

# RWorksheet\_Porras#6

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```
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
```

```
library(ggplot2)
```

```
data(mpg)
```

```
waw <- as.data.frame(mpg)
```

```
waw
```

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

|       |           |                     |     |      |   |            |   |    |    |
|-------|-----------|---------------------|-----|------|---|------------|---|----|----|
| ## 25 | chevrolet | corvette            | 5.7 | 1999 | 8 | auto(l4)   | r | 15 | 23 |
| ## 26 | chevrolet | corvette            | 6.2 | 2008 | 8 | manual(m6) | r | 16 | 26 |
| ## 27 | chevrolet | corvette            | 6.2 | 2008 | 8 | auto(s6)   | r | 15 | 25 |
| ## 28 | chevrolet | corvette            | 7.0 | 2008 | 8 | manual(m6) | r | 15 | 24 |
| ## 29 | chevrolet | k1500 tahoe 4wd     | 5.3 | 2008 | 8 | auto(l4)   | 4 | 14 | 19 |
| ## 30 | chevrolet | k1500 tahoe 4wd     | 5.3 | 2008 | 8 | auto(l4)   | 4 | 11 | 14 |
| ## 31 | chevrolet | k1500 tahoe 4wd     | 5.7 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 32 | chevrolet | k1500 tahoe 4wd     | 6.5 | 1999 | 8 | auto(l4)   | 4 | 14 | 17 |
| ## 33 | chevrolet | malibu              | 2.4 | 1999 | 4 | auto(l4)   | f | 19 | 27 |
| ## 34 | chevrolet | malibu              | 2.4 | 2008 | 4 | auto(l4)   | f | 22 | 30 |
| ## 35 | chevrolet | malibu              | 3.1 | 1999 | 6 | auto(l4)   | f | 18 | 26 |
| ## 36 | chevrolet | malibu              | 3.5 | 2008 | 6 | auto(l4)   | f | 18 | 29 |
| ## 37 | chevrolet | malibu              | 3.6 | 2008 | 6 | auto(s6)   | f | 17 | 26 |
| ## 38 | dodge     | caravan 2wd         | 2.4 | 1999 | 4 | auto(l3)   | f | 18 | 24 |
| ## 39 | dodge     | caravan 2wd         | 3.0 | 1999 | 6 | auto(l4)   | f | 17 | 24 |
| ## 40 | dodge     | caravan 2wd         | 3.3 | 1999 | 6 | auto(l4)   | f | 16 | 22 |
| ## 41 | dodge     | caravan 2wd         | 3.3 | 1999 | 6 | auto(l4)   | f | 16 | 22 |
| ## 42 | dodge     | caravan 2wd         | 3.3 | 2008 | 6 | auto(l4)   | f | 17 | 24 |
| ## 43 | dodge     | caravan 2wd         | 3.3 | 2008 | 6 | auto(l4)   | f | 17 | 24 |
| ## 44 | dodge     | caravan 2wd         | 3.3 | 2008 | 6 | auto(l4)   | f | 11 | 17 |
| ## 45 | dodge     | caravan 2wd         | 3.8 | 1999 | 6 | auto(l4)   | f | 15 | 22 |
| ## 46 | dodge     | caravan 2wd         | 3.8 | 1999 | 6 | auto(l4)   | f | 15 | 21 |
| ## 47 | dodge     | caravan 2wd         | 3.8 | 2008 | 6 | auto(l6)   | f | 16 | 23 |
| ## 48 | dodge     | caravan 2wd         | 4.0 | 2008 | 6 | auto(l6)   | f | 16 | 23 |
| ## 49 | dodge     | dakota pickup 4wd   | 3.7 | 2008 | 6 | manual(m6) | 4 | 15 | 19 |
| ## 50 | dodge     | dakota pickup 4wd   | 3.7 | 2008 | 6 | auto(l4)   | 4 | 14 | 18 |
| ## 51 | dodge     | dakota pickup 4wd   | 3.9 | 1999 | 6 | auto(l4)   | 4 | 13 | 17 |
| ## 52 | dodge     | dakota pickup 4wd   | 3.9 | 1999 | 6 | manual(m5) | 4 | 14 | 17 |
| ## 53 | dodge     | dakota pickup 4wd   | 4.7 | 2008 | 8 | auto(15)   | 4 | 14 | 19 |
| ## 54 | dodge     | dakota pickup 4wd   | 4.7 | 2008 | 8 | auto(15)   | 4 | 14 | 19 |
| ## 55 | dodge     | dakota pickup 4wd   | 4.7 | 2008 | 8 | auto(15)   | 4 | 9  | 12 |
| ## 56 | dodge     | dakota pickup 4wd   | 5.2 | 1999 | 8 | manual(m5) | 4 | 11 | 17 |
| ## 57 | dodge     | dakota pickup 4wd   | 5.2 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 58 | dodge     | durango 4wd         | 3.9 | 1999 | 6 | auto(l4)   | 4 | 13 | 17 |
| ## 59 | dodge     | durango 4wd         | 4.7 | 2008 | 8 | auto(15)   | 4 | 13 | 17 |
| ## 60 | dodge     | durango 4wd         | 4.7 | 2008 | 8 | auto(15)   | 4 | 9  | 12 |
| ## 61 | dodge     | durango 4wd         | 4.7 | 2008 | 8 | auto(15)   | 4 | 13 | 17 |
| ## 62 | dodge     | durango 4wd         | 5.2 | 1999 | 8 | auto(l4)   | 4 | 11 | 16 |
| ## 63 | dodge     | durango 4wd         | 5.7 | 2008 | 8 | auto(15)   | 4 | 13 | 18 |
| ## 64 | dodge     | durango 4wd         | 5.9 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 65 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | manual(m6) | 4 | 12 | 16 |
| ## 66 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | auto(15)   | 4 | 9  | 12 |
| ## 67 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | auto(15)   | 4 | 13 | 17 |
| ## 68 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | auto(15)   | 4 | 13 | 17 |
| ## 69 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | manual(m6) | 4 | 12 | 16 |
| ## 70 | dodge     | ram 1500 pickup 4wd | 4.7 | 2008 | 8 | manual(m6) | 4 | 9  | 12 |
| ## 71 | dodge     | ram 1500 pickup 4wd | 5.2 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 72 | dodge     | ram 1500 pickup 4wd | 5.2 | 1999 | 8 | manual(m5) | 4 | 11 | 16 |
| ## 73 | dodge     | ram 1500 pickup 4wd | 5.7 | 2008 | 8 | auto(15)   | 4 | 13 | 17 |
| ## 74 | dodge     | ram 1500 pickup 4wd | 5.9 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 75 | ford      | expedition 2wd      | 4.6 | 1999 | 8 | auto(l4)   | r | 11 | 17 |
| ## 76 | ford      | expedition 2wd      | 5.4 | 1999 | 8 | auto(l4)   | r | 11 | 17 |
| ## 77 | ford      | expedition 2wd      | 5.4 | 2008 | 8 | auto(l6)   | r | 12 | 18 |
| ## 78 | ford      | explorer 4wd        | 4.0 | 1999 | 6 | auto(15)   | 4 | 14 | 17 |

|        |            |                    |     |      |              |   |    |    |
|--------|------------|--------------------|-----|------|--------------|---|----|----|
| ## 79  | ford       | explorer 4wd       | 4.0 | 1999 | 6 manual(m5) | 4 | 15 | 19 |
| ## 80  | ford       | explorer 4wd       | 4.0 | 1999 | 6 auto(15)   | 4 | 14 | 17 |
| ## 81  | ford       | explorer 4wd       | 4.0 | 2008 | 6 auto(15)   | 4 | 13 | 19 |
| ## 82  | ford       | explorer 4wd       | 4.6 | 2008 | 8 auto(16)   | 4 | 13 | 19 |
| ## 83  | ford       | explorer 4wd       | 5.0 | 1999 | 8 auto(14)   | 4 | 13 | 17 |
| ## 84  | ford       | f150 pickup 4wd    | 4.2 | 1999 | 6 auto(14)   | 4 | 14 | 17 |
| ## 85  | ford       | f150 pickup 4wd    | 4.2 | 1999 | 6 manual(m5) | 4 | 14 | 17 |
| ## 86  | ford       | f150 pickup 4wd    | 4.6 | 1999 | 8 manual(m5) | 4 | 13 | 16 |
| ## 87  | ford       | f150 pickup 4wd    | 4.6 | 1999 | 8 auto(14)   | 4 | 13 | 16 |
| ## 88  | ford       | f150 pickup 4wd    | 4.6 | 2008 | 8 auto(14)   | 4 | 13 | 17 |
| ## 89  | ford       | f150 pickup 4wd    | 5.4 | 1999 | 8 auto(14)   | 4 | 11 | 15 |
| ## 90  | ford       | f150 pickup 4wd    | 5.4 | 2008 | 8 auto(14)   | 4 | 13 | 17 |
| ## 91  | ford       | mustang            | 3.8 | 1999 | 6 manual(m5) | r | 18 | 26 |
| ## 92  | ford       | mustang            | 3.8 | 1999 | 6 auto(14)   | r | 18 | 25 |
| ## 93  | ford       | mustang            | 4.0 | 2008 | 6 manual(m5) | r | 17 | 26 |
| ## 94  | ford       | mustang            | 4.0 | 2008 | 6 auto(15)   | r | 16 | 24 |
| ## 95  | ford       | mustang            | 4.6 | 1999 | 8 auto(14)   | r | 15 | 21 |
| ## 96  | ford       | mustang            | 4.6 | 1999 | 8 manual(m5) | r | 15 | 22 |
| ## 97  | ford       | mustang            | 4.6 | 2008 | 8 manual(m5) | r | 15 | 23 |
| ## 98  | ford       | mustang            | 4.6 | 2008 | 8 auto(15)   | r | 15 | 22 |
