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2024-10-01

## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

# Set working directory (optional if you want relative paths)  
setwd("C:/Users/saika/Desktop/CBA")  
  
# Load dataset into mpg\_data  
mpg\_data <- read.csv("mpg1.csv")  
  
# Quick check  
head(mpg\_data)

## X.1 X manufacturer model displ year cyl trans drv cty hwy fl class  
## 1 1 1 audi a4 1.8 1999 four auto front 18 29 premium compact  
## 2 2 2 audi a4 1.8 1999 four manual front 21 29 premium compact  
## 3 3 3 audi a4 2.0 2008 four manual front 20 31 premium compact  
## 4 4 4 audi a4 2.0 2008 four auto front 21 30 premium compact  
## 5 5 5 audi a4 2.8 1999 six auto front 16 26 premium compact  
## 6 6 6 audi a4 2.8 1999 six manual front 18 26 premium compact

summary(mpg\_data)

## X.1 X manufacturer model   
## Min. : 1.00 Min. : 1.00 Length:234 Length:234   
## 1st Qu.: 59.25 1st Qu.: 59.25 Class :character Class :character   
## Median :117.50 Median :117.50 Mode :character Mode :character   
## Mean :117.50 Mean :117.50   
## 3rd Qu.:175.75 3rd Qu.:175.75   
## Max. :234.00 Max. :234.00   
## displ year cyl trans   
## Min. :1.600 Min. :1999 Length:234 Length:234   
## 1st Qu.:2.400 1st Qu.:1999 Class :character Class :character   
## Median :3.300 Median :2004 Mode :character Mode :character   
## Mean :3.472 Mean :2004   
## 3rd Qu.:4.600 3rd Qu.:2008   
## Max. :7.000 Max. :2008   
## drv cty hwy fl   
## Length:234 Min. : 9.00 Min. :12.00 Length:234   
## Class :character 1st Qu.:14.00 1st Qu.:18.00 Class :character   
## Mode :character Median :17.00 Median :24.00 Mode :character   
## Mean :16.86 Mean :23.44   
## 3rd Qu.:19.00 3rd Qu.:27.00   
## Max. :35.00 Max. :44.00   
## class   
## Length:234   
## Class :character   
## Mode :character   
##   
##   
##

summary(cars)

## speed dist   
## Min. : 4.0 Min. : 2.00   
## 1st Qu.:12.0 1st Qu.: 26.00   
## Median :15.0 Median : 36.00   
## Mean :15.4 Mean : 42.98   
## 3rd Qu.:19.0 3rd Qu.: 56.00   
## Max. :25.0 Max. :120.00

## Including Plots

You can also embed plots, for example:



Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot. Load Tidyverse

library(tidyverse)

set working directory

setwd("C:/Users/saika/Desktop/CBA")

Import data

cars<-read.csv("mpg1.csv")

