```r
#1.a
mpg_data <- read.table("mpg.csv", header = TRUE, sep = ",")
str(mpg_data)
```

```
## 'data.frame':    234 obs. of  12 variables:
##  $ X           : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ manufacturer: chr  "audi" "audi" "audi" "audi" ...
##  $ model       : chr  "a4" "a4" "a4" "a4" ...
##  $ displ       : num  1.8 1.8 2 2 2.8 2.8 3.1 1.8 1.8 2 ...
##  $ year        : int  1999 1999 2008 2008 1999 1999 2008 1999 1999 2008 ...
##  $ cyl         : int  4 4 4 4 6 6 6 4 4 4 ...
##  $ trans       : chr  "auto(l5)" "manual(m5)" "manual(m6)" "auto(av)" ...
##  $ drv         : chr  "f" "f" "f" "f" ...
##  $ cty         : int  18 21 20 21 16 18 18 18 16 20 ...
##  $ hwy         : int  29 29 31 30 26 26 27 26 25 28 ...
##  $ fl          : chr  "p" "p" "p" "p" ...
##  $ class       : chr  "compact" "compact" "compact" "compact" ...
```

#1.b The mpg dataset includes the manufacturer, model, trans (transmission type), drv (drive type), and fl (fuel type). and class (car classification) are categorical variables.

#1.c The mpg dataset includes three continuous variables: displ (engine displacement), cty, and hwy.

```r
#2.
manufacturer_counts <- table(mpg_data$manufacturer)
most_models_manufacturer <- names(which.max(manufacturer_counts))
most_models_count <- max(manufacturer_counts)

model_counts <- table(mpg_data$model)
most_variations_model <- names(which.max(model_counts))
most_variations_count <- max(model_counts)

most_models_manufacturer
```

```
## [1] "dodge"
```

```r
most_models_count
```

```
## [1] 37
```

```r
most_variations_model
```

```
## [1] "caravan 2wd"
```

```r
most_variations_count
```

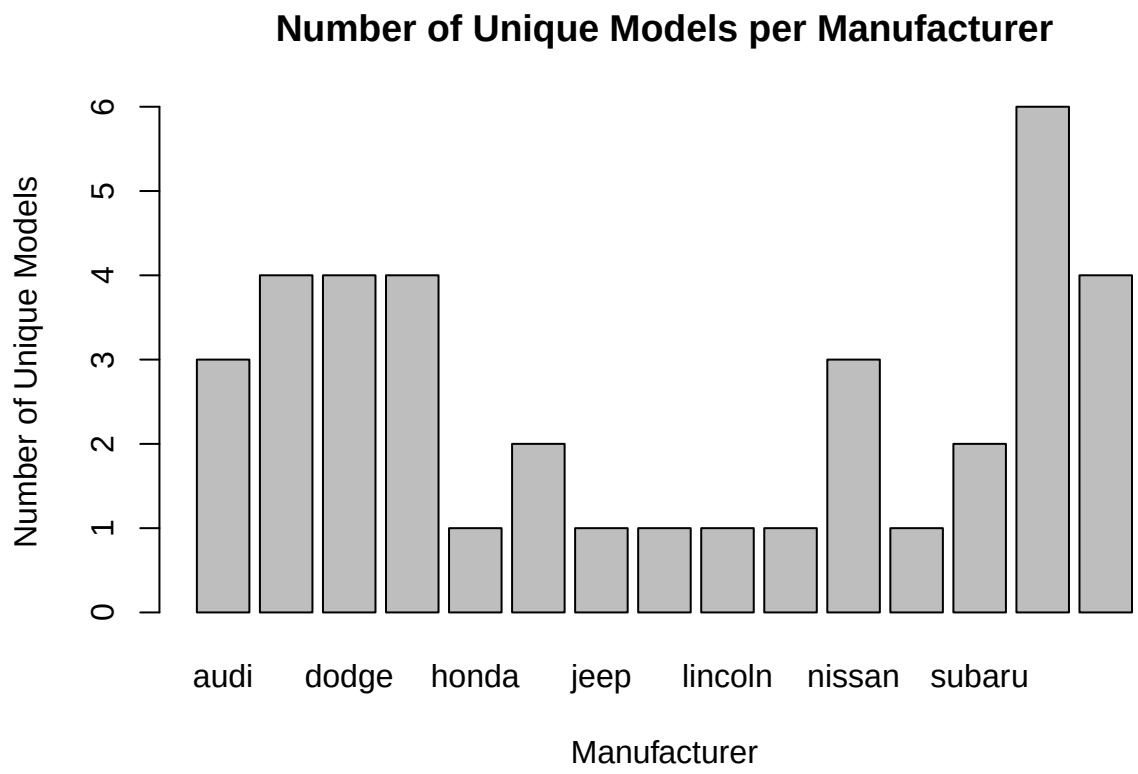
```
## [1] 11
```

```r
#2.a
unique_models_by_manufacturer <- aggregate(model ~ manufacturer,
data = mpg_data, function(x) length(unique(x)))
unique_models_by_manufacturer
```