| ## 99  | ford       | mustang            | 5.4 | 2008 | 8 manual(m6) | r | 14 | 20 |
| ## 100 | honda      | civic              | 1.6 | 1999 | 4 manual(m5) | f | 28 | 33 |
| ## 101 | honda      | civic              | 1.6 | 1999 | 4 auto(14)   | f | 24 | 32 |
| ## 102 | honda      | civic              | 1.6 | 1999 | 4 manual(m5) | f | 25 | 32 |
| ## 103 | honda      | civic              | 1.6 | 1999 | 4 manual(m5) | f | 23 | 29 |
| ## 104 | honda      | civic              | 1.6 | 1999 | 4 auto(14)   | f | 24 | 32 |
| ## 105 | honda      | civic              | 1.8 | 2008 | 4 manual(m5) | f | 26 | 34 |
| ## 106 | honda      | civic              | 1.8 | 2008 | 4 auto(15)   | f | 25 | 36 |
| ## 107 | honda      | civic              | 1.8 | 2008 | 4 auto(15)   | f | 24 | 36 |
| ## 108 | honda      | civic              | 2.0 | 2008 | 4 manual(m6) | f | 21 | 29 |
| ## 109 | hyundai    | sonata             | 2.4 | 1999 | 4 auto(14)   | f | 18 | 26 |
| ## 110 | hyundai    | sonata             | 2.4 | 1999 | 4 manual(m5) | f | 18 | 27 |
| ## 111 | hyundai    | sonata             | 2.4 | 2008 | 4 auto(14)   | f | 21 | 30 |
| ## 112 | hyundai    | sonata             | 2.4 | 2008 | 4 manual(m5) | f | 21 | 31 |
| ## 113 | hyundai    | sonata             | 2.5 | 1999 | 6 auto(14)   | f | 18 | 26 |
| ## 114 | hyundai    | sonata             | 2.5 | 1999 | 6 manual(m5) | f | 18 | 26 |
| ## 115 | hyundai    | sonata             | 3.3 | 2008 | 6 auto(15)   | f | 19 | 28 |
| ## 116 | hyundai    | tiburon            | 2.0 | 1999 | 4 auto(14)   | f | 19 | 26 |
| ## 117 | hyundai    | tiburon            | 2.0 | 1999 | 4 manual(m5) | f | 19 | 29 |
| ## 118 | hyundai    | tiburon            | 2.0 | 2008 | 4 manual(m5) | f | 20 | 28 |
| ## 119 | hyundai    | tiburon            | 2.0 | 2008 | 4 auto(14)   | f | 20 | 27 |
| ## 120 | hyundai    | tiburon            | 2.7 | 2008 | 6 auto(14)   | f | 17 | 24 |
| ## 121 | hyundai    | tiburon            | 2.7 | 2008 | 6 manual(m6) | f | 16 | 24 |
| ## 122 | hyundai    | tiburon            | 2.7 | 2008 | 6 manual(m5) | f | 17 | 24 |
| ## 123 | jeep       | grand cherokee 4wd | 3.0 | 2008 | 6 auto(15)   | 4 | 17 | 22 |
| ## 124 | jeep       | grand cherokee 4wd | 3.7 | 2008 | 6 auto(15)   | 4 | 15 | 19 |
| ## 125 | jeep       | grand cherokee 4wd | 4.0 | 1999 | 6 auto(14)   | 4 | 15 | 20 |
| ## 126 | jeep       | grand cherokee 4wd | 4.7 | 1999 | 8 auto(14)   | 4 | 14 | 17 |
| ## 127 | jeep       | grand cherokee 4wd | 4.7 | 2008 | 8 auto(15)   | 4 | 9  | 12 |
| ## 128 | jeep       | grand cherokee 4wd | 4.7 | 2008 | 8 auto(15)   | 4 | 14 | 19 |
| ## 129 | jeep       | grand cherokee 4wd | 5.7 | 2008 | 8 auto(15)   | 4 | 13 | 18 |
| ## 130 | jeep       | grand cherokee 4wd | 6.1 | 2008 | 8 auto(15)   | 4 | 11 | 14 |
| ## 131 | land rover | range rover        | 4.0 | 1999 | 8 auto(14)   | 4 | 11 | 15 |
| ## 132 | land rover | range rover        | 4.2 | 2008 | 8 auto(s6)   | 4 | 12 | 18 |

|        |            |                 |     |      |   |            |   |    |    |
|--------|------------|-----------------|-----|------|---|------------|---|----|----|
| ## 133 | land rover | range rover     | 4.4 | 2008 | 8 | auto(s6)   | 4 | 12 | 18 |
| ## 134 | land rover | range rover     | 4.6 | 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 135 | lincoln    | navigator 2wd   | 5.4 | 1999 | 8 | auto(l4)   | r | 11 | 17 |
| ## 136 | lincoln    | navigator 2wd   | 5.4 | 1999 | 8 | auto(l4)   | r | 11 | 16 |
| ## 137 | lincoln    | navigator 2wd   | 5.4 | 2008 | 8 | auto(l6)   | r | 12 | 18 |
| ## 138 | mercury    | mountaineer 4wd | 4.0 | 1999 | 6 | auto(l5)   | 4 | 14 | 17 |
| ## 139 | mercury    | mountaineer 4wd | 4.0 | 2008 | 6 | auto(l5)   | 4 | 13 | 19 |
| ## 140 | mercury    | mountaineer 4wd | 4.6 | 2008 | 8 | auto(l6)   | 4 | 13 | 19 |
| ## 141 | mercury    | mountaineer 4wd | 5.0 | 1999 | 8 | auto(l4)   | 4 | 13 | 17 |
| ## 142 | nissan     | altima          | 2.4 | 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 143 | nissan     | altima          | 2.4 | 1999 | 4 | auto(l4)   | f | 19 | 27 |
| ## 144 | nissan     | altima          | 2.5 | 2008 | 4 | auto(av)   | f | 23 | 31 |
| ## 145 | nissan     | altima          | 2.5 | 2008 | 4 | manual(m6) | f | 23 | 32 |
| ## 146 | nissan     | altima          | 3.5 | 2008 | 6 | manual(m6) | f | 19 | 27 |
| ## 147 | nissan     | altima          | 3.5 | 2008 | 6 | auto(av)   | f | 19 | 26 |
| ## 148 | nissan     | maxima          | 3.0 | 1999 | 6 | auto(l4)   | f | 18 | 26 |
| ## 149 | nissan     | maxima          | 3.0 | 1999 | 6 | manual(m5) | f | 19 | 25 |
| ## 150 | nissan     | maxima          | 3.5 | 2008 | 6 | auto(av)   | f | 19 | 25 |
| ## 151 | nissan     | pathfinder 4wd  | 3.3 | 1999 | 6 | auto(l4)   | 4 | 14 | 17 |
| ## 152 | nissan     | pathfinder 4wd  | 3.3 | 1999 | 6 | manual(m5) | 4 | 15 | 17 |
| ## 153 | nissan     | pathfinder 4wd  | 4.0 | 2008 | 6 | auto(l5)   | 4 | 14 | 20 |
| ## 154 | nissan     | pathfinder 4wd  | 5.6 | 2008 | 8 | auto(s5)   | 4 | 12 | 18 |
| ## 155 | pontiac    | grand prix      | 3.1 | 1999 | 6 | auto(l4)   | f | 18 | 26 |
| ## 156 | pontiac    | grand prix      | 3.8 | 1999 | 6 | auto(l4)   | f | 16 | 26 |
| ## 157 | pontiac    | grand prix      | 3.8 | 1999 | 6 | auto(l4)   | f | 17 | 27 |
| ## 158 | pontiac    | grand prix      | 3.8 | 2008 | 6 | auto(l4)   | f | 18 | 28 |
| ## 159 | pontiac    | grand prix      | 5.3 | 2008 | 8 | auto(s4)   | f | 16 | 25 |
| ## 160 | subaru     | forester awd    | 2.5 | 1999 | 4 | manual(m5) | 4 | 18 | 25 |
| ## 161 | subaru     | forester awd    | 2.5 | 1999 | 4 | auto(l4)   | 4 | 18 | 24 |
| ## 162 | subaru     | forester awd    | 2.5 | 2008 | 4 | manual(m5) | 4 | 20 | 27 |
| ## 163 | subaru     | forester awd    | 2.5 | 2008 | 4 | manual(m5) | 4 | 19 | 25 |
| ## 164 | subaru     | forester awd    | 2.5 | 2008 | 4 | auto(l4)   | 4 | 20 | 26 |
| ## 165 | subaru     | forester awd    | 2.5 | 2008 | 4 | auto(l4)   | 4 | 18 | 23 |
| ## 166 | subaru     | impreza awd     | 2.2 | 1999 | 4 | auto(l4)   | 4 | 21 | 26 |
| ## 167 | subaru     | impreza awd     | 2.2 | 1999 | 4 | manual(m5) | 4 | 19 | 26 |
| ## 168 | subaru     | impreza awd     | 2.5 | 1999 | 4 | manual(m5) | 4 | 19 | 26 |
| ## 169 | subaru     | impreza awd     | 2.5 | 1999 | 4 | auto(l4)   | 4 | 19 | 26 |
| ## 170 | subaru     | impreza awd     | 2.5 | 2008 | 4 | auto(s4)   | 4 | 20 | 25 |
| ## 171 | subaru     | impreza awd     | 2.5 | 2008 | 4 | auto(s4)   | 4 | 20 | 27 |
| ## 172 | subaru     | impreza awd     | 2.5 | 2008 | 4 | manual(m5) | 4 | 19 | 25 |
| ## 173 | subaru     | impreza awd     | 2.5 | 2008 | 4 | manual(m5) | 4 | 20 | 27 |
| ## 174 | toyota     | 4runner 4wd     | 2.7 | 1999 | 4 | manual(m5) | 4 | 15 | 20 |
| ## 175 | toyota     | 4runner 4wd     | 2.7 | 1999 | 4 | auto(l4)   | 4 | 16 | 20 |
| ## 176 | toyota     | 4runner 4wd     | 3.4 | 1999 | 6 | auto(l4)   | 4 | 15 | 19 |
| ## 177 | toyota     | 4runner 4wd     | 3.4 | 1999 | 6 | manual(m5) | 4 | 15 | 17 |
| ## 178 | toyota     | 4runner 4wd     | 4.0 | 2008 | 6 | auto(l5)   | 4 | 16 | 20 |