cars

## X.1 X manufacturer model displ year cyl trans drv  
## 1 1 1 audi a4 1.8 1999 four auto front  
## 2 2 2 audi a4 1.8 1999 four manual front  
## 3 3 3 audi a4 2.0 2008 four manual front  
## 4 4 4 audi a4 2.0 2008 four auto front  
## 5 5 5 audi a4 2.8 1999 six auto front  
## 6 6 6 audi a4 2.8 1999 six manual front  
## 7 7 7 audi a4 3.1 2008 six auto front  
## 8 8 8 audi a4 quattro 1.8 1999 four manual all  
## 9 9 9 audi a4 quattro 1.8 1999 four auto all  
## 10 10 10 audi a4 quattro 2.0 2008 four manual all  
## 11 11 11 audi a4 quattro 2.0 2008 four auto all  
## 12 12 12 audi a4 quattro 2.8 1999 six auto all  
## 13 13 13 audi a4 quattro 2.8 1999 six manual all  
## 14 14 14 audi a4 quattro 3.1 2008 six auto all  
## 15 15 15 audi a4 quattro 3.1 2008 six manual all  
## 16 16 16 audi a6 quattro 2.8 1999 six auto all  
## 17 17 17 audi a6 quattro 3.1 2008 six auto all  
## 18 18 18 audi a6 quattro 4.2 2008 eight auto all  
## 19 19 19 chevrolet c1500 suburban 2wd 5.3 2008 eight auto rear  
## 20 20 20 chevrolet c1500 suburban 2wd 5.3 2008 eight auto rear  
## 21 21 21 chevrolet c1500 suburban 2wd 5.3 2008 eight auto rear  
## 22 22 22 chevrolet c1500 suburban 2wd 5.7 1999 eight auto rear  
## 23 23 23 chevrolet c1500 suburban 2wd 6.0 2008 eight auto rear  
## 24 24 24 chevrolet corvette 5.7 1999 eight manual rear  
## 25 25 25 chevrolet corvette 5.7 1999 eight auto rear  
## 26 26 26 chevrolet corvette 6.2 2008 eight manual rear  
## 27 27 27 chevrolet corvette 6.2 2008 eight auto rear  
## 28 28 28 chevrolet corvette 7.0 2008 eight manual rear  
## 29 29 29 chevrolet k1500 tahoe 4wd 5.3 2008 eight auto all  
## 30 30 30 chevrolet k1500 tahoe 4wd 5.3 2008 eight auto all  
## 31 31 31 chevrolet k1500 tahoe 4wd 5.7 1999 eight auto all  
## 32 32 32 chevrolet k1500 tahoe 4wd 6.5 1999 eight auto all  
## 33 33 33 chevrolet malibu 2.4 1999 four auto front  
## 34 34 34 chevrolet malibu 2.4 2008 four auto front  
## 35 35 35 chevrolet malibu 3.1 1999 six auto front  
## 36 36 36 chevrolet malibu 3.5 2008 six auto front  
## 37 37 37 chevrolet malibu 3.6 2008 six auto front  
## 38 38 38 dodge caravan 2wd 2.4 1999 four auto front  
## 39 39 39 dodge caravan 2wd 3.0 1999 six auto front  
## 40 40 40 dodge caravan 2wd 3.3 1999 six auto front  
## 41 41 41 dodge caravan 2wd 3.3 1999 six auto front  
## 42 42 42 dodge caravan 2wd 3.3 2008 six auto front  
## 43 43 43 dodge caravan 2wd 3.3 2008 six auto front  
## 44 44 44 dodge caravan 2wd 3.3 2008 six auto front  
## 45 45 45 dodge caravan 2wd 3.8 1999 six auto front  
## 46 46 46 dodge caravan 2wd 3.8 1999 six auto front  
## 47 47 47 dodge caravan 2wd 3.8 2008 six auto front  
## 48 48 48 dodge caravan 2wd 4.0 2008 six auto front  
## 49 49 49 dodge dakota pickup 4wd 3.7 2008 six manual all  
## 50 50 50 dodge dakota pickup 4wd 3.7 2008 six auto all  
## 51 51 51 dodge dakota pickup 4wd 3.9 1999 six auto all  
## 52 52 52 dodge dakota pickup 4wd 3.9 1999 six manual all  
## 53 53 53 dodge dakota pickup 4wd 4.7 2008 eight auto all  
## 54 54 54 dodge dakota pickup 4wd 4.7 2008 eight auto all  
## 55 55 55 dodge dakota pickup 4wd 4.7 2008 eight auto all  
## 56 56 56 dodge dakota pickup 4wd 5.2 1999 eight manual all  
## 57 57 57 dodge dakota pickup 4wd 5.2 1999 eight auto all  
## 58 58 58 dodge durango 4wd 3.9 1999 six auto all  
## 59 59 59 dodge durango 4wd 4.7 2008 eight auto all  
## 60 60 60 dodge durango 4wd 4.7 2008 eight auto all  
## 61 61 61 dodge durango 4wd 4.7 2008 eight auto all  
## 62 62 62 dodge durango 4wd 5.2 1999 eight auto all  
## 63 63 63 dodge durango 4wd 5.7 2008 eight auto all  
## 64 64 64 dodge durango 4wd 5.9 1999 eight auto all  
## 65 65 65 dodge ram 1500 pickup 4wd 4.7 2008 eight manual all  
## 66 66 66 dodge ram 1500 pickup 4wd 4.7 2008 eight auto all  
## 67 67 67 dodge ram 1500 pickup 4wd 4.7 2008 eight auto all  
## 68 68 68 dodge ram 1500 pickup 4wd 4.7 2008 eight auto all  
## 69 69 69 dodge ram 1500 pickup 4wd 4.7 2008 eight manual all  
## 70 70 70 dodge ram 1500 pickup 4wd 4.7 2008 eight manual all  
## 71 71 71 dodge ram 1500 pickup 4wd 5.2 1999 eight auto all  
## 72 72 72 dodge ram 1500 pickup 4wd 5.2 1999 eight manual all  
## 73 73 73 dodge ram 1500 pickup 4wd 5.7 2008 eight auto all  
## 74 74 74 dodge ram 1500 pickup 4wd 5.9 1999 eight auto all  
## 75 75 75 ford expedition 2wd 4.6 1999 eight auto rear  
## 76 76 76 ford expedition 2wd 5.4 1999 eight auto rear  
## 77 77 77 ford expedition 2wd 5.4 2008 eight auto rear  
## 78 78 78 ford explorer 4wd 4.0 1999 six auto all  
## 79 79 79 ford explorer 4wd 4.0 1999 six manual all  
## 80 80 80 ford explorer 4wd 4.0 1999 six auto all  
## 81 81 81 ford explorer 4wd 4.0 2008 six auto all  
## 82 82 82 ford explorer 4wd 4.6 2008 eight auto all  
## 83 83 83 ford explorer 4wd 5.0 1999 eight auto all  
## 84 84 84 ford f150 pickup 4wd 4.2 1999 six auto all  
## 85 85 85 ford f150 pickup 4wd 4.2 1999 six manual all  
## 86 86 86 ford f150 pickup 4wd 4.6 1999 eight manual all  
## 87 87 87 ford f150 pickup 4wd 4.6 1999 eight auto all  
## 88 88 88 ford f150 pickup 4wd 4.6 2008 eight auto all  
## 89 89 89 ford f150 pickup 4wd 5.4 1999 eight auto all  
## 90 90 90 ford