan
## 46   21   r    minivan
## 47   23   r    minivan
## 48   23   r    minivan
## 49   19   r     pickup
## 50   18   r     pickup
## 51   17   r     pickup
## 52   17   r     pickup
## 53   19   r     pickup
## 54   19   r     pickup
## 55   12   e     pickup
## 56   17   r     pickup
## 57   15   r     pickup
## 58   17   r        suv
## 59   17   r        suv
## 60   12   e        suv
## 61   17   r        suv
## 62   16   r        suv
## 63   18   r        suv
## 64   15   r        suv
## 65   16   r     pickup
## 66   12   e     pickup
## 67   17   r     pickup
## 68   17   r     pickup
## 69   16   r     pickup
## 70   12   e     pickup
## 71   15   r     pickup
```

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## 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
```

#a. first you need to upload and read the csv file using read.csv

#b. the variables that are categorical are manufacturer, trans, model, trans, drv, fl, and class.

#c. the continuous variables are disp, cty, and hwy

#2.

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

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

the most models are dodge which is 37.

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

```
##
##            4runner 4wd                      a4               a4 quattro
##                     6                       7                        8
##            a6 quattro                  altima       c1500 suburban 2wd
##                     3                       6                        5
##                 camry            camry solara              caravan 2wd
##                     7                       7                       11
##                 civic                 corolla                 corvette
##                     9                       5                        5
##       dakota pickup 4wd            durango 4wd          expedition 2wd
##                     9                       7                        3
##           explorer 4wd         f150 pickup 4wd             forester awd
##                     6                       7                        6
##      grand cherokee 4wd             grand prix                      gti
##                     8                       5                        5
##            impreza awd                   jetta          k1500 tahoe 4wd
##                     8                       9                        4
## land cruiser wagon 4wd                 malibu                   maxima
##                     2                       5                        3
##         mountaineer 4wd                mustang            navigator 2wd
##                     4                       9                        3
##             new beetle                  passat            pathfinder 4wd
##                     6                       7                        4
##      ram 1500 pickup 4wd            range rover                   sonata
##                    10                       4                        7
##                tiburon        toyota tacoma 4wd
##                     7                       7
```

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

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

```r
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
```

```r
unique_mod <- mpg %>%
 group_by(manufacturer) %>%
 summarise(models = n_distinct(model))
unique_mod
```

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

#b. Graph the result by using plot() and ggplot().

```r
library(ggplot2)
```

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

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

```r
unique_mod$manufacturer <- as.factor(unique_mod$manufacturer)
unique_mod$models <- as.numeric(unique_mod$models)

plot(unique_mod$manufacturer, unique_mod$models,
     type = "p",
     col = "orange",
```

```
    main = "Number of Unique Models per Manufacturer",
    xlab = "Manufacturer",
    ylab = "Unique Model Count",
    las = 3)
```

Number of Unique Models per Manufacturer
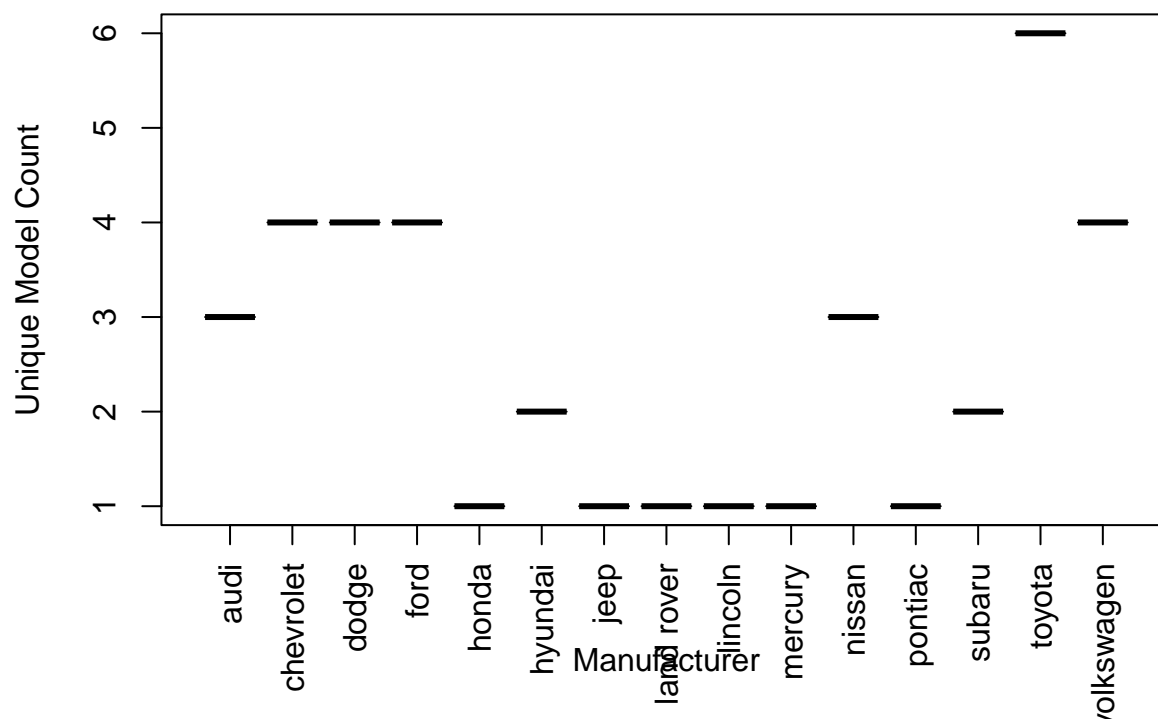

```
ggplot(unique_mod, aes(manufacturer, models), y = models) +
  geom_bar(stat = "identity", fill = "blue", color = "green") +
  labs(title = "Number of Unique Models per Manufacturer", x = "Manufacturer", y = "Unique Model Count")
```

