# UCI Shopping EDA

Aaron Tang

2026-02-09

Link to dataset: https://archive.ics.uci.edu/dataset/468/online+shoppers+purchasing+intention+dataset

```r
# Loading data
work_dir <- here()
raw_data <- read_csv(file.path(work_dir, "shopping", "data", "raw_data", "uci_shopping.csv"), show_col_
head(raw_data)
```

```
## # A tibble: 6 x 18
##   Administrative Administrative_Duration Informational Informational_Duration
##            <dbl>                   <dbl>         <dbl>                  <dbl>
## 1              0                       0             0                      0
## 2              0                       0             0                      0
## 3              0                       0             0                      0
## 4              0                       0             0                      0
## 5              0                       0             0                      0
## 6              0                       0             0                      0
## # i 14 more variables: ProductRelated <dbl>, ProductRelated_Duration <dbl>,
## #   BounceRates <dbl>, ExitRates <dbl>, PageValues <dbl>, SpecialDay <dbl>,
## #   Month <chr>, OperatingSystems <dbl>, Browser <dbl>, Region <dbl>,
## #   TrafficType <dbl>, VisitorType <chr>, Weekend <lgl>, Revenue <lgl>
```

## Description of Variables

### Continuous

- `Administrative`: Number of pages visited about account management
- `Administrative Duration`: Total amount of time (in seconds) spent on account management related pages
- `Informational`: Number of pages visited about website, communication and address information of the shopping site
- `Informational Duration`: Total amount of time spent on informational pages
- `Product Related`: Number of pages visited about product related pages
- `Product Related Duration`: Total amount of time spent on product related pages

- `Bounce Rate`: Average bounce rate value of the pages visited
  - Formula: $BounceRate = 1 - EngagementRate$

  - $EngagementRate$ = percentage of sessions that either lasted longer than 10 seconds, had key events, or two or more screen or page views

  - Google Analytics assigns this value to every page of a website
  - This feature takes the average of all the bounce rates value from all the pages the user visits in a single session

- `Exit Rate`: Average exit rate value of the pages visited

  - Formula: $ExitRate = \frac{NumberOfExits}{NumberOfPageViews} \times 100$

- `Page Value`: Average page value of the pages visited

  - Formula: $PageValue = \frac{TotalRevenue+TotalGoalValue}{UniquePageViews}$
  - $TotalRevenue$ = amount of money generated from a website page (i.e. transaction page)
  - $TotalGoalValue$ = value assigned to a specific page that is defined by the business
  - $UniquePageViews$ = number of unique user visits, only counted once per session

- `Special Day`: Closeness of the site visiting time to a special day

### Categorical

- `OperatingSystems`: Operating system of the visitor
- `Browser`: Browser of the visitor
- `Region`: Geographic region from which the session has been started by the visitor
- `TrafficType`: Traffic source by which the visitor has arrived at the wesbite
- `VisitorType`: Visitor type as "New Visitor", "Returning Visitor", and "Other"
- `Weekend`: Boolean value indicating whether the date of the visit is a weekend
- `Month`: Month value of the visit date
- `Revenue`: Class label indicating whether the visit has been finalized with a transaction