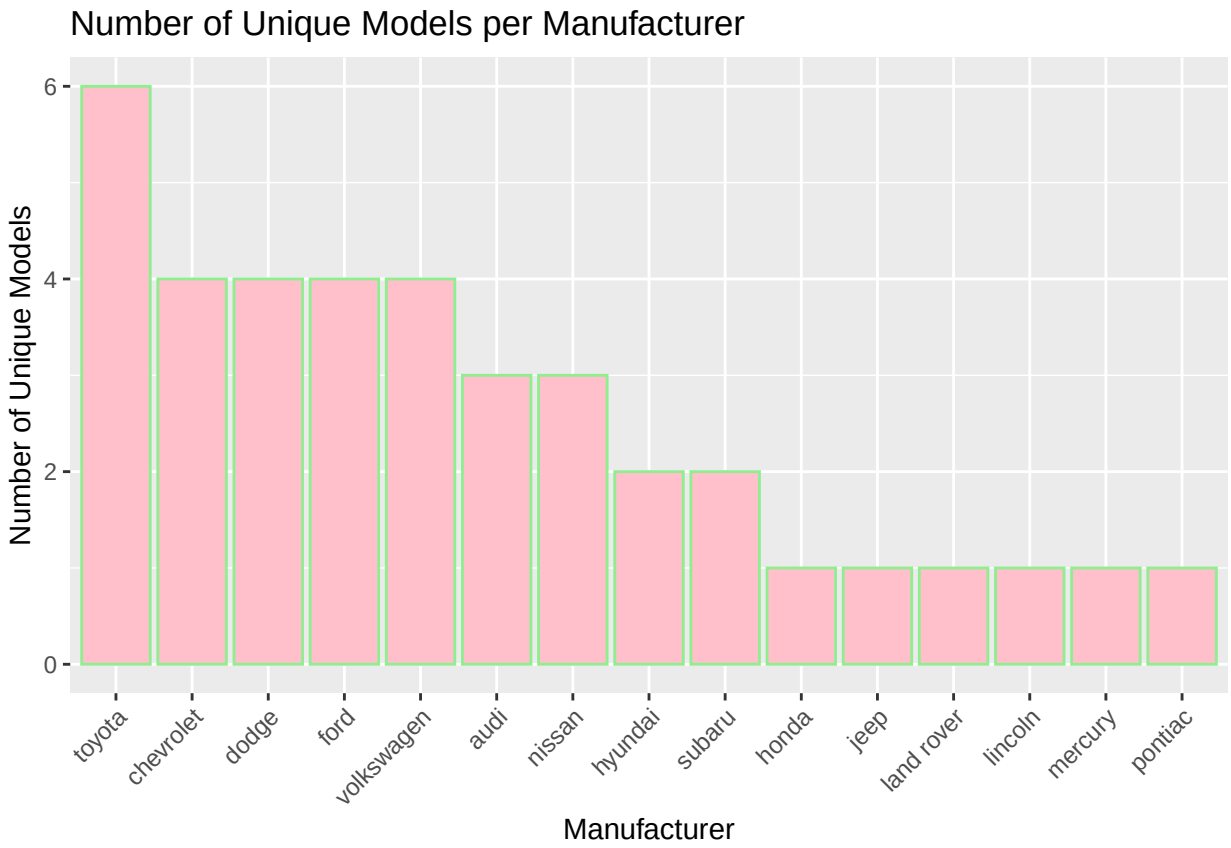
```
##    manufacturer model
## 1          audi     3
## 2     chevrolet     4
## 3         dodge     4
## 4          ford     4
## 5         honda     1
```

```
## 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
```

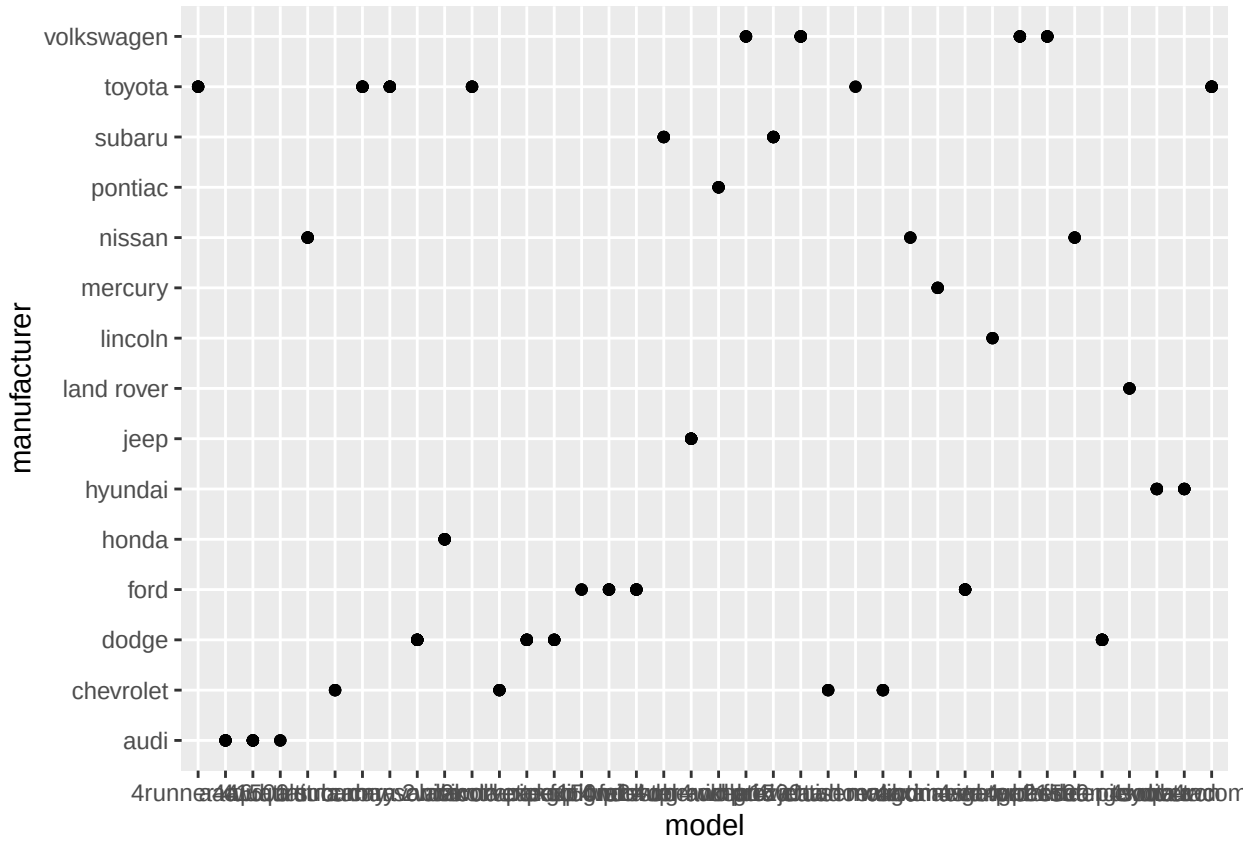
```r
#2.b
barplot(unique_models_by_manufacturer$model,
names.arg = unique_models_by_manufacturer$manufacturer,
main = "Number of Unique Models per Manufacturer",
xlab = "Manufacturer", ylab = "Number of Unique Models")
```




```r
# Using ggplot2
library(ggplot2)
ggplot(unique_models_by_manufacturer, aes(x = reorder(manufacturer, -model), y = model)) +
geom_bar(stat = "identity", fill = "pink", color = "lightgreen") +
labs(title = "Number of Unique Models per Manufacturer", x = "Manufacturer",
y = "Number of Unique Models") +
theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