f150 pickup 4wd 5.4 2008 eight auto all  
## 91 91 91 ford mustang 3.8 1999 six manual rear  
## 92 92 92 ford mustang 3.8 1999 six auto rear  
## 93 93 93 ford mustang 4.0 2008 six manual rear  
## 94 94 94 ford mustang 4.0 2008 six auto rear  
## 95 95 95 ford mustang 4.6 1999 eight auto rear  
## 96 96 96 ford mustang 4.6 1999 eight manual rear  
## 97 97 97 ford mustang 4.6 2008 eight manual rear  
## 98 98 98 ford mustang 4.6 2008 eight auto rear  
## 99 99 99 ford mustang 5.4 2008 eight manual rear  
## 100 100 100 honda civic 1.6 1999 four manual front  
## 101 101 101 honda civic 1.6 1999 four auto front  
## 102 102 102 honda civic 1.6 1999 four manual front  
## 103 103 103 honda civic 1.6 1999 four manual front  
## 104 104 104 honda civic 1.6 1999 four auto front  
## 105 105 105 honda civic 1.8 2008 four manual front  
## 106 106 106 honda civic 1.8 2008 four auto front  
## 107 107 107 honda civic 1.8 2008 four auto front  
## 108 108 108 honda civic 2.0 2008 four manual front  
## 109 109 109 hyundai sonata 2.4 1999 four auto front  
## 110 110 110 hyundai sonata 2.4 1999 four manual front  
## 111 111 111 hyundai sonata 2.4 2008 four auto front  
## 112 112 112 hyundai sonata 2.4 2008 four manual front  
## 113 113 113 hyundai sonata 2.5 1999 six auto front  
## 114 114 114 hyundai sonata 2.5 1999 six manual front  
## 115 115 115 hyundai sonata 3.3 2008 six auto front  
## 116 116 116 hyundai tiburon 2.0 1999 four auto front  
## 117 117 117 hyundai tiburon 2.0 1999 four manual front  
## 118 118 118 hyundai tiburon 2.0 2008 four manual front  
## 119 119 119 hyundai tiburon 2.0 2008 four auto front  
## 120 120 120 hyundai tiburon 2.7 2008 six auto front  
## 121 121 121 hyundai tiburon 2.7 2008 six manual front  
## 122 122 122 hyundai tiburon 2.7 2008 six manual front  
## 123 123 123 jeep grand cherokee 4wd 3.0 2008 six auto all  
## 124 124 124 jeep grand cherokee 4wd 3.7 2008 six auto all  
## 125 125 125 jeep grand cherokee 4wd 4.0 1999 six auto all  
## 126 126 126 jeep grand cherokee 4wd 4.7 1999 eight auto all  
## 127 127 127 jeep grand cherokee 4wd 4.7 2008 eight auto all  
## 128 128 128 jeep grand cherokee 4wd 4.7 2008 eight auto all  
## 129 129 129 jeep grand cherokee 4wd 5.7 2008 eight auto all  
## 130 130 130 jeep grand cherokee 4wd 6.1 2008 eight auto all  
## 131 131 131 land rover range rover 4.0 1999 eight auto all  
## 132 132 132 land rover range rover 4.2 2008 eight auto all  
## 133 133 133 land rover range rover 4.4 2008 eight auto all  
## 134 134 134 land rover range rover 4.6 1999 eight auto all  
## 135 135 135 lincoln navigator 2wd 5.4 1999 eight auto rear  
## 136 136 136 lincoln navigator 2wd 5.4 1999 eight auto rear  
## 137 137 137 lincoln navigator 2wd 5.4 2008 eight auto rear  
## 138 138 138 mercury mountaineer 4wd 4.0 1999 six auto all  
## 139 139 139 mercury mountaineer 4wd 4.0 2008 six auto all  
## 140 140 140 mercury mountaineer 4wd 4.6 2008 eight auto all  
## 141 141 141 mercury mountaineer 4wd 5.0 1999 eight auto all  
## 142 142 142 nissan altima 2.4 1999 four manual front  
## 143 143 143 nissan altima 2.4 1999 four auto front  
## 144 144 144 nissan altima 2.5 2008 four auto front  
## 145 145 145 nissan altima 2.5 2008 four manual front  
## 146 146 146 nissan altima 3.5 2008 six manual front  
## 147 147 147 nissan altima 3.5 2008 six auto front  
## 148 148 148 nissan maxima 3.0 1999 six auto front  
## 149 149 149 nissan maxima 3.0 1999 six manual front  
## 150 150 150 nissan maxima 3.5 2008 six auto front  
## 151 151 151 nissan pathfinder 4wd 3.3 1999 six auto all  
## 152 152 152 nissan pathfinder 4wd 3.3 1999 six manual all  
## 153 153 153 nissan pathfinder 4wd 4.0 2008 six auto all  
## 154 154 154 nissan pathfinder 4wd 5.6 2008 eight auto all  
## 155 155 155 pontiac grand prix 3.1 1999 six auto front  
## 156 156 156 pontiac grand prix 3.8 1999 six auto front  
## 157 157 157 pontiac grand prix 3.8 1999 six auto front  
## 158 158 158 pontiac grand prix 3.8 2008 six auto front  
## 159 159 159 pontiac grand prix 5.3 2008 eight auto front  
## 160 160 160 subaru forester awd 2.5 1999 four manual all  
## 161 161 161 subaru forester awd 2.5 1999 four auto all  
## 162 162 162 subaru forester awd 2.5 2008 four manual all  
## 163 163 163 subaru forester awd 2.5 2008 four manual all  
## 164 164 164 subaru forester awd 2.5 2008 four auto all  
## 165 165 165 subaru forester awd 2.5 2008 four auto all  
## 166 166 166 subaru impreza awd 2.2 1999 four auto all  
## 167 167 167 subaru impreza awd 2.2 1999 four manual all  
## 168 168 168 subaru impreza awd 2.5 1999 four manual all  
## 169 169 169 subaru impreza awd 2.5 1999 four auto all  
## 170 170 170 subaru impreza awd 2.5 2008 four auto all  
## 171 171 171 subaru impreza awd 2.5 2008 four auto all  
## 172 172 172 subaru impreza awd 2.5 2008 four manual all  
## 173 173 173 subaru impreza awd 2.5 2008 four manual all  
## 174 174 174 toyota 4runner 4wd 2.7 1999 four manual all  
## 175 175 175 toyota 4runner 4wd 2.7 1999 four auto all  
## 176 176 176 toyota 4runner 4wd 3.4 1999 six auto all  
## 177 177 177 toyota 4runner 4wd 3.4 1999 six manual all  
## 178 178 178 toyota 4runner 