Number of Unique Models per Manufacturer
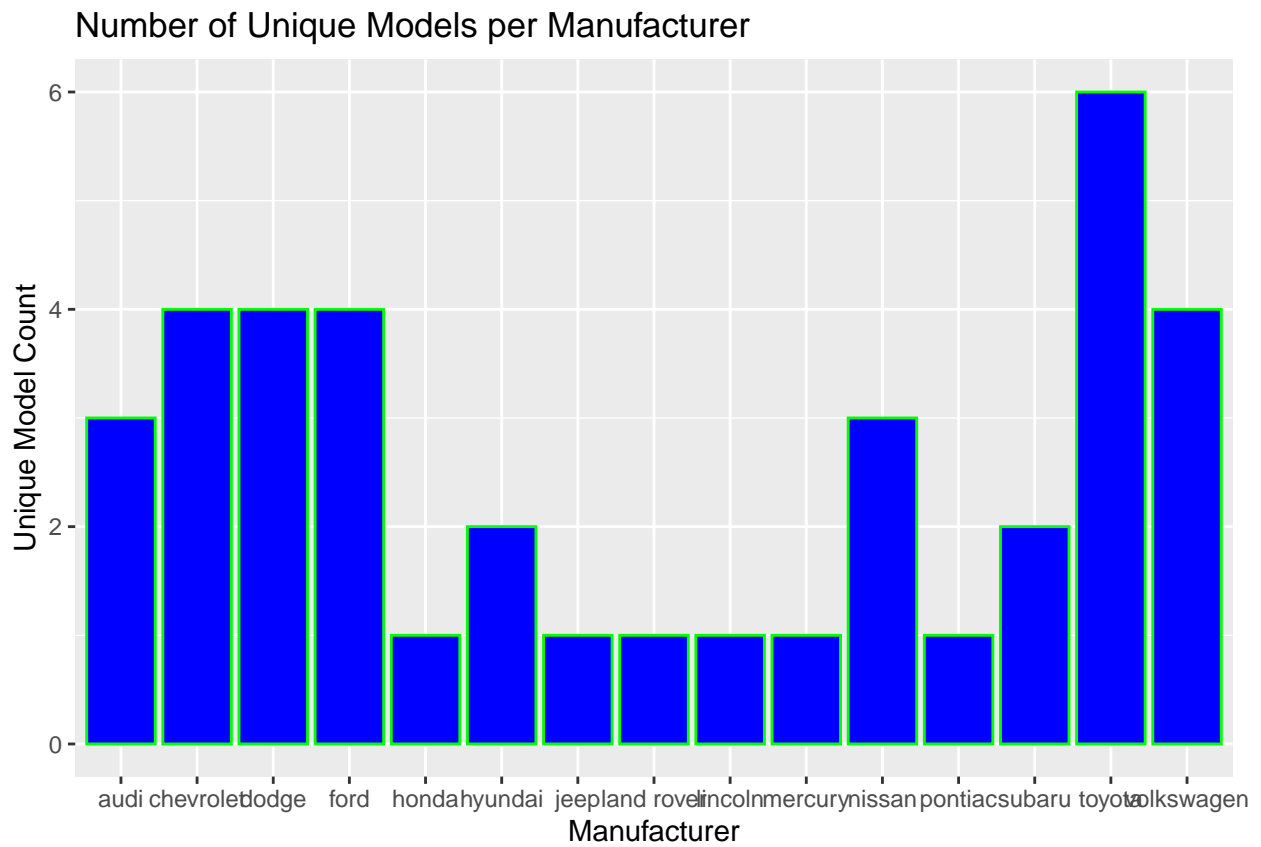
2.

```
library(ggplot2)
ggplot(unique_mod, aes(manufacturer, models), y = models) +
  geom_point( color = "gold")
```
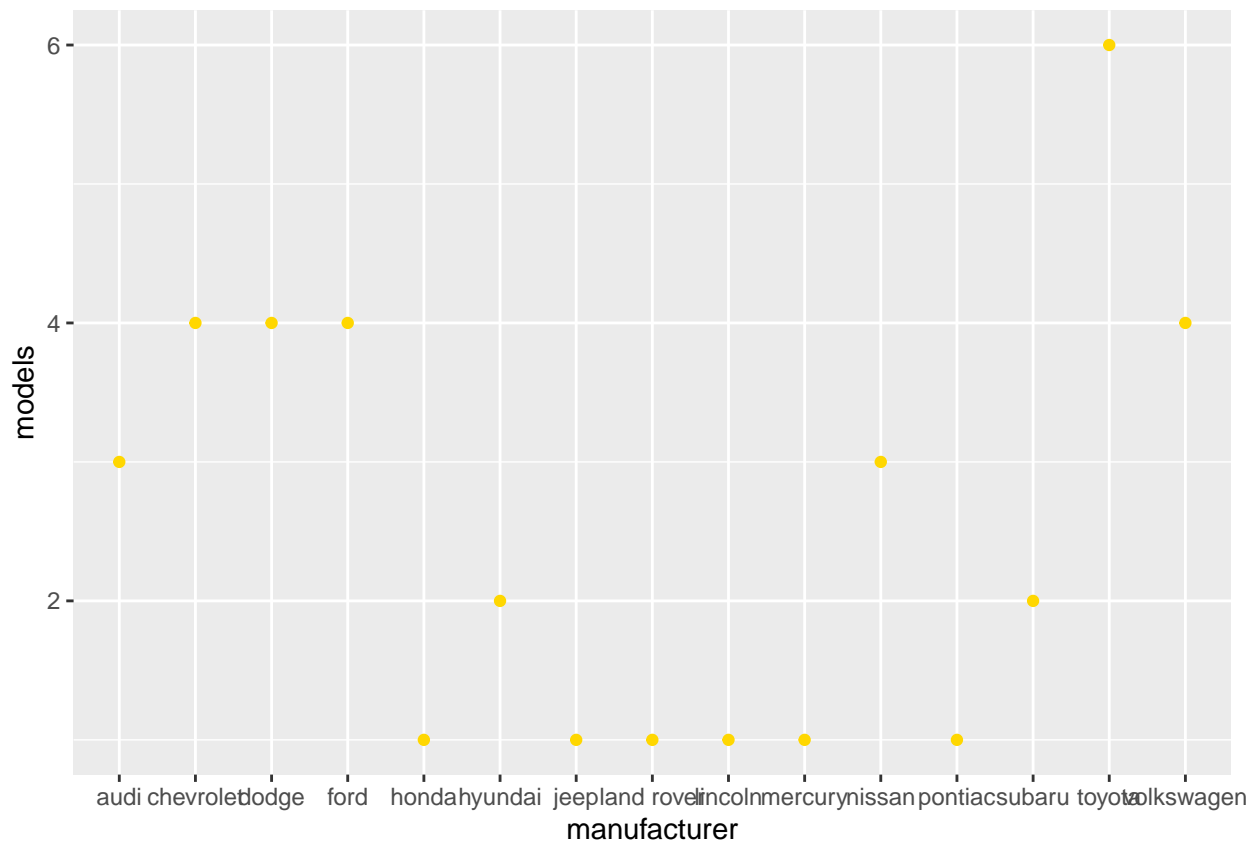
```
# this had shown the representation of the data using point
# b. For you, is it useful? If not, how could you modify the data to make it more informative?

# This is quite useful, but if necessary, you can enhance it by transforming the data, summarizing it,
```