| ## 179 | toyota     | 4runner 4wd     | 4.7 | 2008 | 8 | auto(l5)   | 4 | 14 | 17 |
| ## 180 | toyota     | camry           | 2.2 | 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 181 | toyota     | camry           | 2.2 | 1999 | 4 | auto(l4)   | f | 21 | 27 |
| ## 182 | toyota     | camry           | 2.4 | 2008 | 4 | manual(m5) | f | 21 | 31 |
| ## 183 | toyota     | camry           | 2.4 | 2008 | 4 | auto(l5)   | f | 21 | 31 |
| ## 184 | toyota     | camry           | 3.0 | 1999 | 6 | auto(l4)   | f | 18 | 26 |
| ## 185 | toyota     | camry           | 3.0 | 1999 | 6 | manual(m5) | f | 18 | 26 |
| ## 186 | toyota     | camry           | 3.5 | 2008 | 6 | auto(s6)   | f | 19 | 28 |

|        |            |                        |          |   |            |   |    |    |
|--------|------------|------------------------|----------|---|------------|---|----|----|
| ## 187 | toyota     | camry solara           | 2.2 1999 | 4 | auto(l4)   | f | 21 | 27 |
| ## 188 | toyota     | camry solara           | 2.2 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 189 | toyota     | camry solara           | 2.4 2008 | 4 | manual(m5) | f | 21 | 31 |
| ## 190 | toyota     | camry solara           | 2.4 2008 | 4 | auto(s5)   | f | 22 | 31 |
| ## 191 | toyota     | camry solara           | 3.0 1999 | 6 | auto(l4)   | f | 18 | 26 |
| ## 192 | toyota     | camry solara           | 3.0 1999 | 6 | manual(m5) | f | 18 | 26 |
| ## 193 | toyota     | camry solara           | 3.3 2008 | 6 | auto(s5)   | f | 18 | 27 |
| ## 194 | toyota     | corolla                | 1.8 1999 | 4 | auto(l3)   | f | 24 | 30 |
| ## 195 | toyota     | corolla                | 1.8 1999 | 4 | auto(l4)   | f | 24 | 33 |
| ## 196 | toyota     | corolla                | 1.8 1999 | 4 | manual(m5) | f | 26 | 35 |
| ## 197 | toyota     | corolla                | 1.8 2008 | 4 | manual(m5) | f | 28 | 37 |
| ## 198 | toyota     | corolla                | 1.8 2008 | 4 | auto(l4)   | f | 26 | 35 |
| ## 199 | toyota     | land cruiser wagon 4wd | 4.7 1999 | 8 | auto(l4)   | 4 | 11 | 15 |
| ## 200 | toyota     | land cruiser wagon 4wd | 5.7 2008 | 8 | auto(s6)   | 4 | 13 | 18 |
| ## 201 | toyota     | toyota tacoma 4wd      | 2.7 1999 | 4 | manual(m5) | 4 | 15 | 20 |
| ## 202 | toyota     | toyota tacoma 4wd      | 2.7 1999 | 4 | auto(l4)   | 4 | 16 | 20 |
| ## 203 | toyota     | toyota tacoma 4wd      | 2.7 2008 | 4 | manual(m5) | 4 | 17 | 22 |
| ## 204 | toyota     | toyota tacoma 4wd      | 3.4 1999 | 6 | manual(m5) | 4 | 15 | 17 |
| ## 205 | toyota     | toyota tacoma 4wd      | 3.4 1999 | 6 | auto(l4)   | 4 | 15 | 19 |
| ## 206 | toyota     | toyota tacoma 4wd      | 4.0 2008 | 6 | manual(m6) | 4 | 15 | 18 |
| ## 207 | toyota     | toyota tacoma 4wd      | 4.0 2008 | 6 | auto(l5)   | 4 | 16 | 20 |
| ## 208 | volkswagen | gti                    | 2.0 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 209 | volkswagen | gti                    | 2.0 1999 | 4 | auto(l4)   | f | 19 | 26 |
| ## 210 | volkswagen | gti                    | 2.0 2008 | 4 | manual(m6) | f | 21 | 29 |
| ## 211 | volkswagen | gti                    | 2.0 2008 | 4 | auto(s6)   | f | 22 | 29 |
| ## 212 | volkswagen | gti                    | 2.8 1999 | 6 | manual(m5) | f | 17 | 24 |
| ## 213 | volkswagen | jetta                  | 1.9 1999 | 4 | manual(m5) | f | 33 | 44 |
| ## 214 | volkswagen | jetta                  | 2.0 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 215 | volkswagen | jetta                  | 2.0 1999 | 4 | auto(l4)   | f | 19 | 26 |
| ## 216 | volkswagen | jetta                  | 2.0 2008 | 4 | auto(s6)   | f | 22 | 29 |
| ## 217 | volkswagen | jetta                  | 2.0 2008 | 4 | manual(m6) | f | 21 | 29 |
| ## 218 | volkswagen | jetta                  | 2.5 2008 | 5 | auto(s6)   | f | 21 | 29 |
| ## 219 | volkswagen | jetta                  | 2.5 2008 | 5 | manual(m5) | f | 21 | 29 |
| ## 220 | volkswagen | jetta                  | 2.8 1999 | 6 | auto(l4)   | f | 16 | 23 |
| ## 221 | volkswagen | jetta                  | 2.8 1999 | 6 | manual(m5) | f | 17 | 24 |
| ## 222 | volkswagen | new beetle             | 1.9 1999 | 4 | manual(m5) | f | 35 | 44 |
| ## 223 | volkswagen | new beetle             | 1.9 1999 | 4 | auto(l4)   | f | 29 | 41 |
| ## 224 | volkswagen | new beetle             | 2.0 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 225 | volkswagen | new beetle             | 2.0 1999 | 4 | auto(l4)   | f | 19 | 26 |
| ## 226 | volkswagen | new beetle             | 2.5 2008 | 5 | manual(m5) | f | 20 | 28 |
| ## 227 | volkswagen | new beetle             | 2.5 2008 | 5 | auto(s6)   | f | 20 | 29 |
| ## 228 | volkswagen | passat                 | 1.8 1999 | 4 | manual(m5) | f | 21 | 29 |
| ## 229 | volkswagen | passat                 | 1.8 1999 | 4 | auto(l5)   | f | 18 | 29 |
| ## 230 | volkswagen | passat                 | 2.0 2008 | 4 | auto(s6)   | f | 19 | 28 |
| ## 231 | volkswagen | passat                 | 2.0 2008 | 4 | manual(m6) | f | 21 | 29 |
| ## 232 | volkswagen | passat                 | 2.8 1999 | 6 | auto(l5)   | f | 16 | 26 |
| ## 233 | volkswagen | passat                 | 2.8 1999 | 6 | manual(m5) | f | 18 | 26 |
| ## 234 | volkswagen | passat                 | 3.6 2008 | 6 | auto(s6)   | f | 17 | 26 |
| ##     | fl         | class                  |          |   |            |   |    |    |
| ## 1   | p          | compact                |          |   |            |   |    |    |
| ## 2   | p          | compact                |          |   |            |   |    |    |
| ## 3   | p          | compact                |          |   |            |   |    |    |
| ## 4   | p          | compact                |          |   |            |   |    |    |
| ## 5   | p          | compact                |          |   |            |   |    |    |

|       |   |         |
|-------|---|---------|
| ## 6  | p | compact |
| ## 7  | p | compact |
| ## 8  | p | compact |
| ## 9  | p | compact |
| ## 10 | p | compact |
| ## 11 | p | compact |
| ## 12 | p | compact |
| ## 13 | p | compact |
| ## 14 | p | compact |
| ## 15 | p | compact |
| ## 16 | p | midsize |
| ## 17 | p | midsize |
| ## 18 | p | midsize |
| ## 19 | r | suv     |
| ## 20 | e | suv     |
| ## 21 | r | suv     |
| ## 22 | r | suv     |
| ## 23 | r | suv     |
| ## 24 | p | 2seater |
| ## 25 | p | 2seater |
| ## 26 | p | 2seater |
| ## 27 | p | 2seater |
| ## 28 | p | 2seater |
| ## 29 | r | suv     |
| ## 30 | e | suv     |
| ## 31 | r | suv     |
| ## 32 | d | suv     |
| ## 33 | r | midsize |
| ## 34 | r | midsize |
| ## 35 | r | midsize |
| ## 36 | r | midsize |
| ## 37 | r | midsize |
| ## 38 | r | minivan |
| ## 39 | r | minivan |
| ## 40 | r | minivan |
| ## 41 | r | minivan |
| ## 42 | r | minivan |
| ## 43 | r | minivan |
| ## 44 | e | minivan |
| ## 45 | r | minivan |
| ## 46 | r | minivan |
| ## 47 | r | minivan |
| ## 48 | r | minivan |
| ## 49 | r | pickup  |
| ## 50 | r | pickup  |
| ## 51 | r | pickup  |
| ## 52 | r | pickup  |
| ## 53 | r | pickup  |
| ## 54 | r | pickup  |
| ## 55 | e | pickup  |
| ## 56 | r | pickup  |
| ## 57 | r | pickup  |
| ## 58 | r | suv     |
| ## 59 | r | suv     |