4wd 4.0 2008 six auto all  
## 179 179 179 toyota 4runner 4wd 4.7 2008 eight auto all  
## 180 180 180 toyota camry 2.2 1999 four manual front  
## 181 181 181 toyota camry 2.2 1999 four auto front  
## 182 182 182 toyota camry 2.4 2008 four manual front  
## 183 183 183 toyota camry 2.4 2008 four auto front  
## 184 184 184 toyota camry 3.0 1999 six auto front  
## 185 185 185 toyota camry 3.0 1999 six manual front  
## 186 186 186 toyota camry 3.5 2008 six auto front  
## 187 187 187 toyota camry solara 2.2 1999 four auto front  
## 188 188 188 toyota camry solara 2.2 1999 four manual front  
## 189 189 189 toyota camry solara 2.4 2008 four manual front  
## 190 190 190 toyota camry solara 2.4 2008 four auto front  
## 191 191 191 toyota camry solara 3.0 1999 six auto front  
## 192 192 192 toyota camry solara 3.0 1999 six manual front  
## 193 193 193 toyota camry solara 3.3 2008 six auto front  
## 194 194 194 toyota corolla 1.8 1999 four auto front  
## 195 195 195 toyota corolla 1.8 1999 four auto front  
## 196 196 196 toyota corolla 1.8 1999 four manual front  
## 197 197 197 toyota corolla 1.8 2008 four manual front  
## 198 198 198 toyota corolla 1.8 2008 four auto front  
## 199 199 199 toyota land cruiser wagon 4wd 4.7 1999 eight auto all  
## 200 200 200 toyota land cruiser wagon 4wd 5.7 2008 eight auto all  
## 201 201 201 toyota toyota tacoma 4wd 2.7 1999 four manual all  
## 202 202 202 toyota toyota tacoma 4wd 2.7 1999 four auto all  
## 203 203 203 toyota toyota tacoma 4wd 2.7 2008 four manual all  
## 204 204 204 toyota toyota tacoma 4wd 3.4 1999 six manual all  
## 205 205 205 toyota toyota tacoma 4wd 3.4 1999 six auto all  
## 206 206 206 toyota toyota tacoma 4wd 4.0 2008 six manual all  
## 207 207 207 toyota toyota tacoma 4wd 4.0 2008 six auto all  
## 208 208 208 volkswagen gti 2.0 1999 four manual front  
## 209 209 209 volkswagen gti 2.0 1999 four auto front  
## 210 210 210 volkswagen gti 2.0 2008 four manual front  
## 211 211 211 volkswagen gti 2.0 2008 four auto front  
## 212 212 212 volkswagen gti 2.8 1999 six manual front  
## 213 213 213 volkswagen jetta 1.9 1999 four manual front  
## 214 214 214 volkswagen jetta 2.0 1999 four manual front  
## 215 215 215 volkswagen jetta 2.0 1999 four auto front  
## 216 216 216 volkswagen jetta 2.0 2008 four auto front  
## 217 217 217 volkswagen jetta 2.0 2008 four manual front  
## 218 218 218 volkswagen jetta 2.5 2008 five auto front  
## 219 219 219 volkswagen jetta 2.5 2008 five manual front  
## 220 220 220 volkswagen jetta 2.8 1999 six auto front  
## 221 221 221 volkswagen jetta 2.8 1999 six manual front  
## 222 222 222 volkswagen new beetle 1.9 1999 four manual front  
## 223 223 223 volkswagen new beetle 1.9 1999 four auto front  
## 224 224 224 volkswagen new beetle 2.0 1999 four manual front  
## 225 225 225 volkswagen new beetle 2.0 1999 four auto front  
## 226 226 226 volkswagen new beetle 2.5 2008 five manual front  
## 227 227 227 volkswagen new beetle 2.5 2008 five auto front  
## 228 228 228 volkswagen passat 1.8 1999 four manual front  
## 229 229 229 volkswagen passat 1.8 1999 four auto front  
## 230 230 230 volkswagen passat 2.0 2008 four auto front  
## 231 231 231 volkswagen passat 2.0 2008 four manual front  
## 232 232 232 volkswagen passat 2.8 1999 six auto front  
## 233 233 233 volkswagen passat 2.8 1999 six manual front  
## 234 234 234 volkswagen passat 3.6 2008 six auto front  
## cty hwy fl class  
## 1 18 29 premium compact  
## 2 21 29 premium compact  
## 3 20 31 premium compact  
## 4 21 30 premium compact  
## 5 16 26 premium compact  
## 6 18 26 premium compact  
## 7 18 27 premium compact  
## 8 18 26 premium compact  
## 9 16 25 premium compact  
## 10 20 28 premium compact  
## 11 19 27 premium compact  
## 12 15 25 premium compact  
## 13 17 25 premium compact  
## 14 17 25 premium compact  
## 15 15 25 premium compact  
## 16 15 24 premium midsize  
## 17 17 25 premium midsize  
## 18 16 23 premium midsize  
## 19 14 20 regular suv  
## 20 11 15 ethanol suv  
## 21 14 20 regular suv  
## 22 13 17 regular suv  
## 23 12 17 regular suv  
## 24 16 26 premium 2seater  
## 25 15 23 premium 2seater  
## 26 16 26 premium 2seater  
## 27 15 25 premium 2seater  
## 28 15 24 premium 2seater  
## 29 14 19 regular suv  
## 30 11 14 ethanol suv  
## 31 11 15 regular suv  
## 32 14 17 diesel suv  
## 33 19 27 regular midsize  
## 34 22 30 regular midsize  
## 35 18 26 regular midsize  
## 36 18 29 regular midsize  
## 37 17 26 regular midsize  
## 38 18 24 regular minivan  
## 39 17 24 regular minivan  
## 40 16 22 regular minivan  
## 41 16 22 regular minivan  
## 42 17 24 regular minivan  
## 43 17 24 regular minivan  
## 44 11 17 ethanol minivan  
## 45 15 22 regular minivan  
## 46 15 21 regular minivan  
## 47 16 23 regular minivan  
## 48 16 23 regular minivan  
## 49 15 19 regular pickup  
## 50 14 18 regular pickup  
## 51 13 17 regular pickup  
## 52 14 17 regular pickup  
## 53 14 19 regular pickup  
## 54 14 19 regular pickup  
## 55 9 12 ethanol pickup  
## 56 11 17 regular pickup  
## 57 11 15 regular pickup  
## 58 13 17 regular suv  
## 59 13 17 regular suv  
## 60 9 12 ethanol suv  
## 61 13 17 