```
#2.a
ggplot(mpg, aes(model, manufacturer)) + geom_point()
```



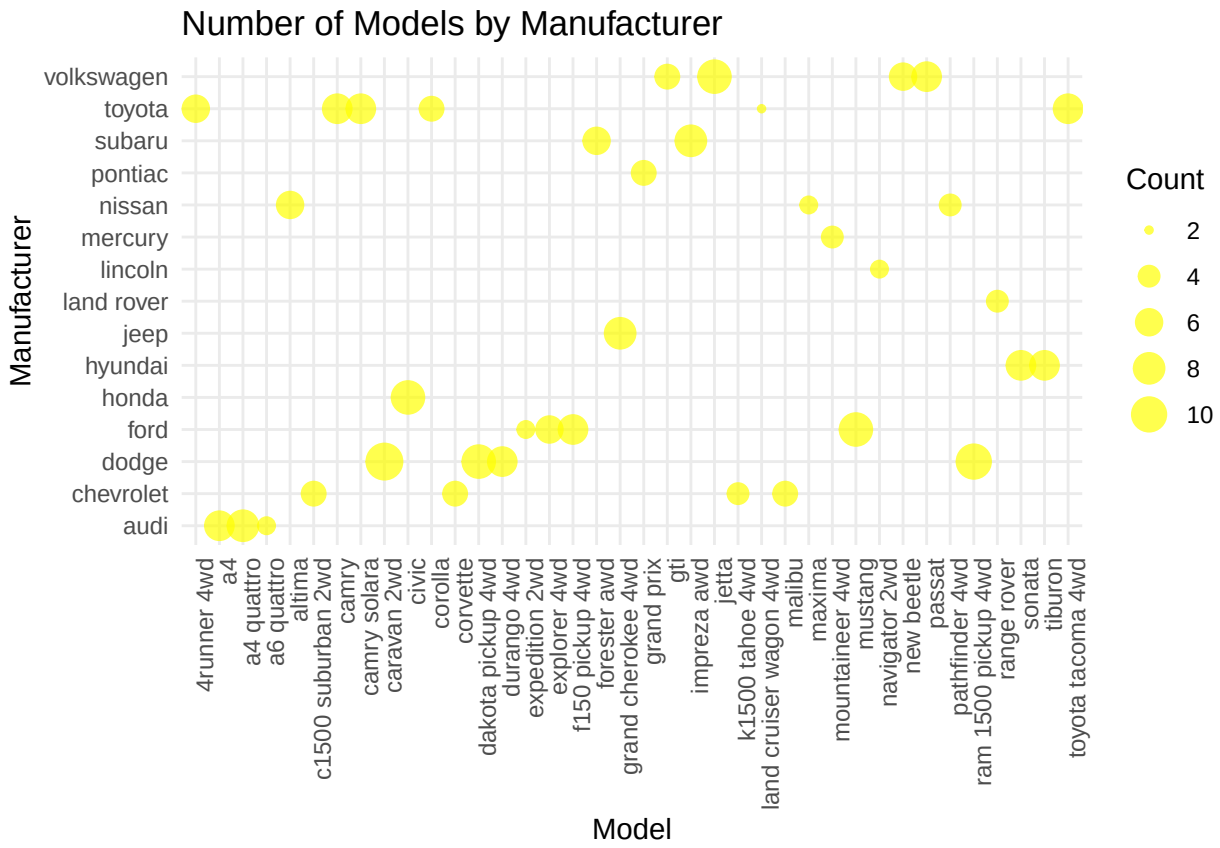

```
#2.b
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

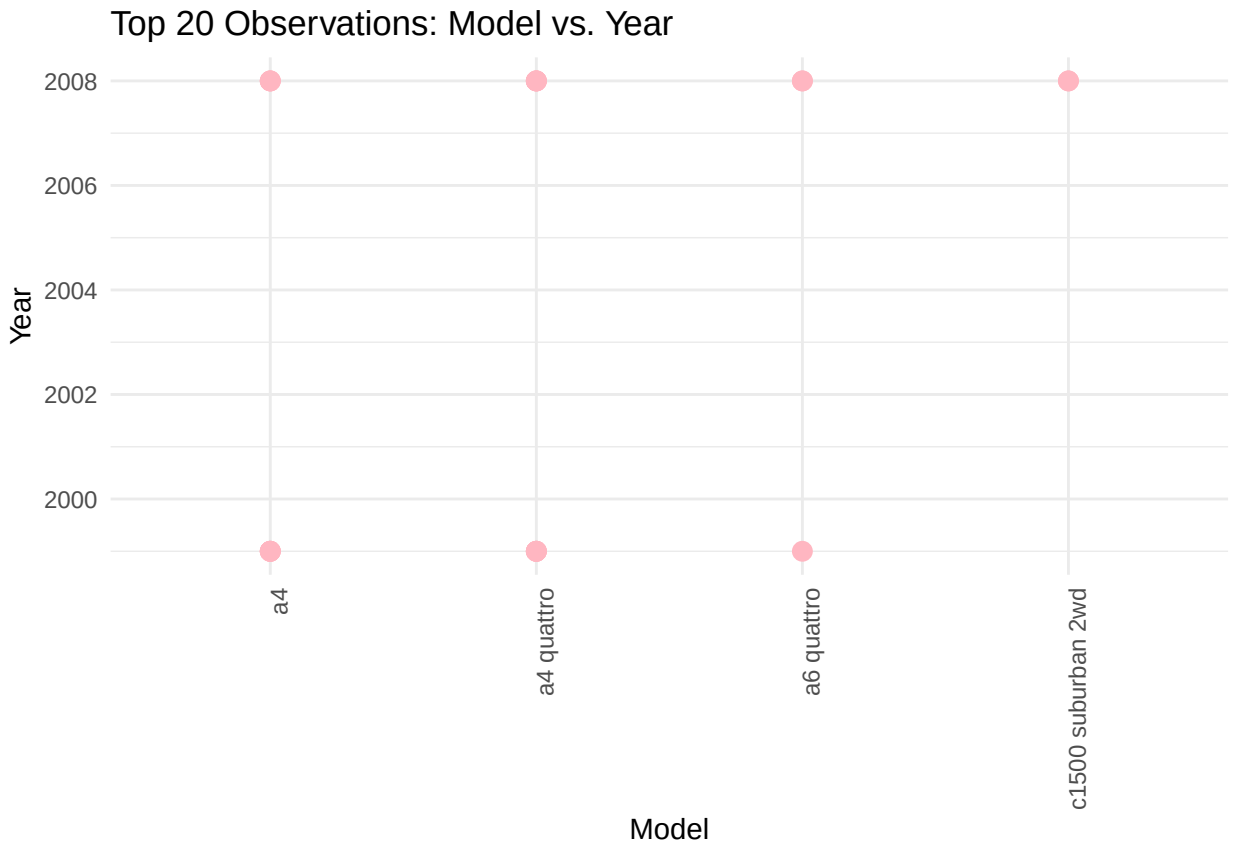
```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
model_counts <- mpg_data %>%
group_by(manufacturer, model) %>%
summarise(count = n(), .groups = "drop")
ggplot(model_counts, aes(x = model, y = manufacturer, size = count)) +
geom_point(color = "yellow", alpha = 0.7) +
theme_minimal() +
labs(title = "Number of Models by Manufacturer",
x = "Model",
y = "Manufacturer",
size = "Count") +
theme(axis.text.x = element_text(angle = 90, hjust = 1))
```




```r
#3.
top_20_data <- mpg_data %>% slice_head(n = 20)
ggplot(top_20_data, aes(x = model, y = year)) +
geom_point(color = "lightpink", size = 3) +
theme_minimal() +
labs(title = "Top 20 Observations: Model vs. Year",
x = "Model",
y = "Year") +
theme(axis.text.x = element_text(angle = 90, hjust = 1))
```