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

```
top_mpg <- mpg %>%
  arrange(desc(mpg)) %>%
  head(20)
top_mpg
```

```
##      X manufacturer       model displ year cyl       trans drv cty hwy fl
## 1  234   volkswagen      passat   3.6 2008   6    auto(s6)   f  17  26  p
## 2  233   volkswagen      passat   2.8 1999   6  manual(m5)   f  18  26  p
## 3  232   volkswagen      passat   2.8 1999   6    auto(l5)   f  16  26  p
## 4  231   volkswagen      passat   2.0 2008   4  manual(m6)   f  21  29  p
## 5  230   volkswagen      passat   2.0 2008   4    auto(s6)   f  19  28  p
## 6  229   volkswagen      passat   1.8 1999   4    auto(l5)   f  18  29  p
## 7  228   volkswagen      passat   1.8 1999   4  manual(m5)   f  21  29  p
## 8  227   volkswagen  new beetle   2.5 2008   5    auto(s6)   f  20  29  r
## 9  226   volkswagen  new beetle   2.5 2008   5  manual(m5)   f  20  28  r
## 10 225   volkswagen  new beetle   2.0 1999   4    auto(l4)   f  19  26  r
## 11 224   volkswagen  new beetle   2.0 1999   4  manual(m5)   f  21  29  r
## 12 223   volkswagen  new beetle   1.9 1999   4    auto(l4)   f  29  41  d
## 13 222   volkswagen  new beetle   1.9 1999   4  manual(m5)   f  35  44  d
## 14 221   volkswagen       jetta   2.8 1999   6  manual(m5)   f  17  24  r
```

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```
## 15 220    volkswagen       jetta   2.8 1999   6    auto(l4)    f   16   23   r
## 16 219    volkswagen       jetta   2.5 2008   5 manual(m5)    f   21   29   r
## 17 218    volkswagen       jetta   2.5 2008   5    auto(s6)    f   21   29   r
## 18 217    volkswagen       jetta   2.0 2008   4 manual(m6)    f   21   29   p
## 19 216    volkswagen       jetta   2.0 2008   4    auto(s6)    f   22   29   p
## 20 215    volkswagen       jetta   2.0 1999   4    auto(l4)    f   19   26   r
##         class
## 1     midsize
## 2     midsize
## 3     midsize
## 4     midsize
## 5     midsize
## 6     midsize
## 7     midsize
## 8   subcompact
## 9   subcompact
## 10  subcompact
## 11  subcompact
## 12  subcompact
## 13  subcompact
## 14    compact
## 15    compact
## 16    compact
## 17    compact
## 18    compact
## 19    compact
## 20    compact
```

```r
ggplot(top_mpg, aes(model,year)) + geom_point()
```
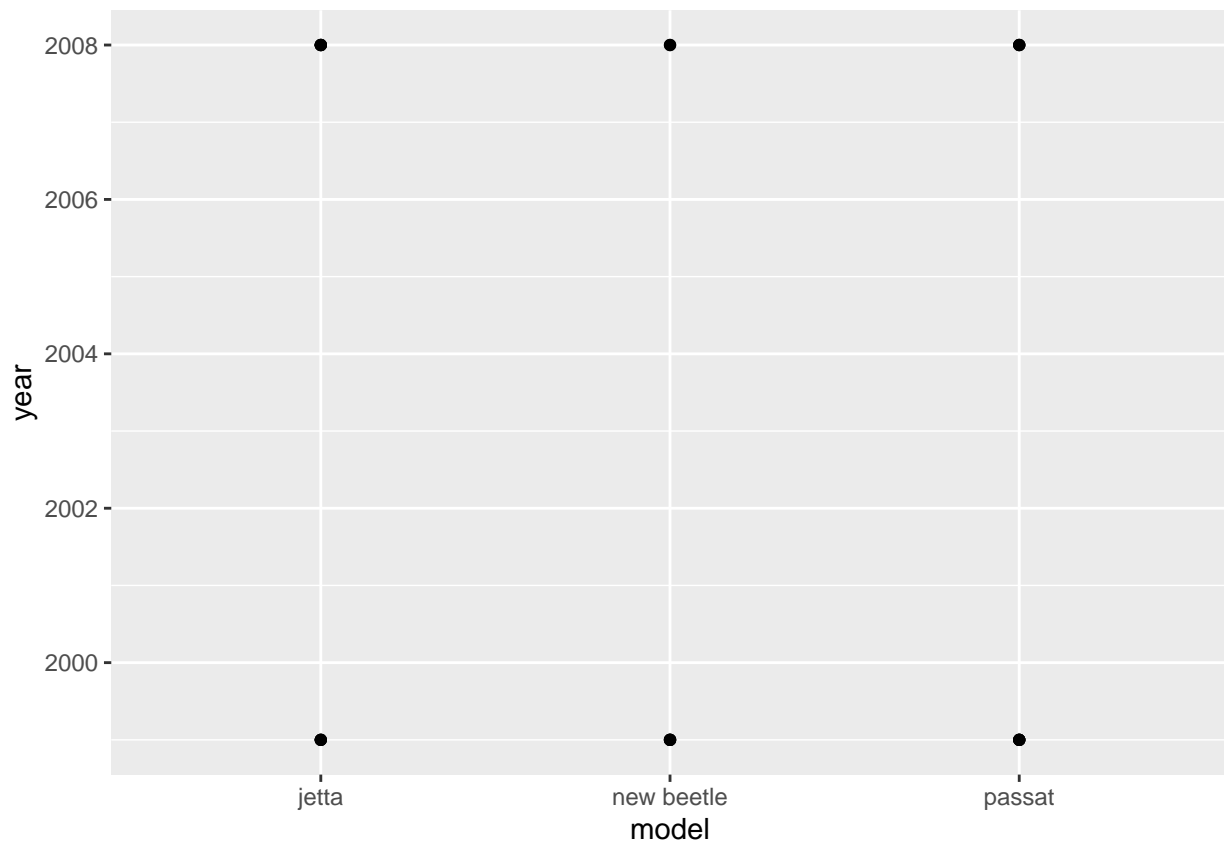
#4. Using the pipe (%>%), group the model and get the number of cars per model. Show codes and its result