```

## 60 e      suv
## 61 r      suv
## 62 r      suv
## 63 r      suv
## 64 r      suv
## 65 r      pickup
## 66 e      pickup
## 67 r      pickup
## 68 r      pickup
## 69 r      pickup
## 70 e      pickup
## 71 r      pickup
## 72 r      pickup
## 73 r      pickup
## 74 r      pickup
## 75 r      suv
## 76 r      suv
## 77 r      suv
## 78 r      suv
## 79 r      suv
## 80 r      suv
## 81 r      suv
## 82 r      suv
## 83 r      suv
## 84 r      pickup
## 85 r      pickup
## 86 r      pickup
## 87 r      pickup
## 88 r      pickup
## 89 r      pickup
## 90 r      pickup
## 91 r subcompact
## 92 r subcompact
## 93 r subcompact
## 94 r subcompact
## 95 r subcompact
## 96 r subcompact
## 97 r subcompact
## 98 r subcompact
## 99 p subcompact
## 100 r subcompact
## 101 r subcompact
## 102 r subcompact
## 103 p subcompact
## 104 r subcompact
## 105 r subcompact
## 106 r subcompact
## 107 c subcompact
## 108 p subcompact
## 109 r      midsize
## 110 r      midsize
## 111 r      midsize
## 112 r      midsize
## 113 r      midsize

```

```

## 114 r    midsize
## 115 r    midsize
## 116 r subcompact
## 117 r subcompact
## 118 r subcompact
## 119 r subcompact
## 120 r subcompact
## 121 r subcompact
## 122 r subcompact
## 123 d      suv
## 124 r      suv
## 125 r      suv
## 126 r      suv
## 127 e      suv
## 128 r      suv
## 129 r      suv
## 130 p      suv
## 131 p      suv
## 132 r      suv
## 133 r      suv
## 134 p      suv
## 135 r      suv
## 136 p      suv
## 137 r      suv
## 138 r      suv
## 139 r      suv
## 140 r      suv
## 141 r      suv
## 142 r    compact
## 143 r    compact
## 144 r    midsize
## 145 r    midsize
## 146 p    midsize
## 147 p    midsize
## 148 r    midsize
## 149 r    midsize
## 150 p    midsize
## 151 r      suv
## 152 r      suv
## 153 p      suv
## 154 p      suv
## 155 r    midsize
## 156 p    midsize
## 157 r    midsize
## 158 r    midsize
## 159 p    midsize
## 160 r      suv
## 161 r      suv
## 162 r      suv
## 163 p      suv
## 164 r      suv
## 165 p      suv
## 166 r subcompact
## 167 r subcompact

```



```

## 168 r subcompact
## 169 r subcompact
## 170 p compact
## 171 r compact
## 172 p compact
## 173 r compact
## 174 r suv
## 175 r suv
## 176 r suv
## 177 r suv
## 178 r suv
## 179 r suv
## 180 r midsize
## 181 r midsize
## 182 r midsize
## 183 r midsize
## 184 r midsize
## 185 r midsize
## 186 r midsize
## 187 r compact
## 188 r compact
## 189 r compact
## 190 r compact
## 191 r compact
## 192 r compact
## 193 r compact
## 194 r compact
## 195 r compact
## 196 r compact
## 197 r compact
## 198 r compact
## 199 r suv
## 200 r suv
## 201 r pickup
## 202 r pickup
## 203 r pickup
## 204 r pickup
## 205 r pickup
## 206 r pickup
## 207 r pickup
## 208 r compact
## 209 r compact
## 210 p compact
## 211 p compact
## 212 r compact
## 213 d compact
## 214 r compact
## 215 r compact
## 216 p compact
## 217 p compact
## 218 r compact
## 219 r compact
## 220 r compact
## 221 r compact

```

```
## 222 d subcompact
## 223 d subcompact
## 224 r subcompact
## 225 r subcompact
## 226 r subcompact
## 227 r subcompact
## 228 p midsize
## 229 p midsize
## 230 p midsize
## 231 p midsize
## 232 p midsize
## 233 p midsize
## 234 p midsize
```

1. How many columns are in mpg dataset? How about the number of rows? Show the codes and its result.

```
mpg_data <- glimpse(waw)
```

```
## Rows: 234
## Columns: 11
## $ manufacturer <chr> "audi", "audi", "audi", "audi", "audi", "audi", "audi", "~
## $ model <chr> "a4", "a4", "a4", "a4", "a4", "a4", "a4", "a4 quattro", "~
## $ displ <dbl> 1.8, 1.8, 2.0, 2.0, 2.8, 2.8, 3.1, 1.8, 1.8, 2.0, 2.0, 2.~
## $ year <int> 1999, 1999, 2008, 2008, 1999, 1999, 2008, 1999, 1999, 200~
## $ cyl <int> 4, 4, 4, 4, 6, 6, 6, 4, 4, 4, 4, 6, 6, 6, 6, 6, 6, 8, 8, ~
## $ trans <chr> "auto(l5)", "manual(m5)", "manual(m6)", "auto(av)", "auto~
## $ drv <chr> "f", "f", "f", "f", "f", "f", "f", "4", "4", "4", "4", "4~
## $ cty <int> 18, 21, 20, 21, 16, 18, 18, 18, 16, 20, 19, 15, 17, 17, 1~
## $ hwy <int> 29, 29, 31, 30, 26, 26, 27, 26, 25, 28, 27, 25, 25, 25, 2~
## $ fl <chr> "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p", "p~
## $ class <chr> "compact", "compact", "compact", "compact", "compact", "c~
```

Answer: It has 11 columns and a row of 234

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

```
manufact <- mpg_data %>% group_by(manufacturer,model) %>% count()
manufact
```

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

Answer: The manufacturer that has the most model are the Dodge while the most variations for model are the caravan2wd.

```
colnames(manufact) <-c("Manufacturer", "Model", "Counts")
```

a. Group the manufacturers and find the unique models. Copy the codes and result.

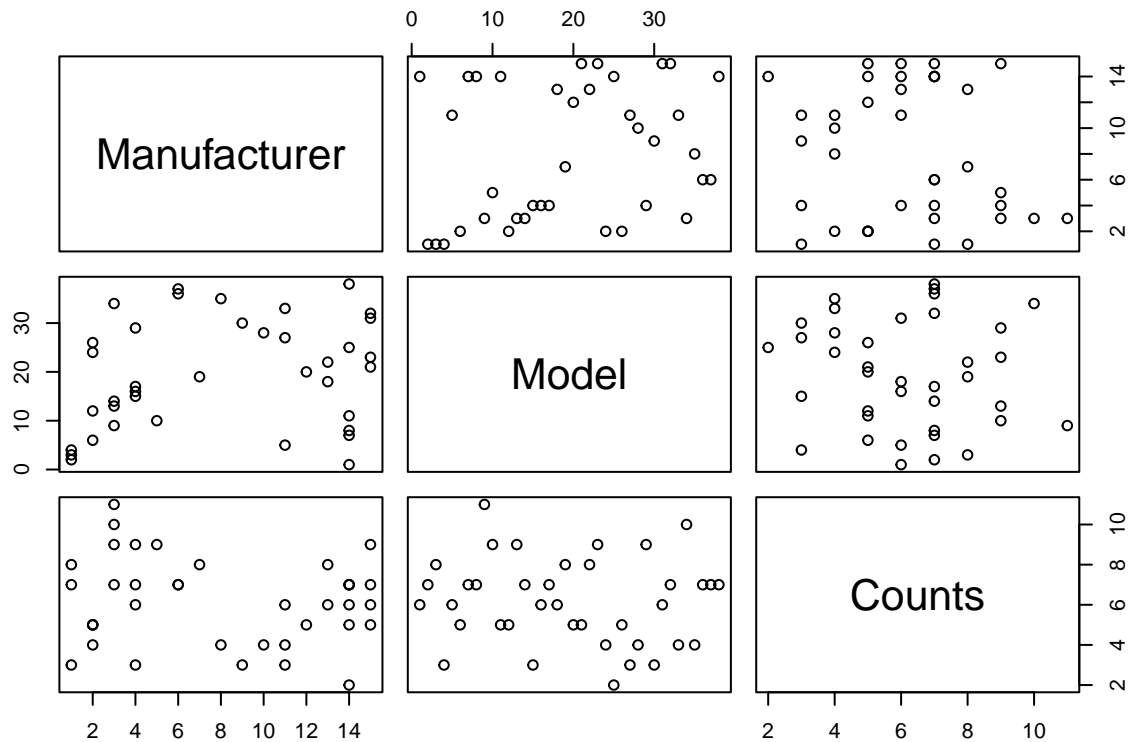
```
unique_data <- mpg_data %>% group_by(manufacturer) %>%  
  distinct(model) %>% count()  
unique_data
```