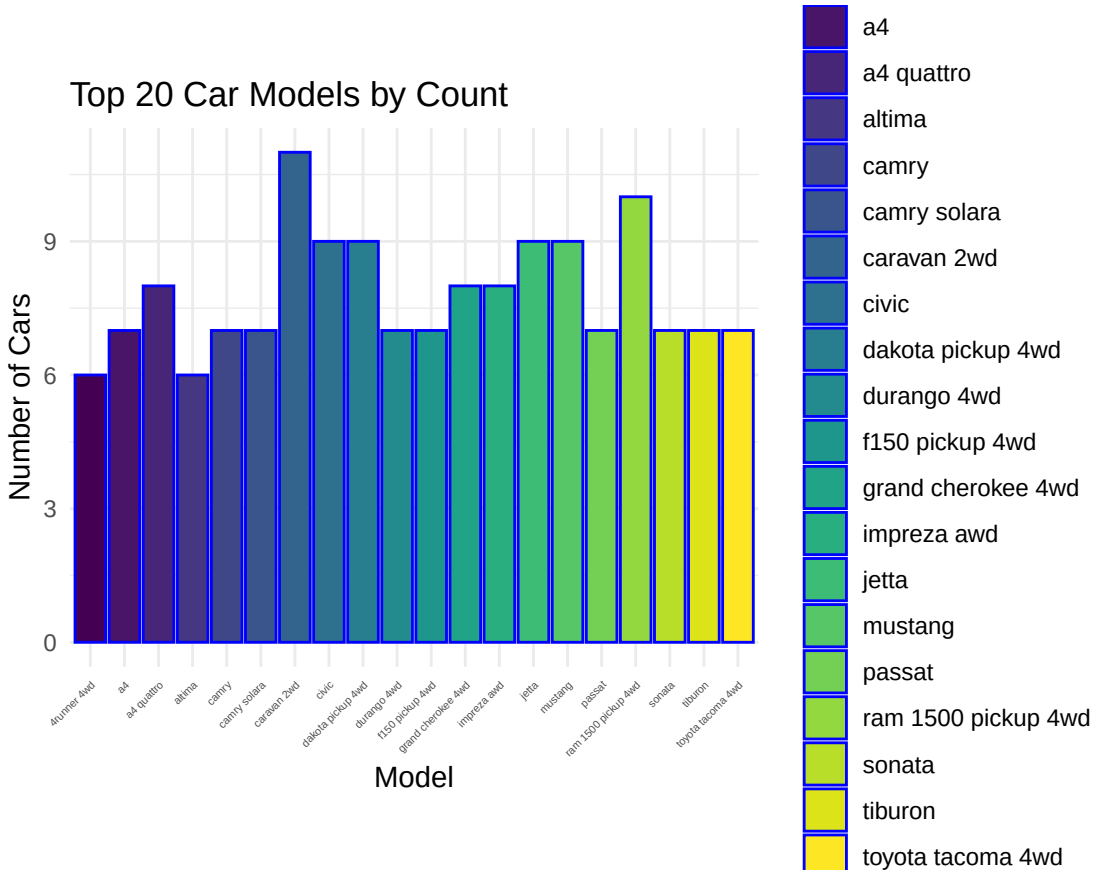



```
#4.
cars_per_model <- mpg_data %>%
group_by(model) %>%
summarise(count = n(), .groups = "drop")
cars_per_model
```

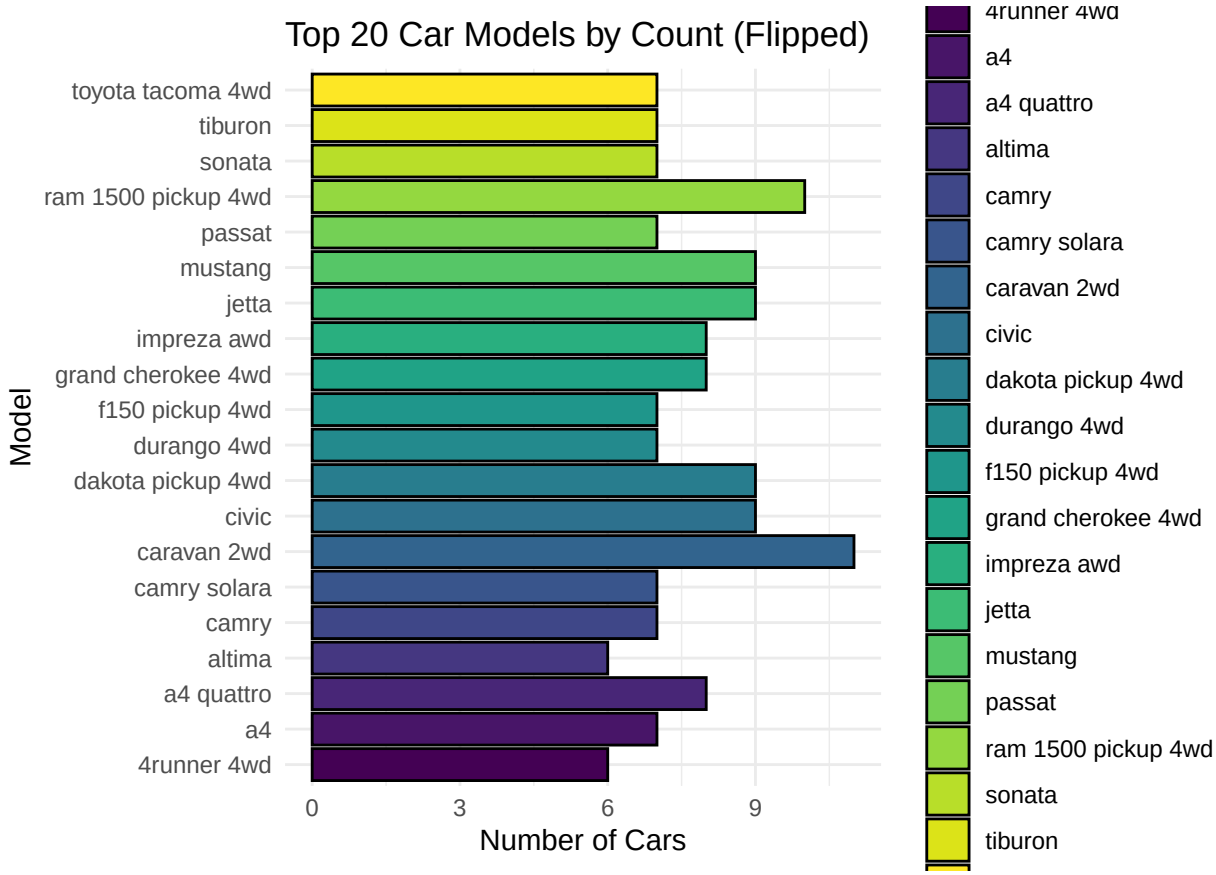
```
## # A tibble: 38 x 2
##    model              count
##    <chr>              <int>
##  1 4runner 4wd            6
##  2 a4                     7
##  3 a4 quattro             8
##  4 a6 quattro             3
##  5 altima                 6
##  6 c1500 suburban 2wd     5
##  7 camry               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