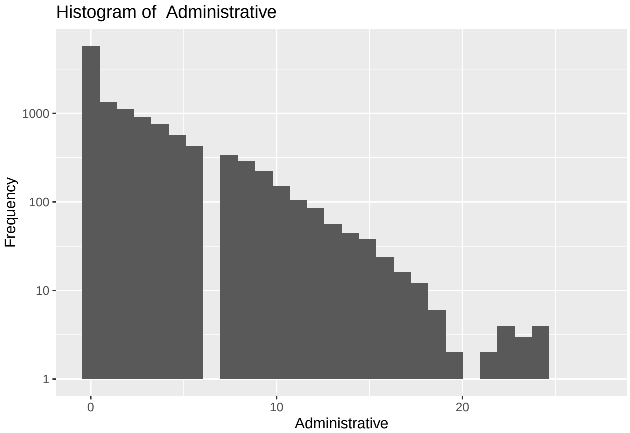
## Summary

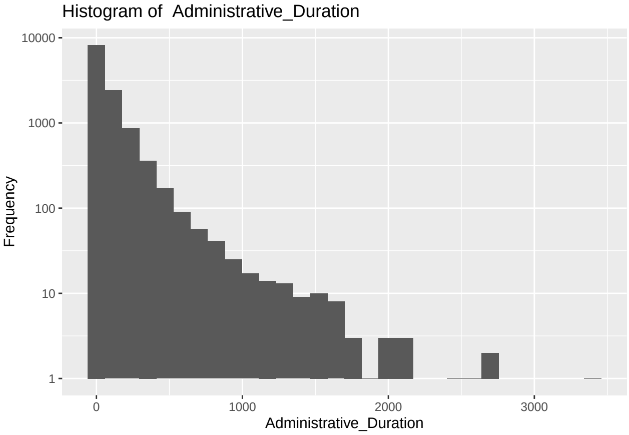
```r
continuous_var <- c("Administrative", "Administrative_Duration", "Informational",
                    "Informational_Duration", "ProductRelated", "ProductRelated_Duration",
                    "BounceRates", "ExitRates", "PageValues")

categorical_var <- c("Month", "OperatingSystems", "Browser", "Region", "TrafficType",
                     "VisitorType", "Weekend", "Revenue")

shopping_uci <- raw_data %>%
  mutate(across(all_of(categorical_var), as.factor))

summary(shopping_uci)
```

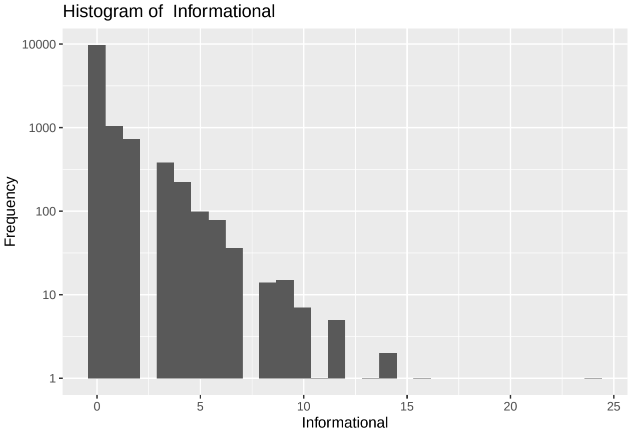
```
##  Administrative   Administrative_Duration Informational
##  Min.   : 0.000   Min.   :   0.00         Min.   : 0.0000
##  1st Qu.: 0.000   1st Qu.:   0.00         1st Qu.: 0.0000
##  Median : 1.000   Median :   7.50         Median : 0.0000
##  Mean   : 2.315   Mean   :  80.82         Mean   : 0.5036
##  3rd Qu.: 4.000   3rd Qu.:  93.26         3rd Qu.: 0.0000
##  Max.   :27.000   Max.   :3398.75         Max.   :24.0000
##
##  Informational_Duration ProductRelated   ProductRelated_Duration
##  Min.   :   0.00        Min.   :  0.00   Min.   :    0.0
##  1st Qu.:   0.00        1st Qu.:  7.00   1st Qu.:  184.1
##  Median :   0.00        Median : 18.00   Median :  598.9
##  Mean   :  34.47        Mean   : 31.73   Mean   : 1194.8
##  3rd Qu.:   0.00        3rd Qu.: 38.00   3rd Qu.: 1464.2
##  Max.   :2549.38        Max.   :705.00   Max.   :63973.5
##
##   BounceRates         ExitRates         PageValues        SpecialDay
##  Min.   :0.000000   Min.   :0.00000   Min.   :  0.000   Min.   :0.00000
##  1st Qu.:0.000000   1st Qu.:0.01429   1st Qu.:  0.000   1st Qu.:0.00000
##  Median :0.003112   Median :0.02516   Median :  0.000   Median :0.00000
##  Mean   :0.022191   Mean   :0.04307   Mean   :  5.889   Mean   :0.06143
##  3rd Qu.:0.016813   3rd Qu.:0.05000   3rd Qu.:  0.000   3rd Qu.:0.00000
##  Max.   :0.200000   Max.   :0.20000   Max.   :361.764   Max.   :1.00000
##
##      Month      OperatingSystems    Browser         Region      TrafficType
##  May    :3364   2      :6601   2      :7961   1      :4780   2      :3913
##  Nov    :2998   1      :2585   1      :2462   3      :2403   1      :2451
##  Mar    :1907   3      :2555   4      : 736   4      :1182   3      :2052
##  Dec    :1727   4      : 478   5      : 467   2      :1136   4      :1069
##  Oct    : 549   8      :  79   6      : 174   6      : 805   13     : 738
##  Sep    : 448   6      :  19   10     : 163   7      : 761   10     : 450
##  (Other):1337   (Other):  13   (Other): 367   (Other):1263   (Other):1657
##             VisitorType     Weekend      Revenue
##  New_Visitor      : 1694   FALSE:9462   FALSE:10422
##  Other            :   85   TRUE :2868   TRUE : 1908
##  Returning_Visitor:10551
##
##
##
##
```