```
## # A tibble: 15 x 2  
## # Groups:   manufacturer [15]  
##   manufacturer      n  
##   <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
```

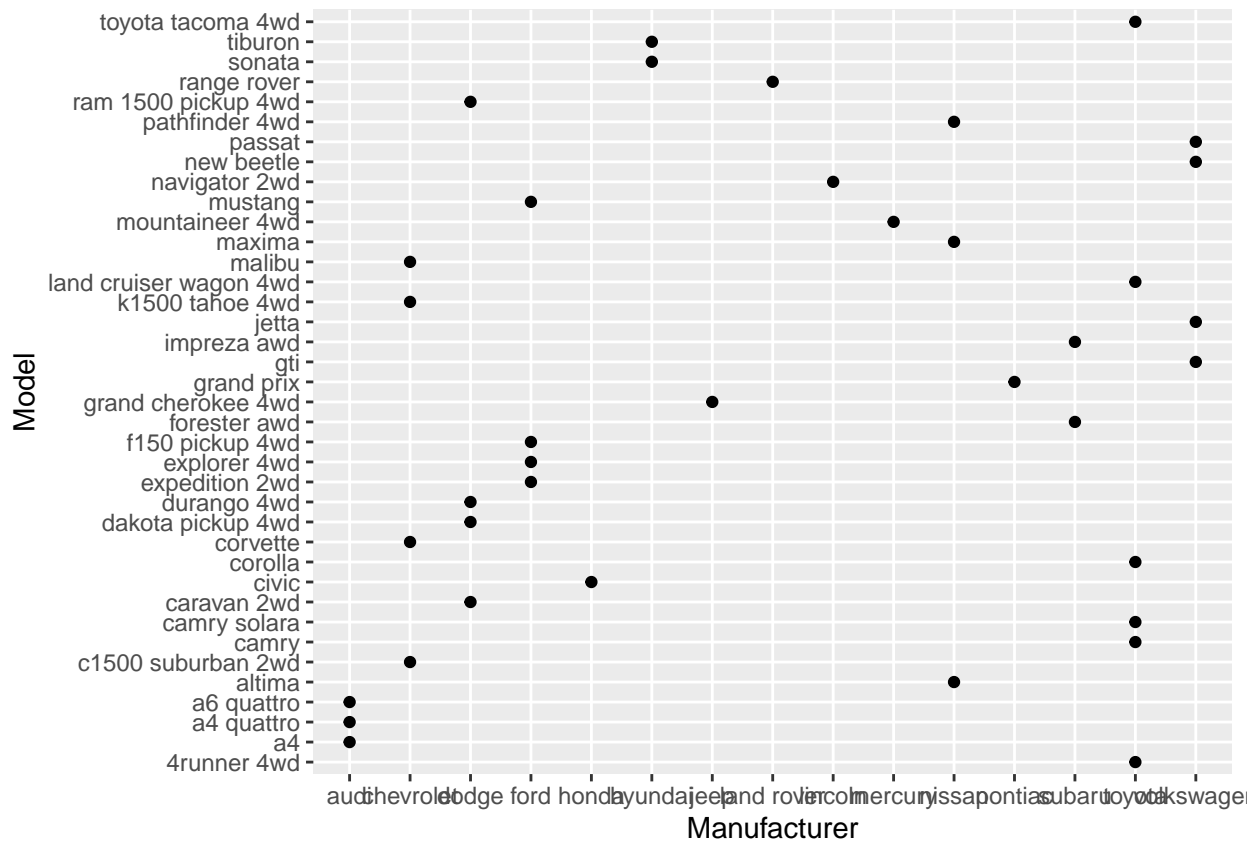
```
colnames(unique_data)<-c("Manufacturer", "Unique Counts")
```

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

```
plot(manufact)
```

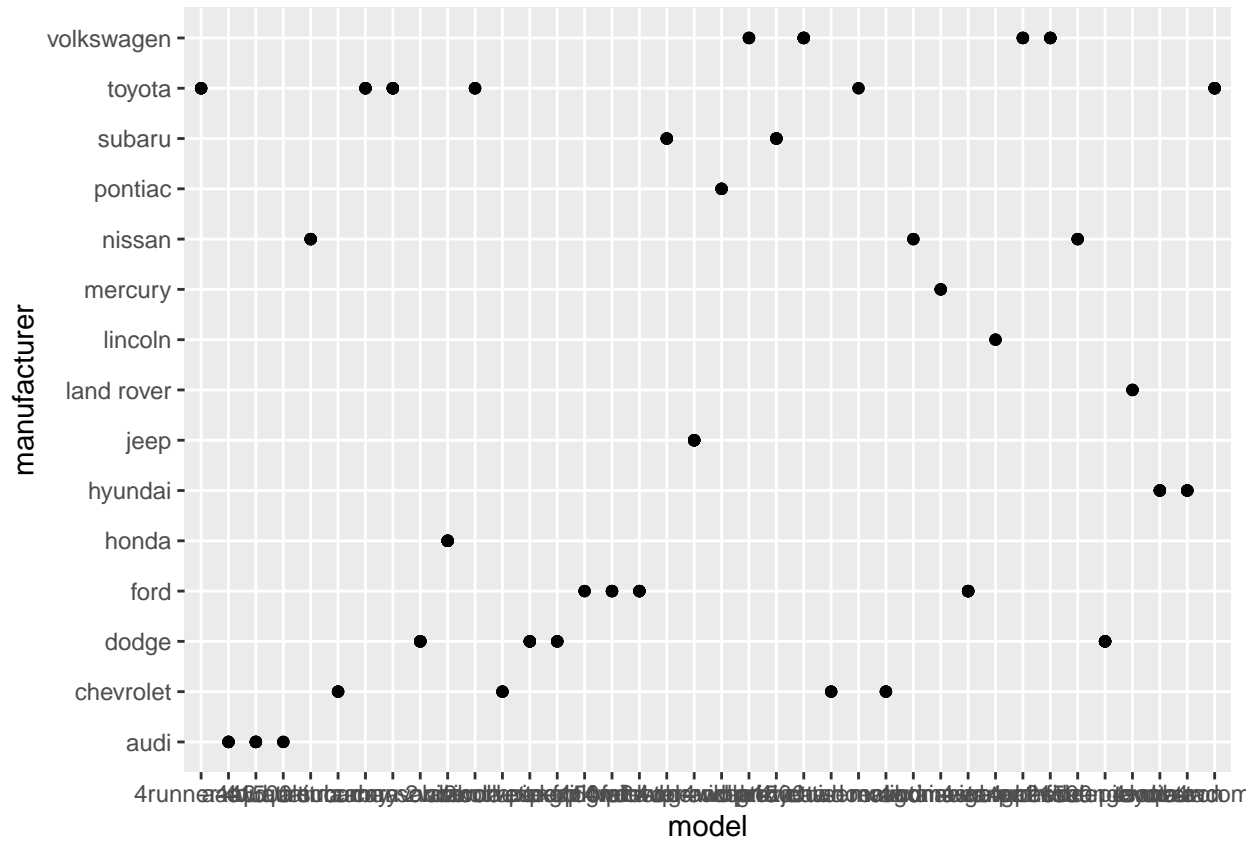


```
ggplot(manufact, aes(Manufacturer,Model)) + geom_point()
```



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

```
ggplot(waw, aes(model, manufacturer)) + geom_point()
```



- a. What does `ggplot(mpg, aes(model, manufacturer)) + geom_point()` show? Answer: A point graph of a model and manufacturer of mpg data set.
- b. For you, is it useful? If not, how could you modify the data to make it more informative? Answer: For me, It is useful but it can be more modify if there have a legend to easily read the data.
4. Using the pipe (`%>%`), group the model and get the number of cars per model. Show codes and its result.

```
cars_per_model <- mpg_data %>% group_by(model) %>% count()
cars_per_model
```

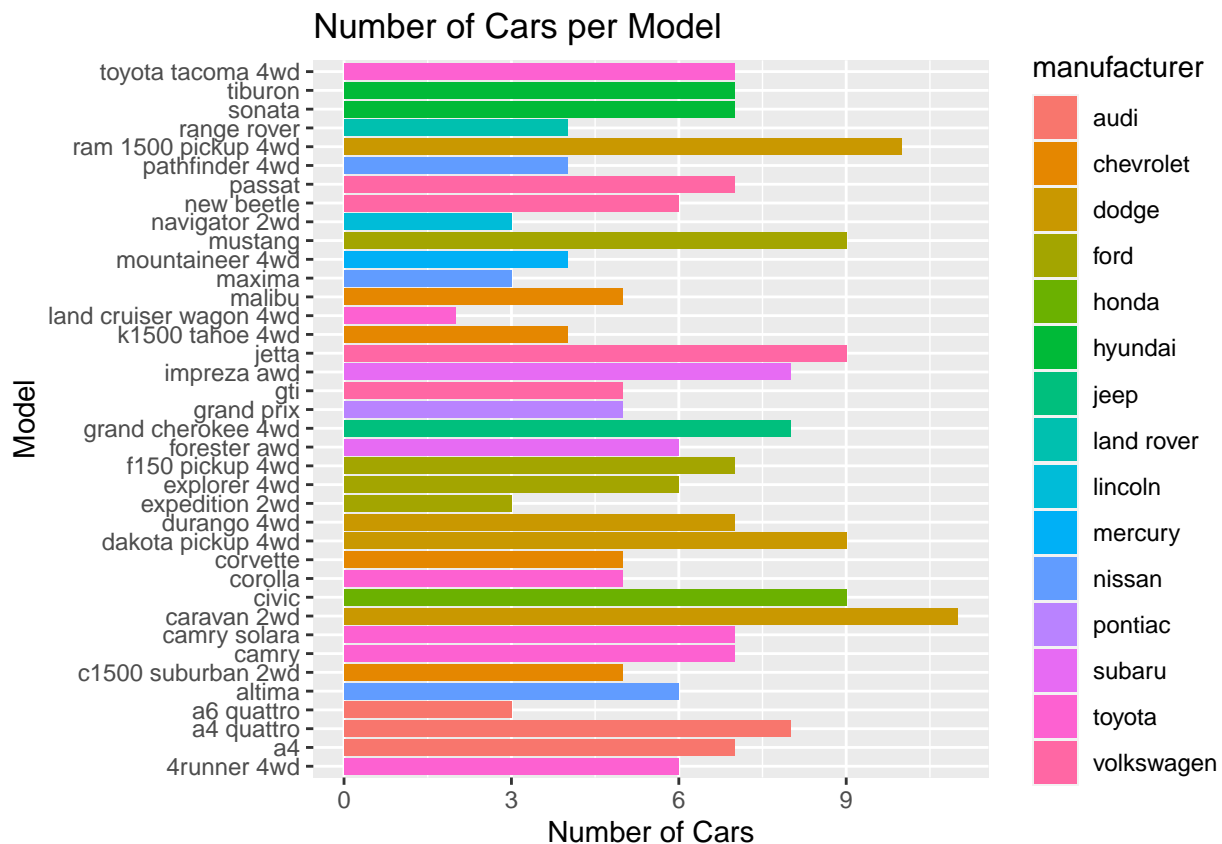
```
## # A tibble: 38 x 2
## # Groups:   model [38]
##   model
##   <chr>
## 1 4runner 4wd
## 2 a4
## 3 a4 quattro
## 4 a6 quattro
## 5 altima
## 6 c1500 suburban 2wd
## 7 camry
## 8 camry solara
## 9 caravan 2wd
## 10 civic
## # ... with 28 more rows
```