```
car_counted <- mpg %>%
  group_by(model) %>%
  summarise(count = n()) %>%
  arrange(desc(count))

# Display the result
car_counted
```

```
## # A tibble: 38 x 2
##    model               count
##    <chr>               <int>
##  1 caravan 2wd            11
##  2 ram 1500 pickup 4wd    10
##  3 civic                   9
##  4 dakota pickup 4wd       9
##  5 jetta                   9
##  6 mustang                 9
##  7 a4 quattro              8
##  8 grand cherokee 4wd      8
##  9 impreza awd             8
## 10 a4                      7
## # i 28 more rows
```

a.

```
ggplot(car_counted, aes(x = model, y = count)) +
  geom_bar(stat = "identity", fill = "red", color = "blue") +
  labs(title = "Top 20 Observations", x = "Model", y = "Count of Cars")
```

Top 20 Observations
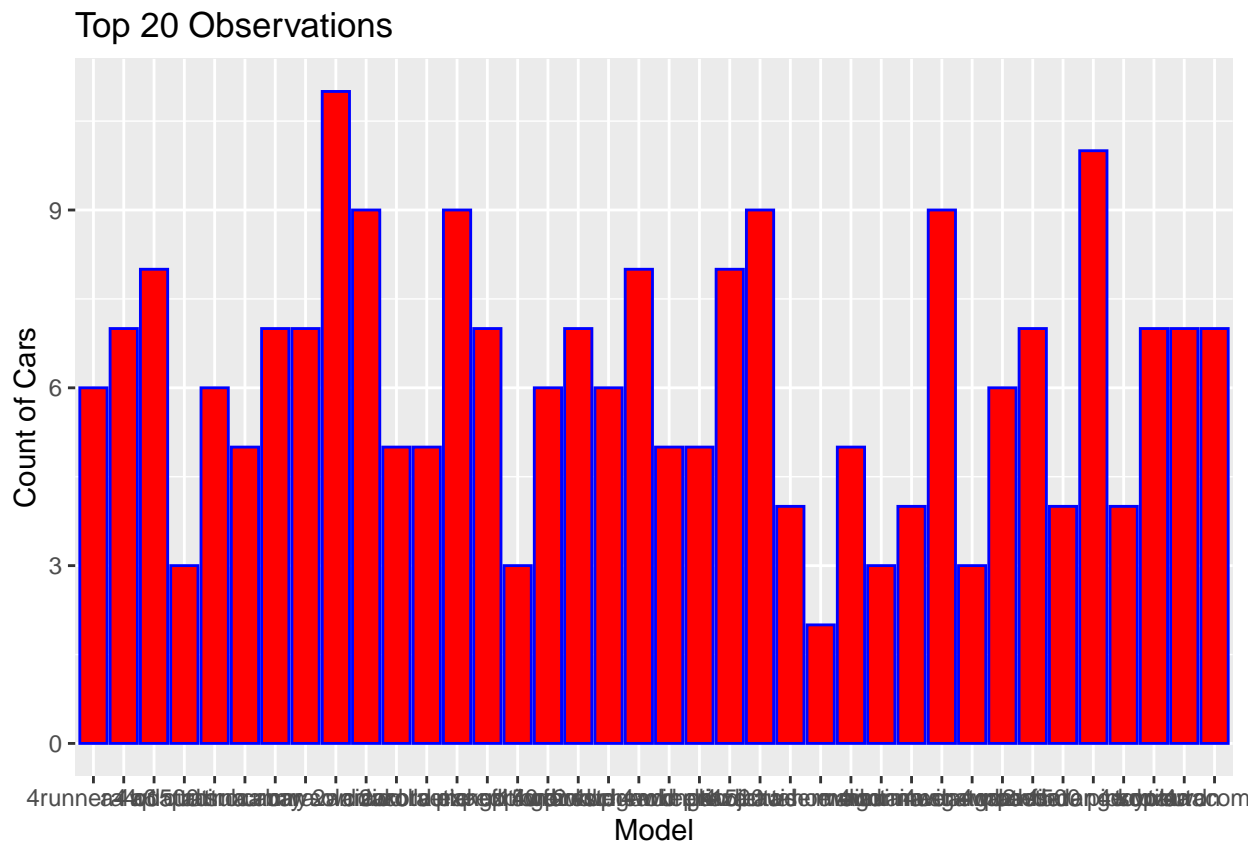
#b.