```
#4.a
top_20_models <- cars_per_model %>%
arrange(desc(count)) %>%
slice_head(n = 20)
ggplot(top_20_models, aes(x = model, y = count, fill = model)) +
geom_bar(stat = "identity", color = "blue") +
theme_minimal() +
```

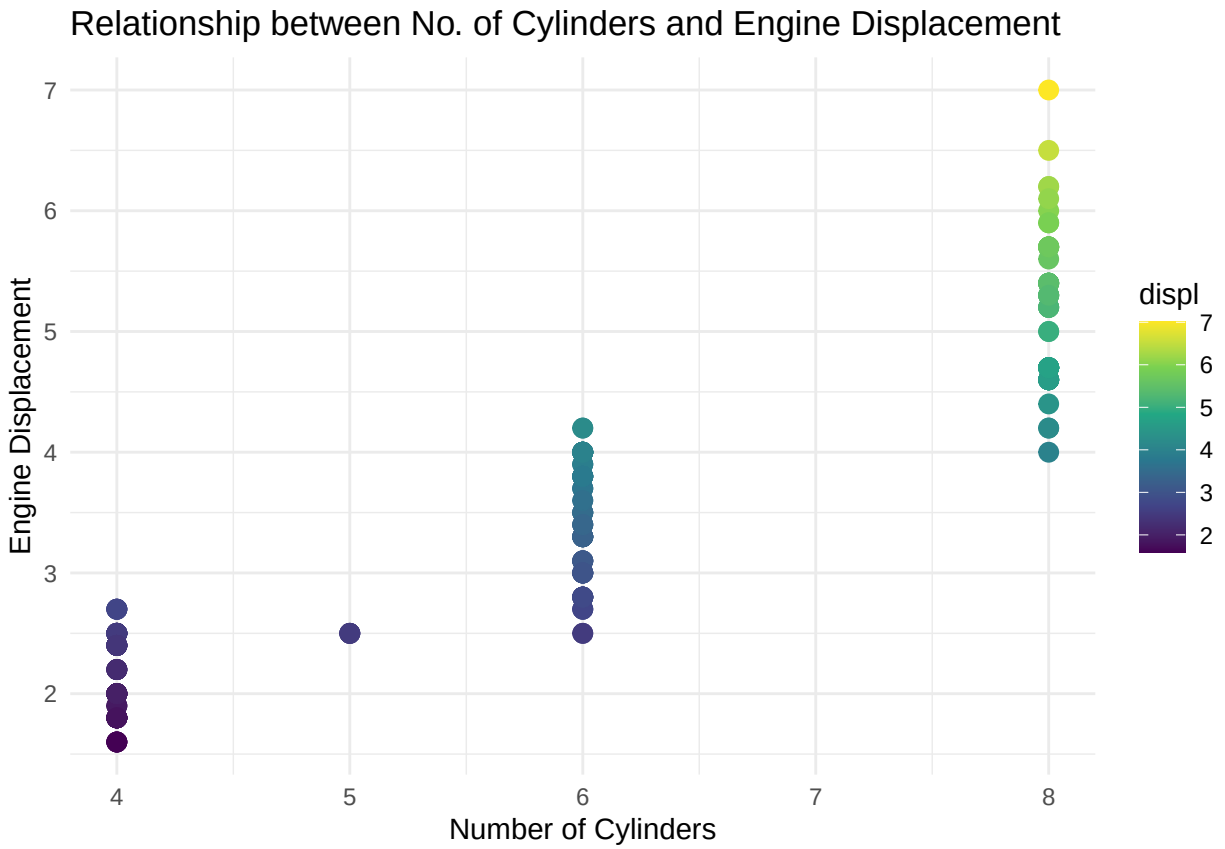
```
labs(title = "Top 20 Car Models by Count",
x = "Model",
y = "Number of Cars") +
theme(axis.text.x = element_text(angle = 45, hjust = 1, size = 4),
plot.margin = margin(1, 1, 1, 1, "cm"))+ scale_fill_viridis_d()
```



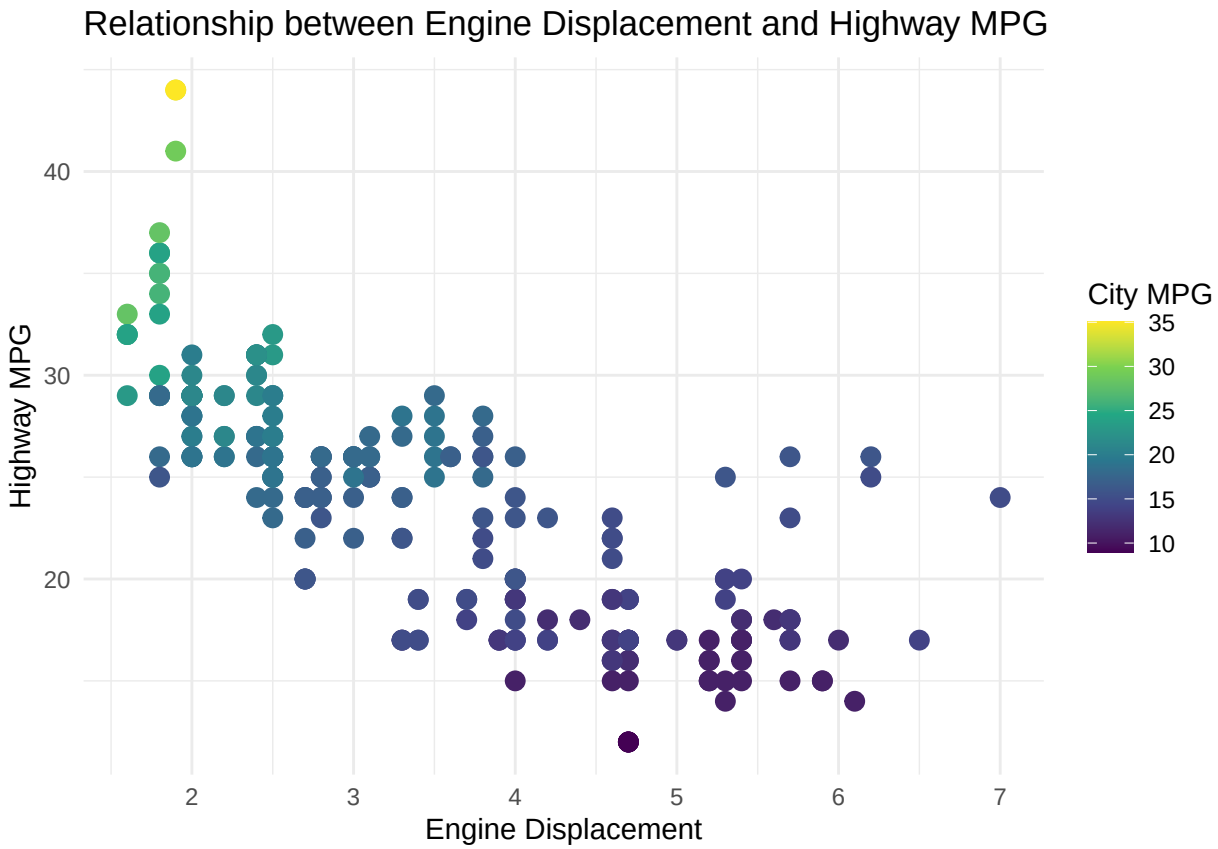