```
colnames(cars_per_model) <- c("Model", "Counts")
```

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

```
qplot(model, data = waw,
main = "Number of Cars per Model",
xlab = "Model",
ylab = "Number of Cars", geom = "bar", fill = manufacturer) + coord_flip()
```

```
## Warning: `qplot()` was deprecated in ggplot2 3.4.0.
```



b. Use only the top 20 observations. Show code and results.

```
observations_twenty <- cars_per_model[1:20,] %>% top_n(2)
```

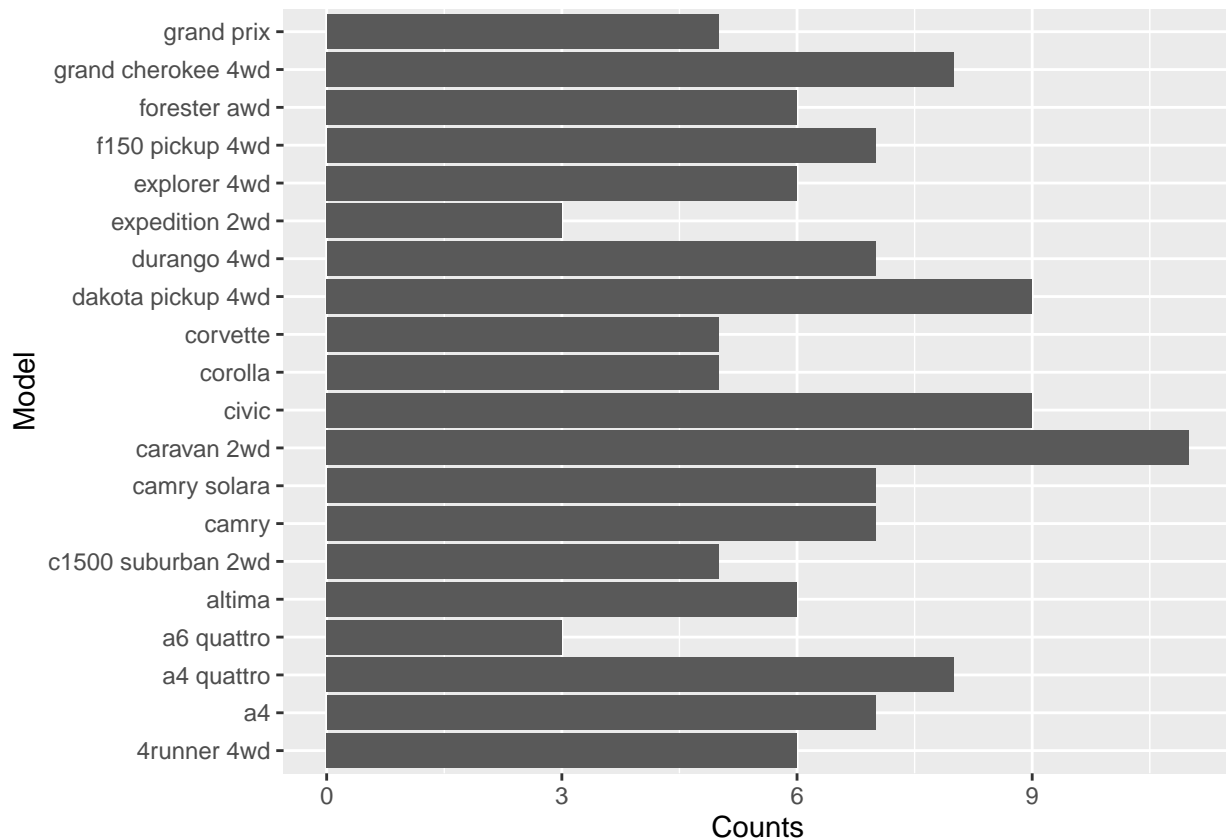
```
## Selecting by Counts
```

```
observations_twenty
```

```
## # A tibble: 20 x 2
## # Groups:   Model [20]
##   Model      Counts
##   <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
```

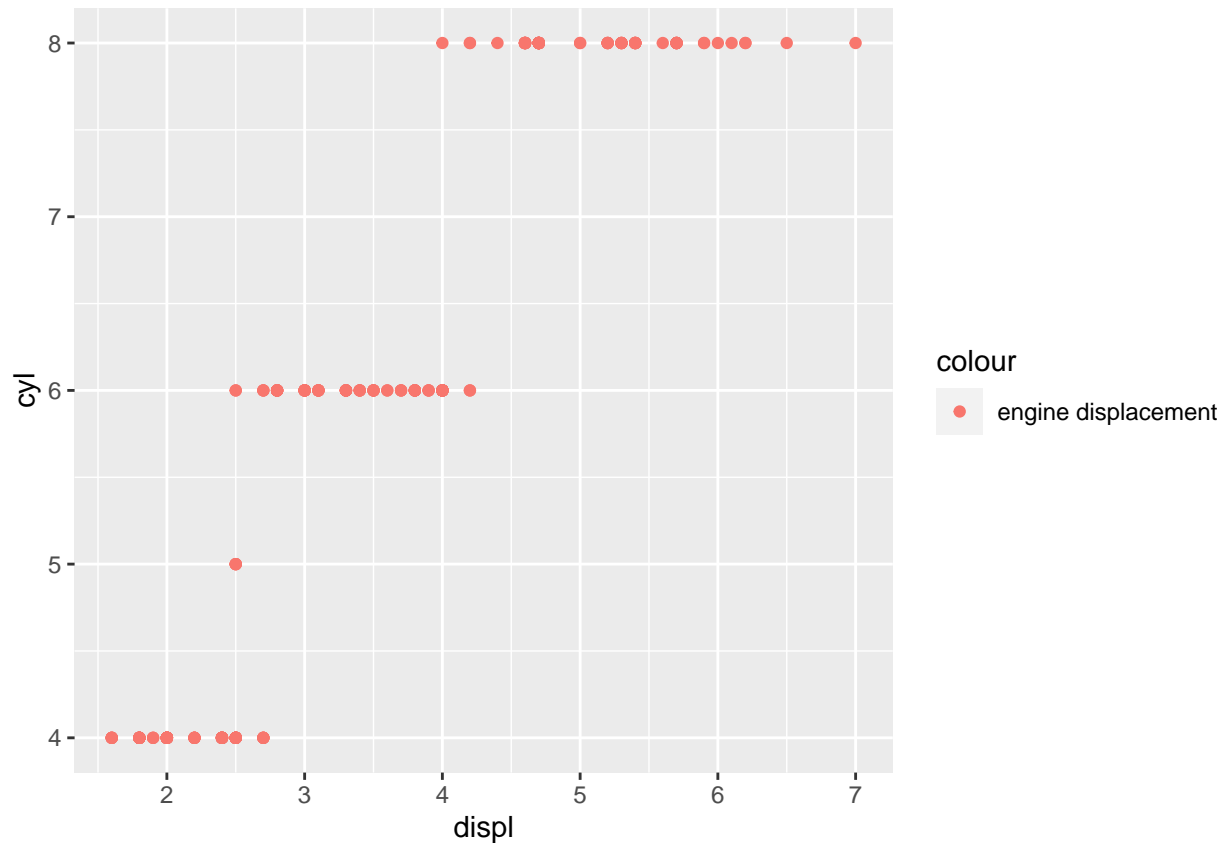
```
ggplot(observations_twenty, aes(x = Model, y = Counts)) +
  geom_bar(stat = "Identity") + coord_flip()
```



5. Plot the relationship between cyl - number of cylinders and displ

- engine displacement using `geom_point` with aesthetic colour = engine displacement. Title should be "Relationship between No. of Cylinders and Engine Displacement".