```
ggplot(car_counted, aes(x = model, y = count)) +
  geom_bar(stat = "identity", fill = "red", color = "blue") +
  labs(title = "Top 20 Observations", x = "Model", y = "Count of Cars") +
  coord_flip()
```

Top 20 Observations
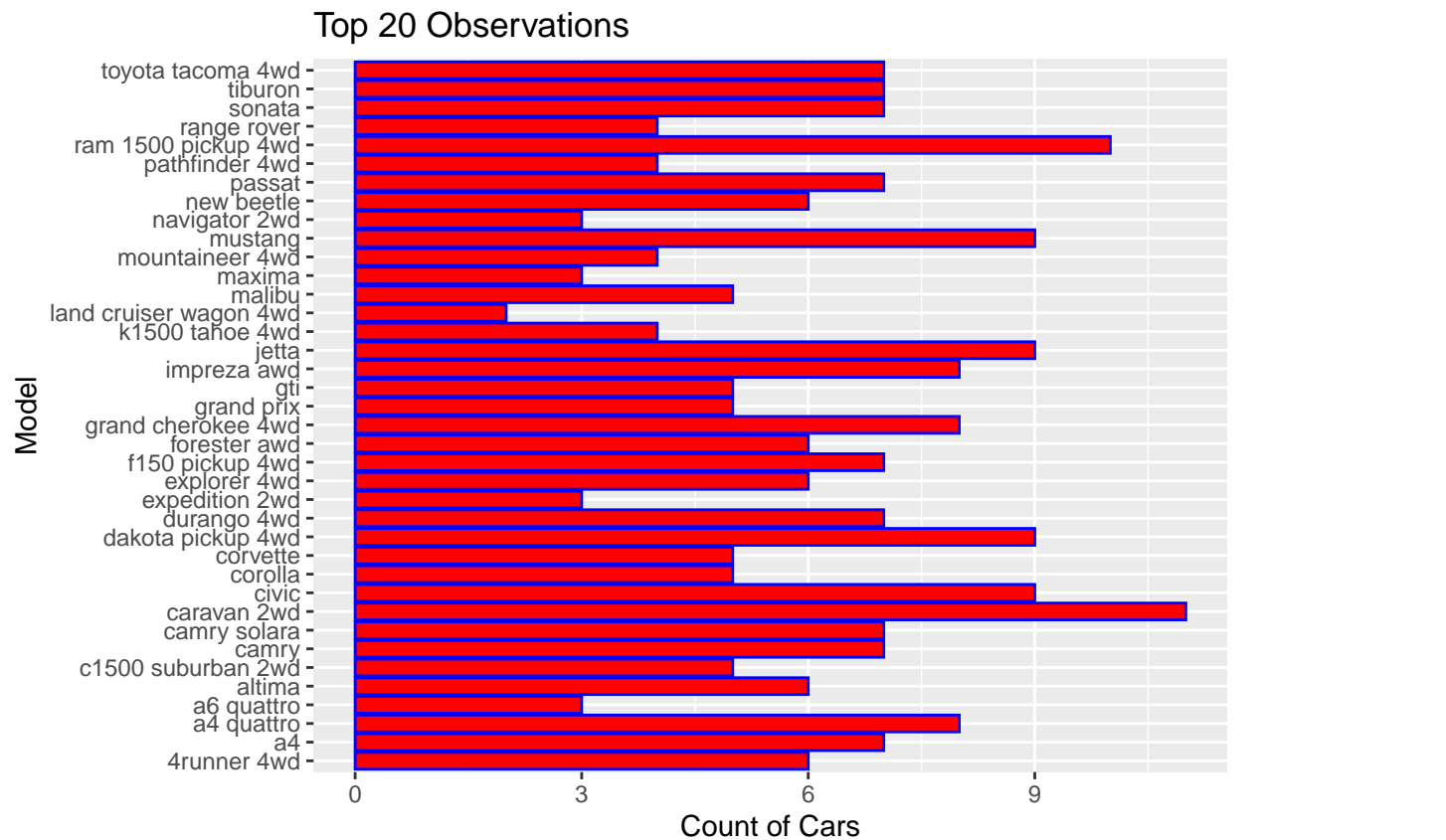
#5.

```
library("ggplot2")
ggplot(mpg, aes(x = displ, y = cyl, color = displ)) + geom_point(size = 3) +  labs(title = "Relationship
       x = "Number of Cylinders (cyl)",
       y = "Engine Displacement (displ)")
```

Relationship between No. of Cylinders and Engine Displacement
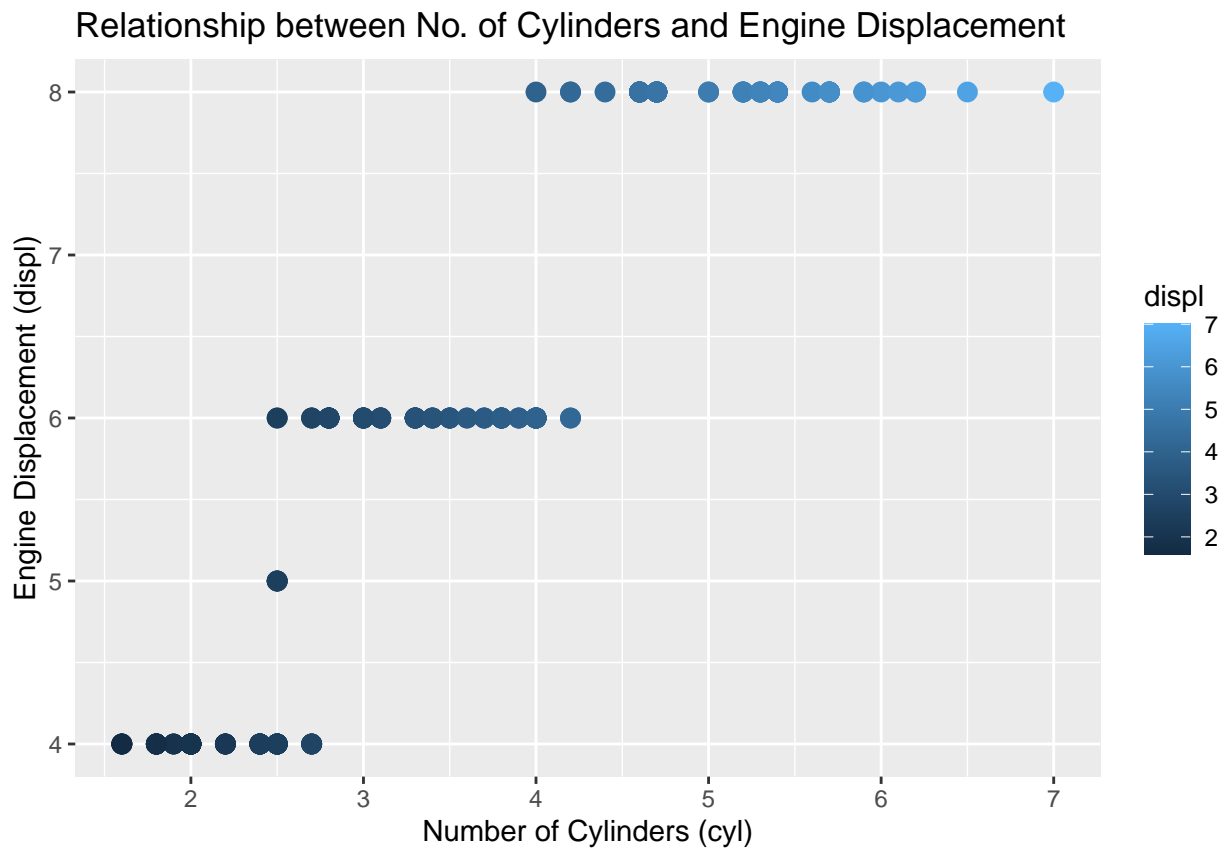
#6. Plot the relationship between displ (engine displacement) and hwy(highway miles per gallon).