```
#4.b
ggplot(top_20_models, aes(x = model, y = count, fill = model)) +
geom_bar(stat = "identity", color = "black") +
coord_flip() +
theme_minimal() +
labs(title = "Top 20 Car Models by Count (Flipped)",
x = "Model",
y = "Number of Cars") +
scale_fill_viridis_d()
```




```r
#5.
ggplot(mpg_data, aes(x = cyl, y = displ, color = displ)) +
geom_point(size = 3) +
theme_minimal() +
labs(title = "Relationship between No. of Cylinders and Engine Displacement",
x = "Number of Cylinders",
y = "Engine Displacement") +
scale_color_viridis_c()
```




```
#6.
library(ggplot2)
ggplot(mpg_data, aes(x = displ, y = hwy, color = cty)) +
geom_point(size = 3) +
theme_minimal() +
labs(title = "Relationship between Engine Displacement and Highway MPG",
x = "Engine Displacement",
y = "Highway MPG",
color = "City MPG") +
scale_color_viridis_c() # Adds a continuous color scale
```




```
traffic_data <- read.csv("traffic.csv")
#6. a
num_observations <- nrow(traffic_data)
num_variables <- ncol(traffic_data)
variable_names <- names(traffic_data)
cat("Number of observations:", num_observations, "\n")
```

```
## Number of observations: 48120
```

```
cat("Number of variables:", num_variables, "\n")
```

```
## Number of variables: 4
```

```
cat("Variables:", variable_names, "\n")
```

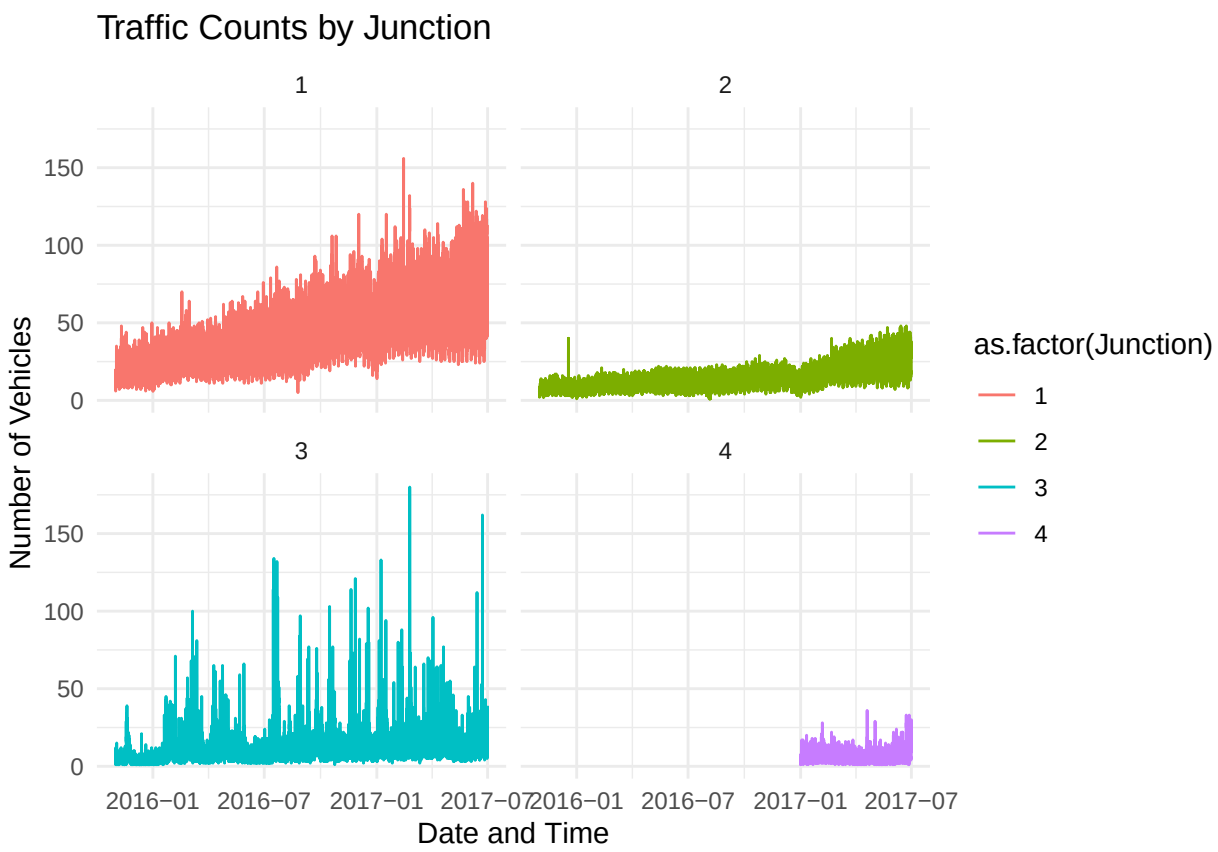
```
## Variables: DateTime Junction Vehicles ID
```