```
ggplot(data = mpg_data, mapping = aes(x = displ, y = cyl,
                                     main = "Relationship between No of Cylinders
                                     and Engine Displacement")) +
  geom_point(mapping = aes(colour = "engine displacement"))
```

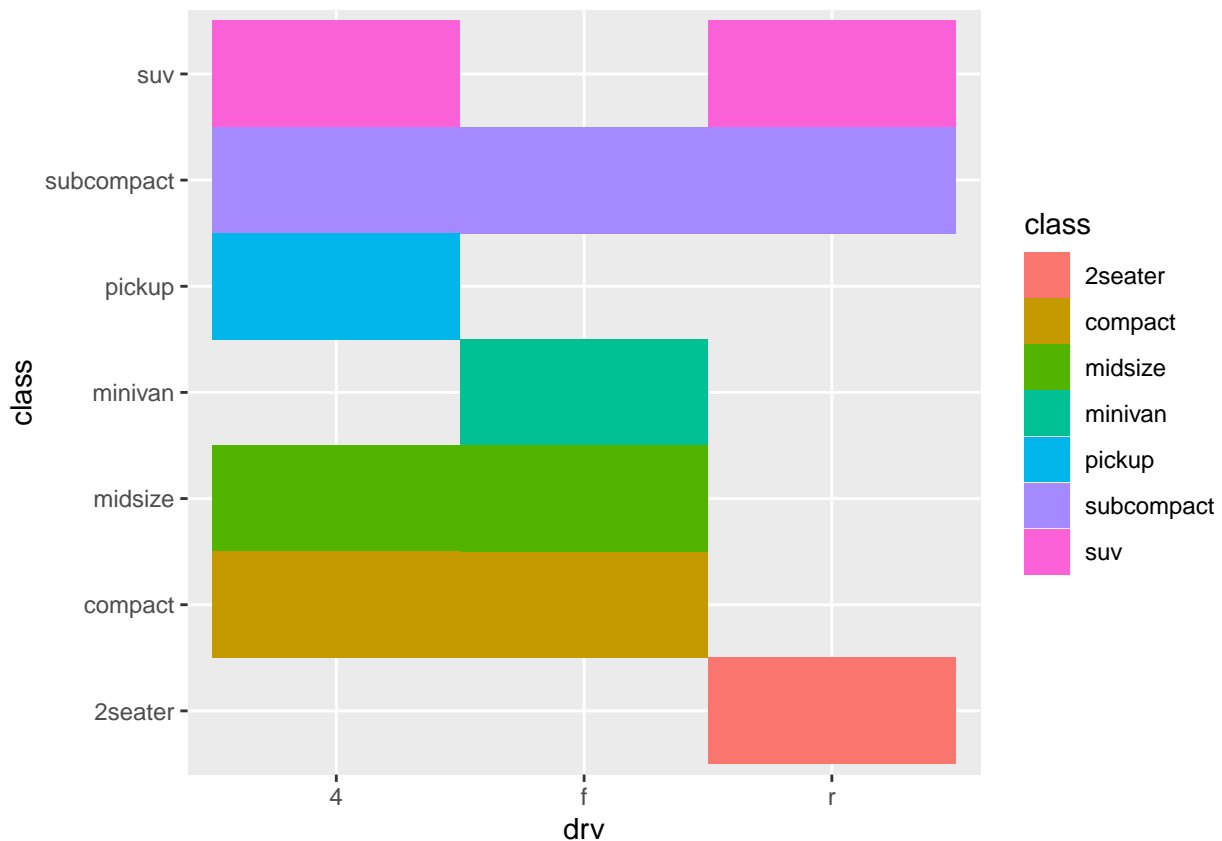


b. How would you describe its relationship? Answer: The cyl is in the y axis and the disp is in the x axis that can easily read the clustered data, which indicate the engine displacement.

6. Get the total number of observations for drv - type of drive train (f = front-wheel drive, r = rear wheel drive, 4 = 4wd) and class - type of class (Example: suv, 2seater, etc.). Plot using the geom\_tile() where the number of observations for class be used as a fill for aesthetics.

```
ggplot(data = mpg_data, mapping = aes(x = drv, y = class)) +  
  geom_tile(aes(fill = class))
```





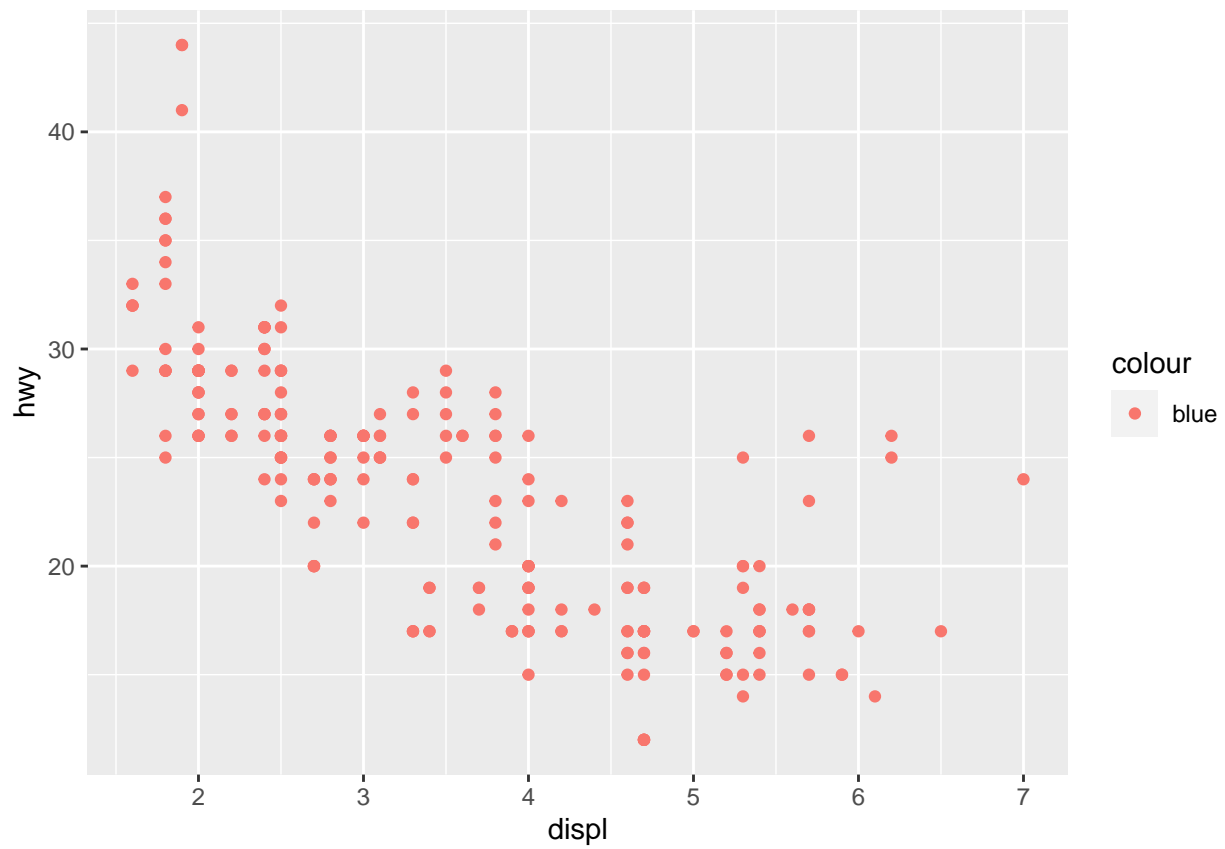
b. Interpret the result. Answer: The y axis is class and the x axis is drv. It graph the data and the data is in the different colors.

7. Discuss the difference between these codes. Its outputs for each are shown below.

Answer: The two code are the same. In the code it says that the colour is both blue but in the first code the result is color red and in the smaller graph unlike in the second code that the graph is bigger than the first graph and the result is color blue.

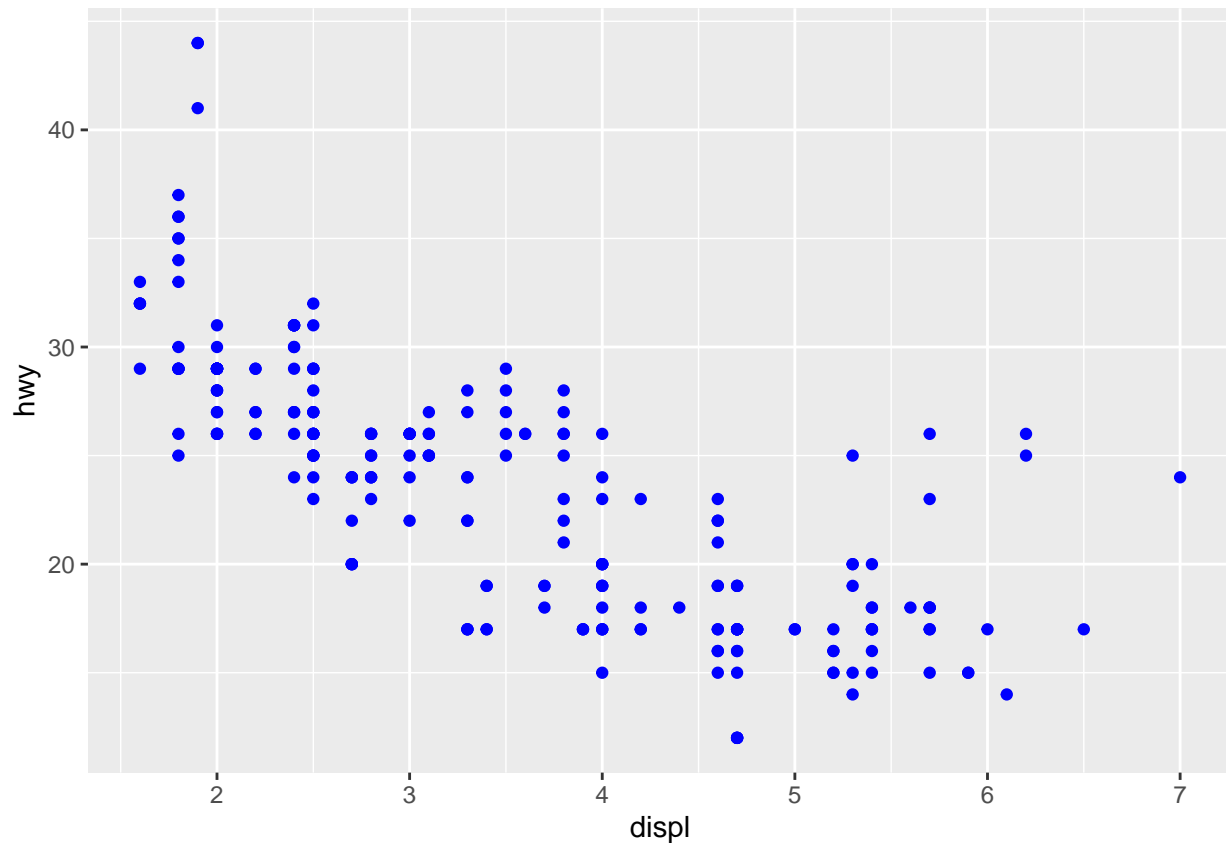
Code #1

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy, colour = "blue"))
```