regular suv  
## 62 11 16 regular suv  
## 63 13 18 regular suv  
## 64 11 15 regular suv  
## 65 12 16 regular pickup  
## 66 9 12 ethanol pickup  
## 67 13 17 regular pickup  
## 68 13 17 regular pickup  
## 69 12 16 regular pickup  
## 70 9 12 ethanol pickup  
## 71 11 15 regular pickup  
## 72 11 16 regular pickup  
## 73 13 17 regular pickup  
## 74 11 15 regular pickup  
## 75 11 17 regular suv  
## 76 11 17 regular suv  
## 77 12 18 regular suv  
## 78 14 17 regular suv  
## 79 15 19 regular suv  
## 80 14 17 regular suv  
## 81 13 19 regular suv  
## 82 13 19 regular suv  
## 83 13 17 regular suv  
## 84 14 17 regular pickup  
## 85 14 17 regular pickup  
## 86 13 16 regular pickup  
## 87 13 16 regular pickup  
## 88 13 17 regular pickup  
## 89 11 15 regular pickup  
## 90 13 17 regular pickup  
## 91 18 26 regular subcompact  
## 92 18 25 regular subcompact  
## 93 17 26 regular subcompact  
## 94 16 24 regular subcompact  
## 95 15 21 regular subcompact  
## 96 15 22 regular subcompact  
## 97 15 23 regular subcompact  
## 98 15 22 regular subcompact  
## 99 14 20 premium subcompact  
## 100 28 33 regular subcompact  
## 101 24 32 regular subcompact  
## 102 25 32 regular subcompact  
## 103 23 29 premium subcompact  
## 104 24 32 regular subcompact  
## 105 26 34 regular subcompact  
## 106 25 36 regular subcompact  
## 107 24 36 CNG subcompact  
## 108 21 29 premium subcompact  
## 109 18 26 regular midsize  
## 110 18 27 regular midsize  
## 111 21 30 regular midsize  
## 112 21 31 regular midsize  
## 113 18 26 regular midsize  
## 114 18 26 regular midsize  
## 115 19 28 regular midsize  
## 116 19 26 regular subcompact  
## 117 19 29 regular subcompact  
## 118 20 28 regular subcompact  
## 119 20 27 regular subcompact  
## 120 17 24 regular subcompact  
## 121 16 24 regular subcompact  
## 122 17 24 regular subcompact  
## 123 17 22 diesel suv  
## 124 15 19 regular suv  
## 125 15 20 regular suv  
## 126 14 17 regular suv  
## 127 9 12 ethanol suv  
## 128 14 19 regular suv  
## 129 13 18 regular suv  
## 130 11 14 premium suv  
## 131 11 15 premium suv  
## 132 12 18 regular suv  
## 133 12 18 regular suv  
## 134 11 15 premium suv  
## 135 11 17 regular suv  
## 136 11 16 premium suv  
## 137 12 18 regular suv  
## 138 14 17 regular suv  
## 139 13 19 regular suv  
## 140 13 19 regular suv  
## 141 13 17 regular suv  
## 142 21 29 regular compact  
## 143 19 27 regular compact  
## 144 23 31 regular midsize  
## 145 23 32 regular midsize  
## 146 19 27 premium midsize  
## 147 19 26 premium midsize  
## 148 18 26 regular midsize  
## 149 19 25 regular midsize  
## 150 19 25 premium midsize  
## 151 14 17 regular suv  
## 152 15 17 regular suv  
## 153 14 20 premium suv  
## 154 12 18 premium suv  
## 155 18 26 regular midsize  
## 156 16 26 premium midsize  
## 157 17 27 regular midsize  
## 158 18 28 regular midsize  
## 159 16 25 premium midsize  
## 160 18 25 regular suv  
## 161 18 24 regular suv  
## 162 20 27 regular suv  
## 163 19 25 premium suv  
## 164 20 26 regular suv  
## 165 18 23 premium suv  
## 166 21 26 regular subcompact  
## 167 19 26 regular subcompact  
## 168 19 26 regular subcompact  
## 169 19 26 regular subcompact  
## 170 20 25 premium compact  
## 171 20 27 regular compact  
## 172 19 25 premium compact  
## 173 20 27 regular compact  
## 174 15 20 regular suv  
## 175 16 20 regular suv  
## 176 15 19 regular suv  
## 177 15 17 regular suv  
## 178 16 20 regular suv  
## 179 14 17 regular suv  
## 180 21 29 regular midsize  
## 181 21 27 regular midsize  
## 182 21 31 regular midsize  
## 183 21 31 regular midsize  
## 184 18 26 regular midsize  
## 185 18 26 regular midsize  
## 186 19 28 regular midsize  
## 187 21 27 regular compact  
## 188 21 29 regular compact  
## 189 21 31 regular compact  
## 190 22 31 regular compact  
## 191 18 26 regular compact  
## 192 18 26 regular compact  
## 193 18 27 regular compact  
## 194 24 30 regular compact  
## 195 24 33 regular compact  
## 196 26 35 regular compact  
## 197 28 37 regular compact  
## 198 26 35 regular compact  
## 199 11 15 regular suv  
## 200 13 18 regular suv  
## 201 15 20 regular pickup  
## 202 16 20 regular pickup  
## 203 17 22 regular pickup  
## 204 15 17 regular pickup  
## 205 15 19 regular pickup  
## 206 15 18 regular pickup  
## 207 16 20 regular pickup  
## 208 21 29 regular compact  
## 209 19 26 regular compact  
## 210 21 29 premium compact  
## 211 22 29 premium compact  
## 212 17 24 regular compact  
## 213 33 44 diesel compact  
## 214 21 29 regular compact  
## 215 19 26 regular compact  
## 216 22 29 premium compact  
## 217 21 29 premium compact  
## 218 21 29 regular compact  
## 219 21 29 regular compact  
## 220 16 23 regular compact  
## 221 17 24 regular compact  
## 222 35 44 diesel subcompact  
## 223 29 41 diesel subcompact  
## 224 21 29 regular subcompact  
## 225 19 26 regular subcompact  
## 226 20 28 regular subcompact  
## 227 20 29 regular subcompact  
## 228 21 29 premium midsize  
## 229 18 29 premium midsize  
## 230 19 28 premium midsize  
## 231 21 29 premium midsize  
## 232 16 26 premium midsize  
## 233 18 26 premium midsize  
## 234 17 26 premium midsize