```
#6.b
junction_list <- split(traffic_data, traffic_data$Junction)
for (junction in names(junction_list)) {
cat("Data for junction:", junction, "\n")
print(head(junction_list[[junction]]))
cat("\n")
}
```

```
## Data for junction: 1
##              DateTime Junction Vehicles          ID
## 1 2015-11-01 00:00:00        1       15 20151101001
## 2 2015-11-01 01:00:00        1       13 20151101011
## 3 2015-11-01 02:00:00        1       10 20151101021
```

```
## 4 2015-11-01 03:00:00        1        7 20151101031
## 5 2015-11-01 04:00:00        1        9 20151101041
## 6 2015-11-01 05:00:00        1        6 20151101051
##
## Data for junction: 2
##                  DateTime Junction Vehicles          ID
## 14593 2015-11-01 00:00:00        2        6 20151101002
## 14594 2015-11-01 01:00:00        2        6 20151101012
## 14595 2015-11-01 02:00:00        2        5 20151101022
## 14596 2015-11-01 03:00:00        2        6 20151101032
## 14597 2015-11-01 04:00:00        2        7 20151101042
## 14598 2015-11-01 05:00:00        2        2 20151101052
##
## Data for junction: 3
##                  DateTime Junction Vehicles          ID
## 29185 2015-11-01 00:00:00        3        9 20151101003
## 29186 2015-11-01 01:00:00        3        7 20151101013
## 29187 2015-11-01 02:00:00        3        5 20151101023
## 29188 2015-11-01 03:00:00        3        1 20151101033
## 29189 2015-11-01 04:00:00        3        2 20151101043
## 29190 2015-11-01 05:00:00        3        2 20151101053
##
## Data for junction: 4
##                  DateTime Junction Vehicles          ID
## 43777 2017-01-01 00:00:00        4        3 20170101004
## 43778 2017-01-01 01:00:00        4        1 20170101014
## 43779 2017-01-01 02:00:00        4        4 20170101024
## 43780 2017-01-01 03:00:00        4        4 20170101034
## 43781 2017-01-01 04:00:00        4        2 20170101044
## 43782 2017-01-01 05:00:00        4        1 20170101054
```

```r
#6.c
library(ggplot2)
traffic_data$DateTime <- as.POSIXct(traffic_data$DateTime, format="%Y-%m-%d %H:%M:%S")
ggplot(traffic_data, aes(x = DateTime, y = Vehicles, color = as.factor(Junction))) +
geom_line() +
facet_wrap(~ Junction) +
labs(title = "Traffic Counts by Junction", x = "Date and Time",
y = "Number of Vehicles") +
theme_minimal()
```




```
library(readxl)
alexa_data <- read_excel("alexa_file.xlsx")
#7.a
num_observations <- nrow(alexa_data)
num_columns <- ncol(alexa_data)
column_names <- names(alexa_data)
cat("Number of observations:", num_observations, "\n")
```

```
## Number of observations: 3150
```

```
cat("Number of columns:", num_columns, "\n")
```

```
## Number of columns: 5
```

```
cat("Column names:", column_names, "\n")
```

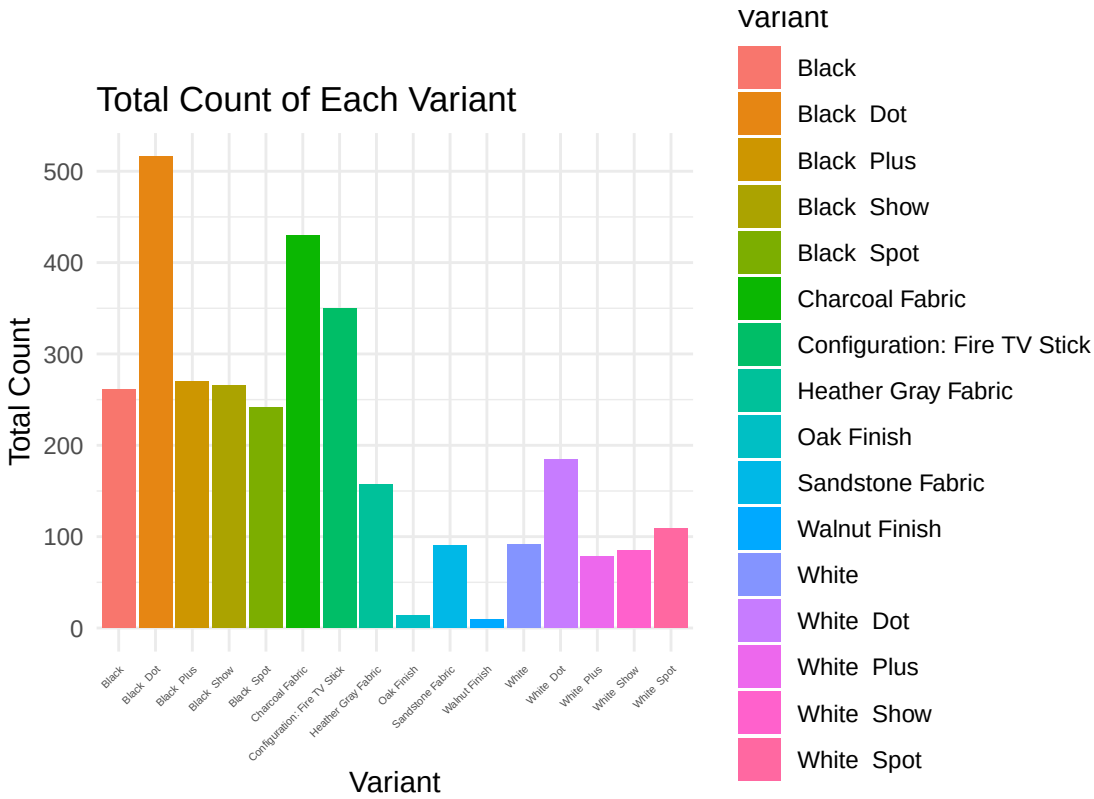
```
## Column names: rating date Variant verified_reviews feedback
```