Code #2

```
ggplot(data = mpg) +  
geom_point(mapping = aes(x = displ, y = hwy), colour = "blue")
```



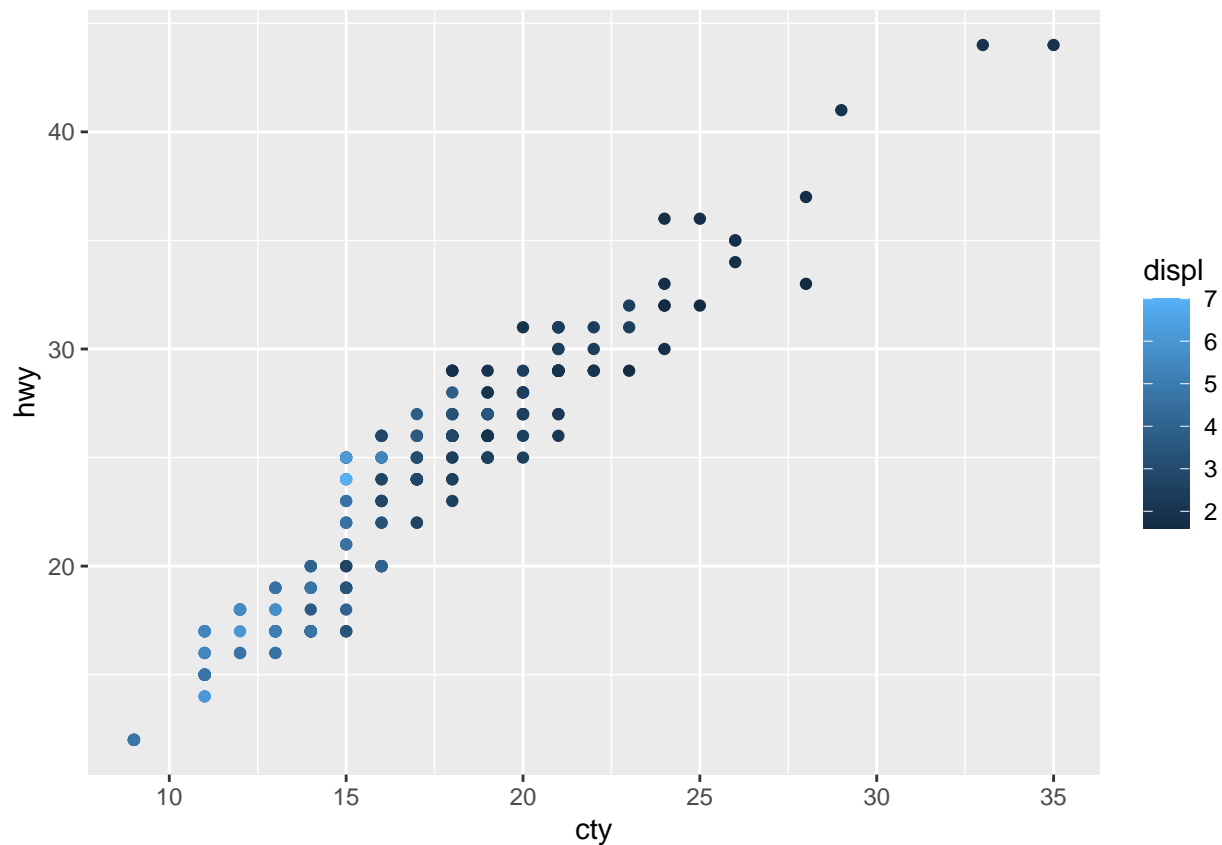
8. Try to run the command `?mpg`. What is the result of this command?

```
command<-?mpg
command
```

Answer: The result of the code is the description or the data set of mpg.

- Which variables from mpg dataset are categorical? Answer: The Manufacturer, Model, Trans, drv, fl, class, cyl, cty, and hwy.
- Which are continuous variables? Answer: displ, year, cyl, cty, and hwy.
- Plot the relationship between displ (engine displacement) and hwy(highway miles per gallon). Mapped it with a continuous variable you have identified in #5-b. What is its result? Why it produced such output? Answer: The result have been graph and it shows that they are in the positive rate.

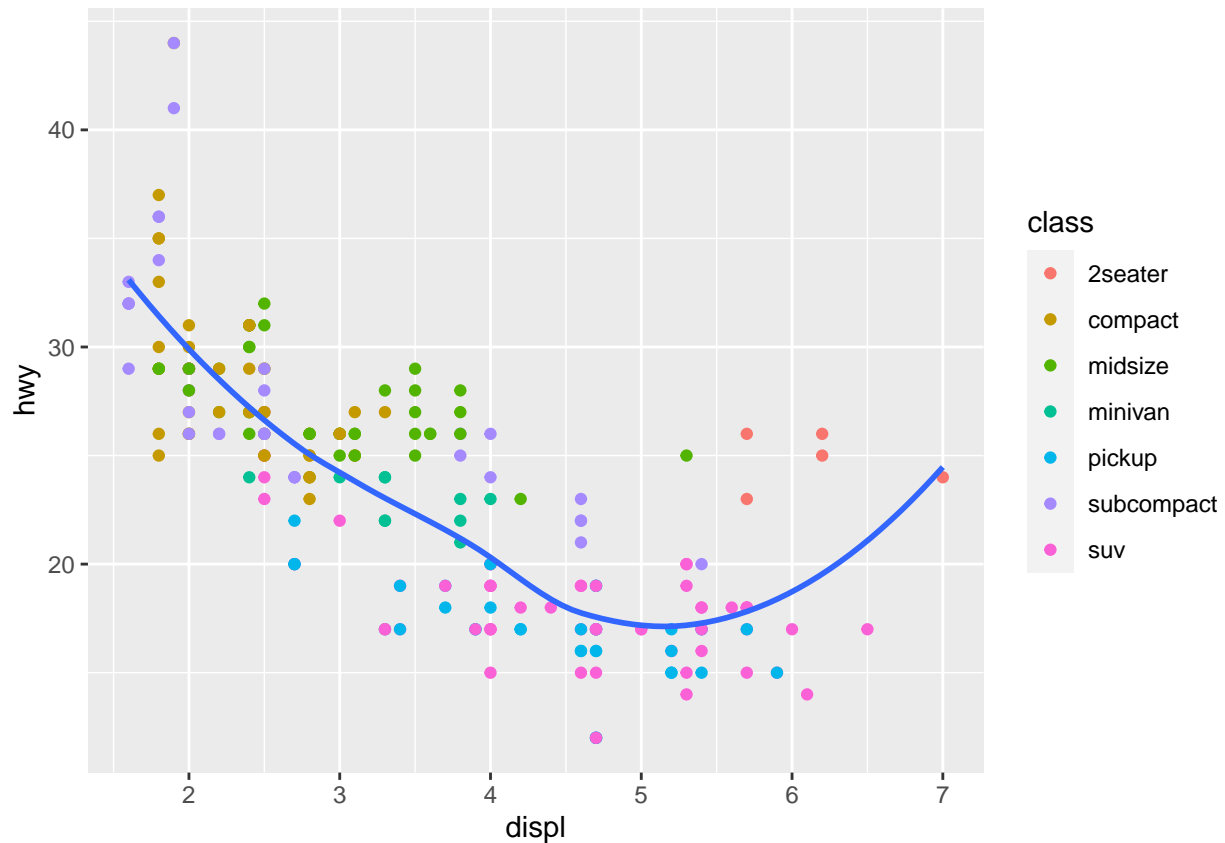
```
ggplot(mpg, aes(x = cty, y = hwy, colour = displ)) + geom_point()
```



9. Plot the relationship between `displ` (engine displacement) and `hwy` (highway miles per gallon) using `geom_point()`. Add a trend line over the existing plot using `geom_smooth()` with `se = FALSE`. Default method is “loess”.

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point(mapping = aes(color = class)) +
  geom_smooth(se = FALSE)
```

```
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```



10. Using the relationship of displ and hwy, add a trend line over existing plot. Set the `se = FALSE` to remove the confidence interval and `method = lm` to check for linear modeling.

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy, color = class)) +
  geom_point()+
  geom_smooth(se = FALSE, method = lm)
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