scatter plot of highway mileage vs displacement by class

ggplot(mpg\_data, aes(x = displ, y = hwy, color = class)) +   
 geom\_point() +   
 geom\_smooth(se = FALSE) +  
 labs(  
 x = "Displacement in liters",  
 y = "Miles per gallon",  
 title = "Highway Mileage vs Displacement"  
 ) +  
 theme\_minimal()

## `geom\_smooth()` using method = 'loess' and formula = 'y ~ x'

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : span too small. fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : pseudoinverse used at 5.6935

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : neighborhood radius 0.5065

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : reciprocal condition number 0

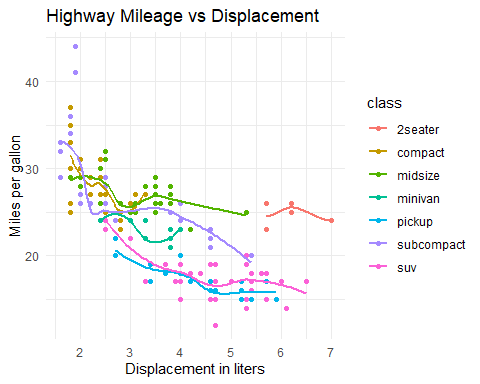
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : There are other near singularities as well. 0.65044

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : pseudoinverse used at 4.008

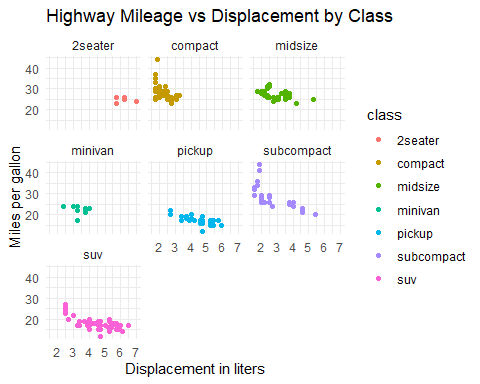
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : neighborhood radius 0.708

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : reciprocal condition number 0

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : There are other near singularities as well. 0.25

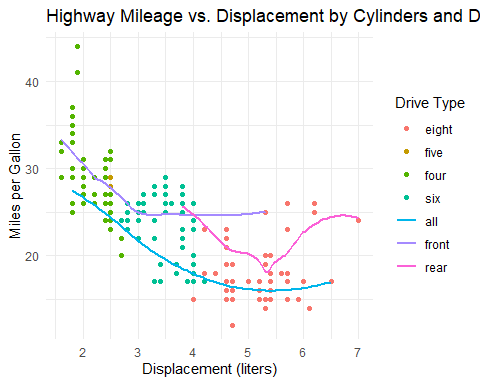


ggplot(mpg\_data, aes(x = displ, y = hwy, color = class)) +   
 geom\_point() +   
 facet\_wrap(~class) +   
 labs(  
 x = "Displacement in liters",  
 y = "Miles per gallon",  
 title = "Highway Mileage vs Displacement by Class"  
 ) +  
 theme\_minimal()



ggplot(mpg\_data, aes(x = displ, y = hwy)) +   
 geom\_point(aes(color = factor(cyl))) +   
 geom\_smooth(aes(color = drv), method = "loess", se = FALSE) +   
 labs(  
 title = "Highway Mileage vs. Displacement by Cylinders and Drive Type",  
 x = "Displacement (liters)",  
 y = "Miles per Gallon",  
 color = "Drive Type"  
 ) +   
 theme\_minimal()

## `geom\_smooth()` using formula = 'y ~ x'



ggplot(mpg\_data, aes(x = displ, y = hwy)) +   
 geom\_point(aes(color = drv)) +   
 geom\_smooth(aes(color = drv), se = FALSE) +   
 labs(  
 title = "Highway Mileage vs. Displacement by Number of Cylinders",  
 x = "Displacement (liters)",  
 y = "Miles per Gallon",  
 color = "Drive Type"  
 ) +   
 facet\_wrap(~cyl)

## `geom\_smooth()` using method = 'loess' and formula = 'y ~ x'

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : pseudoinverse used at 2.7045

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : neighborhood radius 0.2045

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : reciprocal condition number 0

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : There are other near singularities as well. 0.04