```
#7.b
library(dplyr)
variation_totals <- alexa_data %>%
group_by(Variant) %>%
summarise(total = n())
print(variation_totals)
```

```
## # A tibble: 16 x 2
##    Variant                      total
##    <chr>                        <int>
##  1 Black                          261
##  2 Black  Dot                     516
```

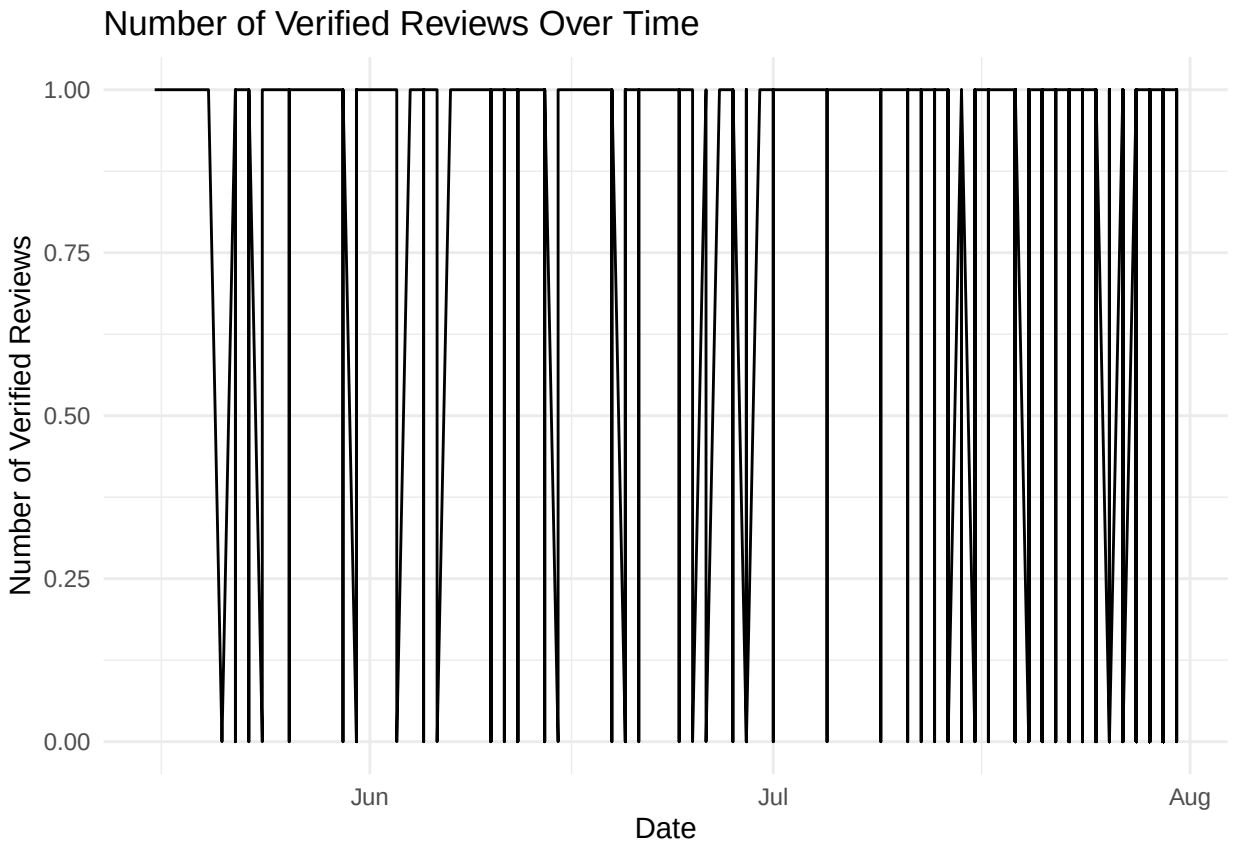
```
##  3 Black  Plus                    270
##  4 Black  Show                   265
##  5 Black  Spot                   241
##  6 Charcoal Fabric               430
##  7 Configuration: Fire TV Stick  350
##  8 Heather Gray Fabric           157
##  9 Oak Finish                     14
## 10 Sandstone 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
```

```r
#7.c
library(ggplot2)
ggplot(variation_totals, aes(x = Variant, y = total, fill = Variant)) +
geom_bar(stat = "identity") +
labs(title = "Total Count of Each Variant", x = "Variant",
y = "Total Count") +
theme_minimal() +
theme(axis.text.x = element_text(angle = 45, hjust = 1, size = 4),
plot.margin = margin(1, 1, 1, 1, "cm"))
```




```r
#7.d
alexa_data$date <- as.Date(alexa_data$date)
ggplot(alexa_data, aes(x = date, y = feedback)) +
geom_line() +
labs(title = "Number of Verified Reviews Over Time", x = "Date",
```

```
y = "Number of Verified Reviews") +
theme_minimal()
```




```
#7.e
rating_by_variant <- alexa_data %>%
group_by(Variant) %>%
summarise(avg_rating = mean(rating, na.rm = TRUE))
print(rating_by_variant)
```

```
## # A tibble: 16 x 2
##    Variant                       avg_rating
##    <chr>                              <dbl>
##  1 Black                               4.23
##  2 Black  Dot                          4.45
##  3 Black  Plus                         4.37
##  4 Black  Show                         4.49
##  5 Black  Spot                         4.31
##  6 Charcoal Fabric                     4.73
##  7 Configuration: Fire TV Stick        4.59
##  8 Heather Gray Fabric                 4.69
##  9 Oak Finish                          4.86
## 10 Sandstone Fabric                    4.36
## 11 Walnut Finish                       4.89
## 12 White                               4.14
## 13 White  Dot                          4.42
## 14 White  Plus                         4.36
## 15 White  Show                         4.28
```

```
## 16 White  Spot                          4.31
```

```
ggplot(rating_by_variant, aes(x = Variant, y = avg_rating, fill = Variant)) +
geom_bar(stat = "identity") +
labs(title = "Average Rating by Variant", x = "Variant", y = "Average Rating") +
theme_minimal() +
theme(axis.text.x = element_text(angle = 45, hjust = 1, size = 4),
plot.margin = margin(1, 1, 1, 1, "cm"))
```