```
ggplot(mpg, aes(x = displ, y = hwy, color = cyl)) +
  geom_point(size = 3) +
  labs(title = "Relationship between Engine Displacement and Highway MPG",
       x = "Engine Displacement (displ)",
       y = "Highway MPG (hwy)")
```

Relationship between Engine Displacement and Highway MPG

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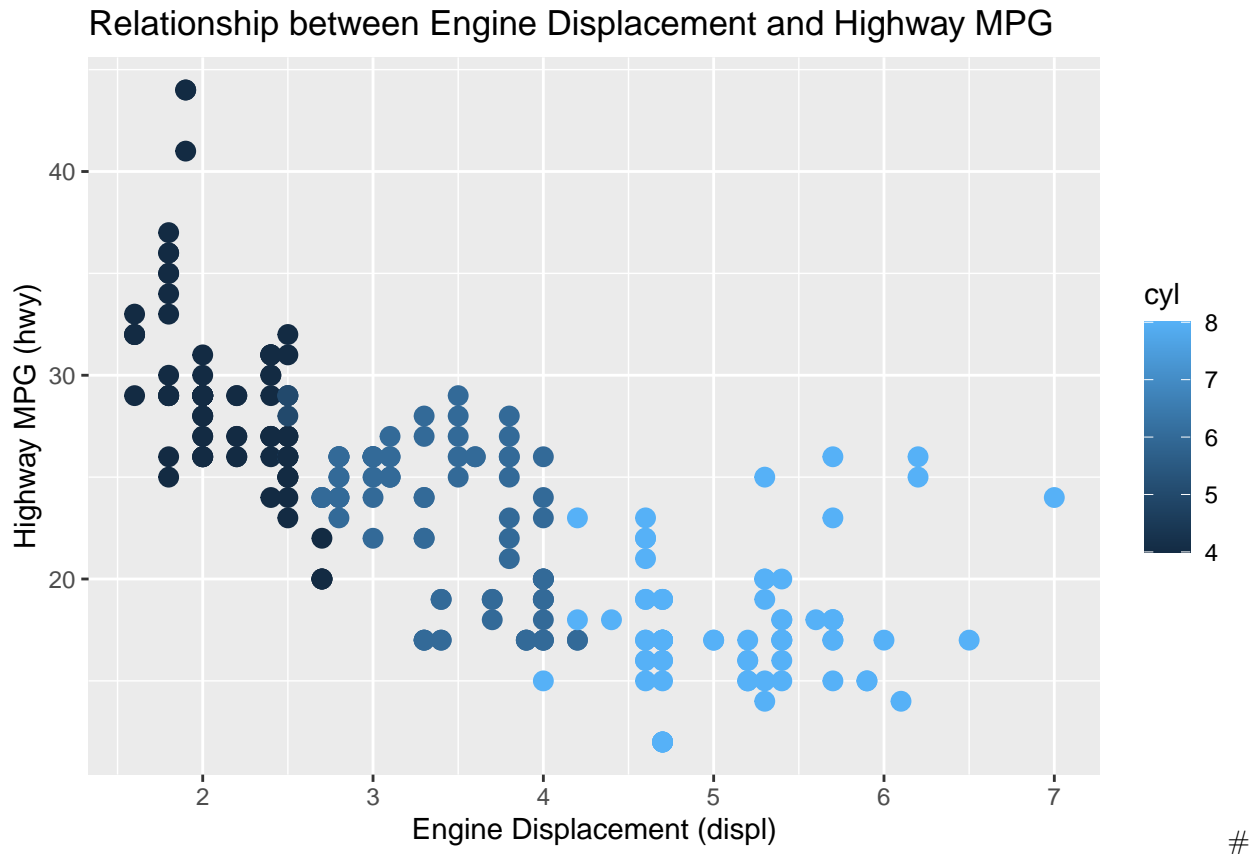
6. Import the traffic.csv onto your R environment.

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

```r
str(traffic)
```

```
## 'data.frame':    48120 obs. of  4 variables:
##  $ DateTime: chr  "2015-11-01 00:00:00" "2015-11-01 01:00:00" "2015-11-01 02:00:00" "2015-11-01 03:00
##  $ Junction: int  1 1 1 1 1 1 1 1 1 1 ...
##  $ Vehicles: int  15 13 10 7 9 6 9 8 11 12 ...
##  $ ID      : num  2.02e+10 2.02e+10 2.02e+10 2.02e+10 2.02e+10 ...
```

```r
# The dataset contains 48,120 observations and 4 variables: DateTime, Junction, Vehicles, and ID.
```

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

```r
junction <- split(traffic, traffic$Junction)
```

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

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

```r
# Plot each junction using geom_line() and facet_wrap()
```

```r
ggplot(traffic, aes(x = DateTime, y = Vehicles)) +
  geom_line(color = "blue") +
  labs(title = "Traffic Volume Over Time at Each Junction",
       x = "DateTime",
       y = "Number of Vehicles") +
  facet_wrap(~ Junction)
```


Traffic Volume Over Time at Each Junction