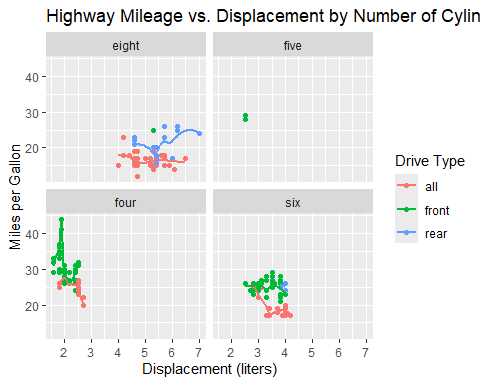
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : span too small. fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : pseudoinverse used at 3.799

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : neighborhood radius 0.201

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : reciprocal condition number 0

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,  
## : There are other near singularities as well. 0.040401



Kalyan Peesapati

2024-10-22

## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

summary(cars)

## speed dist   
## Min. : 4.0 Min. : 2.00   
## 1st Qu.:12.0 1st Qu.: 26.00   
## Median :15.0 Median : 36.00   
## Mean :15.4 Mean : 42.98   
## 3rd Qu.:19.0 3rd Qu.: 56.00   
## Max. :25.0 Max. :120.00

## Including Plots

You can also embed plots, for example:



Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.

library(tidyverse)

## Warning: package 'tidyverse' was built under R version 4.4.2

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.4 ✔ readr 2.1.5  
## ✔ forcats 1.0.0 ✔ stringr 1.5.1  
## ✔ ggplot2 3.5.1 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.3 ✔ tidyr 1.3.1  
## ✔ purrr 1.0.2   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

Set working Directory

plays <- read.csv("C:/Users/saika/Desktop/CBA/Prevention Plays.csv")  
head(plays)

## X Affiliation Age\_Group Ethnicity  
## 1 1 Daley Middle School Ages 10-13 South Asian  
## 2 2 Daley Middle School Age 10-14 White/Caucasian  
## 3 3 daley middle school Age 10-14 Multi-race  
## 4 4 2cd Act Age 10-14 Asian/ Pacific Islander  
## 5 5 2nd Act Ages 10-13 Mixed Ethnicity  
## 6 6 2nd Act Age 19 and older Caucasian  
## Gender\_Identity New\_learning Identify\_Resources  
## 1 Cisgender female/woman/girl 4 4  
## 2 Other/ Prefer not to identify 5 3  
## 3 Cisgender male/man/boy 4 4  
## 4 Cisgender female/woman/girl 5 5  
## 5 Cisgender female/woman/girl 3 1  
## 6 Cisgender female/woman/girl 5 - Strongly agree 5 - Strongly agree  
## Change\_Opinion  
## 1 Somewhat  
## 2 Somewhat  
## 3 Somewhat  
## 4 Somewhat  
## 5 Somewhat  
## 6 Yes  
## Favorite\_part  
## 1 The play  
## 2 The Play  
## 3 The Play  
## 4 Hearing personal stories from actors that have lived experience with substance use or identify as a person that is in long term recovery  
## 5 The play  
## 6 The Talkback/Question and Answer Forum with Actors  
## Continue\_Conversation  
## 1 4  
## 2   
## 3   
## 4   
## 5 5  
## 6 5 - Strongly agree  
## Additional\_Feedback  
## 1 Where there any friends or close friends that you had that did the same that you did?  
## 2 i actually really liked it i think they could have changed some of the movements and did not do as much hand movement because it makes is look unrealistic   
## 3 nothing   
## 4 No, i think the play was really cool and inspiring, and shows kids that it's okay to ask for help.  
## 5 None   
## 6

count\_Affiliation <- count(plays, Affiliation)  
head(count\_Affiliation)

## Affiliation n  
## 1 Daley Middle School 2  
## 2 daley middle school 1  
## 3 2cd Act 1  
## 4 2nd Act 2  
## 5 360 HIGH SCHOOL 1  
## 6 360 High School 1

Bar chart with descending bar

Top\_Affiliation <- count\_Affiliation %>%   
 arrange(desc(n)) %>%   
 slice\_head(n = 21)  
  
Top\_Affiliation

## Affiliation n  
## 1 Daley Middle School 253  
## 2 Daley middle school 89  
## 3 James S. Daley Middle School 86  
## 4 James S Daley Middle School 48  
## 5 Sullivan Middle School 46  
## 6 BBHMS 40  
## 7 Daley 29  
## 8 Sullivan middle school 27  
## 9 sullivan middle school 25  
## 10 James Daley Middle School 24  
## 11 James Sullivan Middle School 24  
## 12 daley middle school 22  
## 13 Butler Middle School 21  
## 14 Brecksville Broadview Heights Middle School 19  
## 15 Lynnfield Middle School 19  
## 16 Daley Middle school 18  
## 17 Lynnfield middle school 14  
## 18 bbhms 13  
## 19 Brecksville Broadview Heights 12  
## 20 butler middle school 12  
## 21 Sullivan 11

Rename the Affiliaitions

plays$Affiliation <- recode(plays$Affiliation,  
 "BBH" = "BBH MIDDLE SCHOOL",  
 "BRECKSVILLE BROADVIEW HEIGHTS" = "BBH MIDDLE SCHOOL",  
 "BRECKSVILLE BROADVIEW HEIGHTS MIDDLE SCHOOL" = "BBH MIDDLE SCHOOL"  
)  
  
# Recount affiliations after renaming  
count\_Affiliation <- count(plays, Affiliation)  
  
# Filter top affiliations again (e.g., top 20)  
Top\_Affiliation <- count\_Affiliation %>%   
 arrange(desc(n)) %>%   
 slice\_head(n = 20)  
  
Top\_Affiliation

## Affiliation n  
## 1 Daley Middle School 253  
## 2 Daley middle school 89  
## 3 James S. Daley Middle School 86  
## 4 James S Daley Middle School 48  
## 5 Sullivan Middle School 46  
## 6 BBHMS 40  
## 7 Daley 29  
## 8 Sullivan middle school 27  
## 9 sullivan middle school 25  
## 10 James Daley Middle School 24  
## 11 James Sullivan Middle School 24  
## 12 daley middle school 22  
## 13 Butler Middle School 21  
## 14 Brecksville Broadview Heights Middle School 19  
## 15 Lynnfield Middle School 19  
## 16 Daley Middle school 18  
## 17 Lynnfield middle school 14  
## 18 bbhms 13  
## 19 Brecksville Broadview Heights 12  
## 20 butler middle school 12

Kalyan Peesapati

2024-10-15

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## 3rd Qu.:19.0 3rd Qu.: 56.00   
## Max. :25.0 Max. :120.00

## Including Plots

You can also embed plots, for example:



Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.

# Load necessary libraries  
library(tidyverse)

## Warning: package 'tidyverse' was built under R version 4.4.2

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
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## ✔ forcats 1.0.0 ✔ stringr 1.5.1  
## ✔ ggplot2 3.5.1 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.3 ✔ tidyr 1.3.1  
## ✔ purrr 1.0.2   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

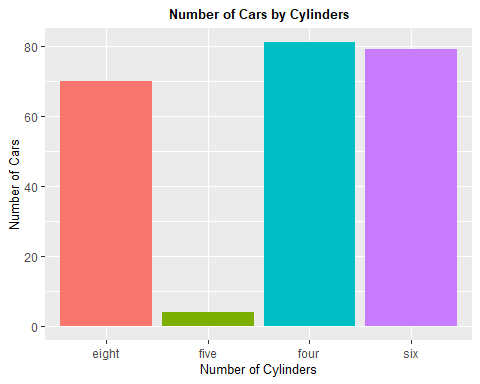
set working directory

setwd("C:/Users/saika/Desktop/CBA")

# Import the data  
Cars <- read.csv("mpg1.csv")  
head(cars)

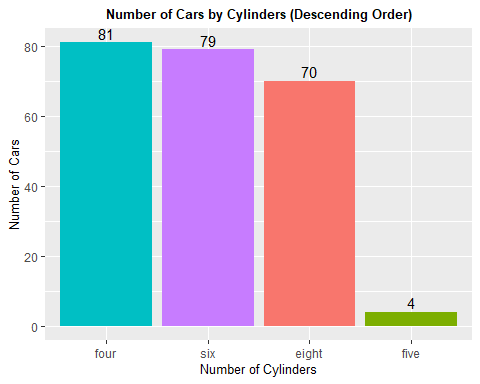
## speed dist  
## 1 4 2  
## 2 4 10  
## 3 7 4  
## 4 7 22  
## 5 8 16  
## 6 9 10

# Simple Bar Chart for Number of Cylinders (Without Data Labels)  
ggplot(Cars) +  
 geom\_bar(aes(x=factor(cyl), fill=factor(cyl))) +   
 theme(legend.position="none") +   
 labs(x="Number of Cylinders", y="Number of Cars",   
 title="Number of Cars by Cylinders") +   
 theme(plot.title=element\_text(size = 10, face = "bold", hjust=0.5)) +  
 theme(axis.title=element\_text(size=10, vjust=0.3))



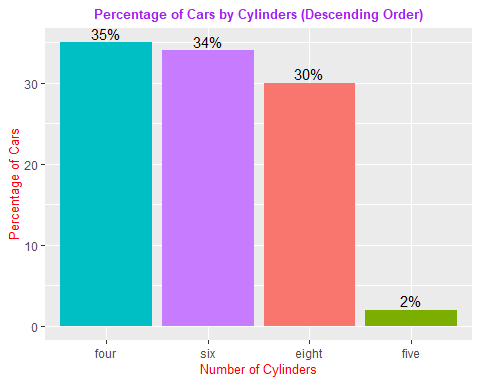
# Comments:  
# 1. This chart shows the number of cars categorized by their cylinders.  
# 2. Data labels are intentionally excluded as per the requirements.

# Frequency Distribution by Number of Cylinders  
cyl\_count <- count(Cars, cyl)  
  
# Bar chart with descending order and data labels  
ggplot(cyl\_count, aes(x=reorder(factor(cyl), -n), y=n, fill=factor(cyl))) +   
 geom\_bar(stat="identity") +   
 theme(legend.position="none") +   
 geom\_text(aes(label=n), vjust=-0.3) +   
 labs(x="Number of Cylinders", y="Number of Cars",   
 title="Number of Cars by Cylinders (Descending Order)") +   
 theme(plot.title=element\_text(size = 10, face = "bold", hjust=0.5)) +  
 theme(axis.title=element\_text(size=10, vjust=0.3))



# Comments:  
# 1. The bars are ordered in descending order based on the number of cars in each cylinder group.  
# 2. Data labels show the count of cars in each cylinder group.

# Add Percent column to the frequency distribution and round to zero decimal places  
cyl\_count$percent <- round(cyl\_count$n \* 100 / sum(cyl\_count$n), 0)  
  
# Bar chart with percentages as labels  
ggplot(cyl\_count, aes(x=reorder(factor(cyl), -percent), y=percent, fill=factor(cyl))) +   
 geom\_bar(stat="identity") +   
 theme(legend.position="none") +   
 geom\_text(aes(label=paste0(percent, "%")), vjust=-0.3) +   
 labs(x="Number of Cylinders", y="Percentage of Cars",   
 title="Percentage of Cars by Cylinders (Descending Order)") +   
 theme(plot.title=element\_text(size = 10, face = "bold", color = "purple", hjust=0.5)) +  
 theme(axis.title=element\_text(size=10, color = "red", vjust=0.3))



# Comments:  
# 1. Data labels now show the percentage of cars in each cylinder category instead of counts.  
# 2. The bars are ordered in descending order by percentage, as required.