```
# 7.
```
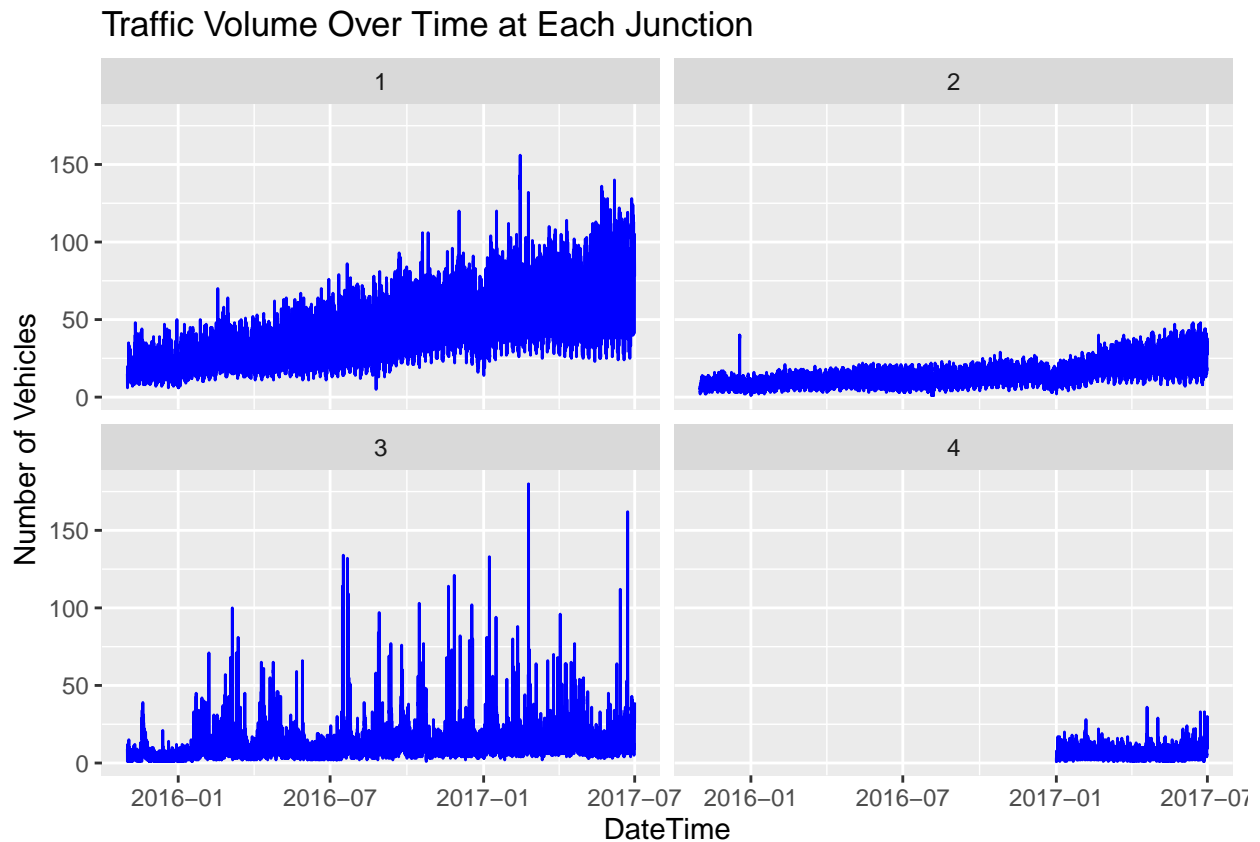
```r
alexa <- read.csv("alexa_file.csv")
```

```r
str(alexa)
```

```
## 'data.frame':    3150 obs. of  5 variables:
##  $ rating           : int  5 5 4 5 5 5 3 5 5 5 ...
##  $ date             : chr  "31-Jul-18" "31-Jul-18" "31-Jul-18" "31-Jul-18" ...
##  $ variation        : chr  "Charcoal Fabric " "Charcoal Fabric " "Walnut Finish " "Charcoal Fabric "
##  $ verified_reviews : chr  "Love my Echo!" "Loved it!" "Sometimes while playing a game, you can answe
##  $ feedback         : int  1 1 1 1 1 1 1 1 1 1 ...
```

```r
ncol(alexa)
```

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

```r
# There are 3150 observations and 5 columns in alexafile
```

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

```r
print(colnames(alexa))
```

```
## [1] "rating"          "date"            "variation"       "verified_reviews"
## [5] "feedback"
```

```
variation_totals <- alexa %>%
 group_by(variation) %>%
  summarise(total = n())
variation_totals
```

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

c.

```
library("ggplot2")
ggplot(alexa, aes(x = date, y = variation)) +
geom_point() + labs(title = "Variations over Time", x = "Date", y = "Variation", color = "Verified")
```

Variations over Time
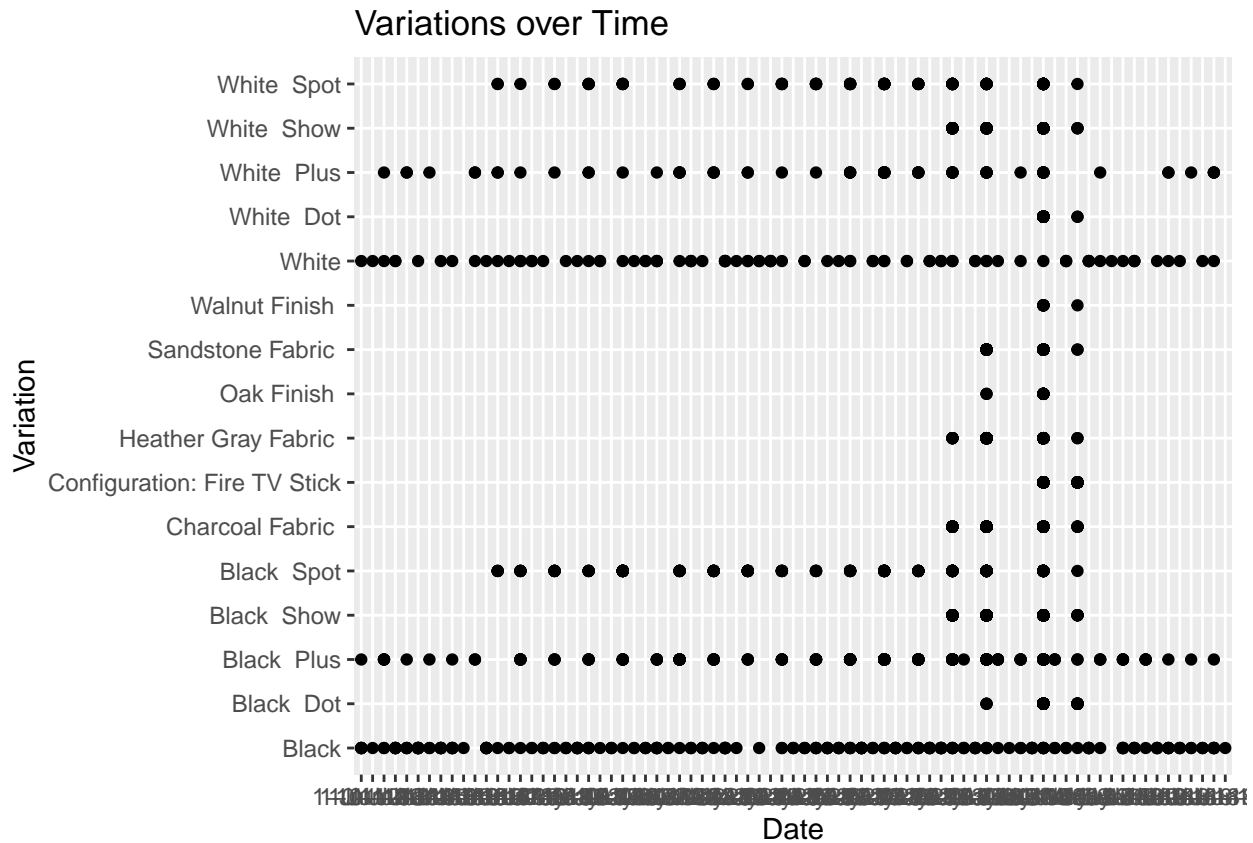
d. Plot a geom_line() with the date and the number of verified reviews. Complete the details of the graphs. Show your answer and solution.

```r
alexa$date <- as.Date(alexa$date, format = "%d-%b-%y")
review_counts <- alexa %>%
  group_by(date) %>%
  summarise(review_count = n())
ggplot(data = review_counts, aes(x = date, y = review_count)) +
  geom_line(color = "blue", size = 1) +
  labs(
    title = "Number of Verified Reviews Over Time",
    x = "Date",
    y = "Number of Verified Reviews"
  ) +
  theme_minimal()
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

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Number of Verified Reviews Over Time

#e.
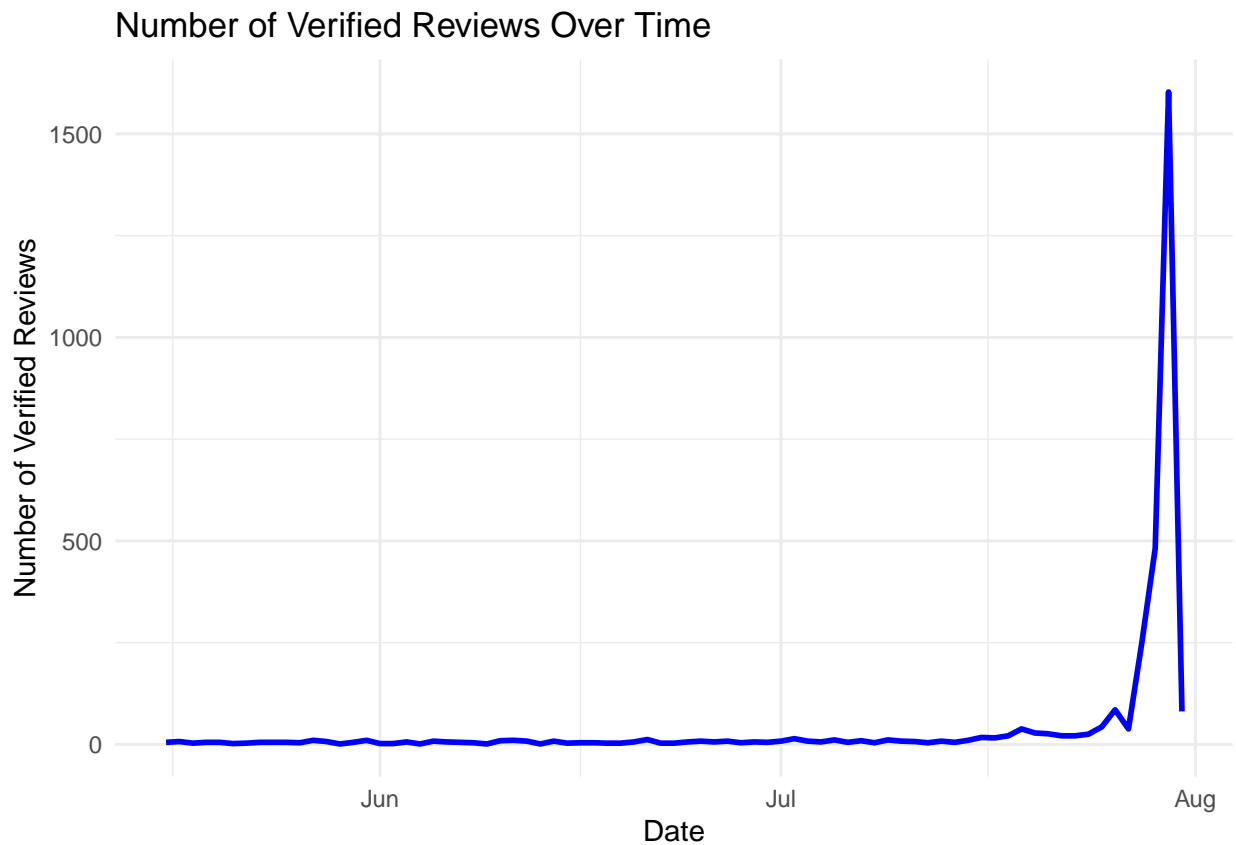
```r
variation_ratings <- alexa %>%
  group_by(variation) %>%
  summarise(average_rating = mean(rating, na.rm = TRUE)) %>%
  arrange(desc(average_rating))


ggplot(variation_ratings, aes(x = reorder(variation, -average_rating), y = average_rating)) +
  geom_bar(stat = "identity", fill = "gold") +
  coord_flip() +  # Flip coordinates for better readability
  labs(title = "Average Rating by Product Variation",
       x = "Product Variation",
       y = "Average Rating") +
  theme_minimal()
```

Average Rating by Product Variation