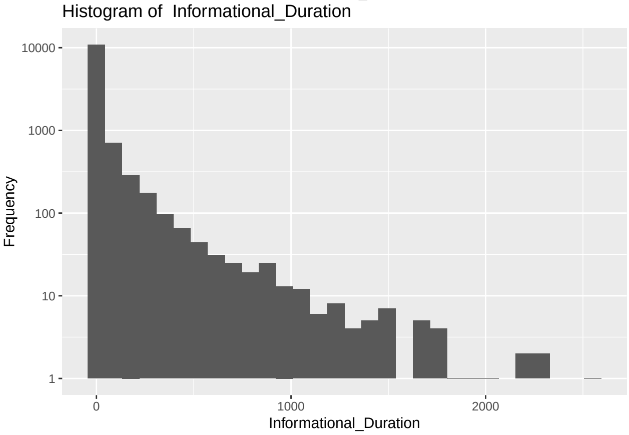
## Bar Charts/Histograms of Variables

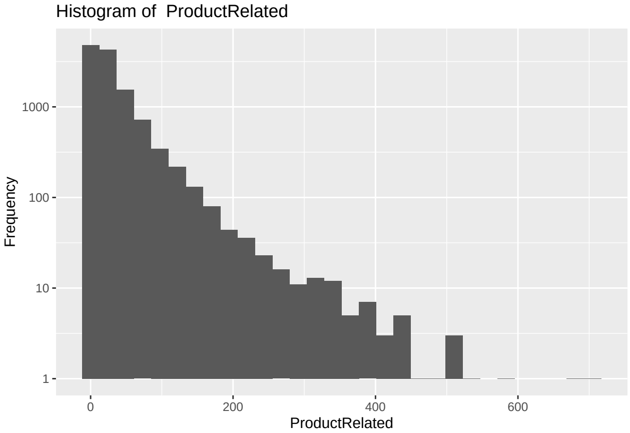
```
# Histograms of Continuous Variables
par(mfrow = c(2, 3))

for (i in 1:length(continuous_var)) {
  current = shopping_uci[[continuous_var[i]]]
  plot <- ggplot(data = shopping_uci, mapping = aes(x = current)) +
    geom_histogram() +
    labs(
      y = "Frequency",
      x = continuous_var[i],
      title = paste("Histogram of ", continuous_var[i])
    ) +
    scale_y_log10()

  print(plot)
}
```

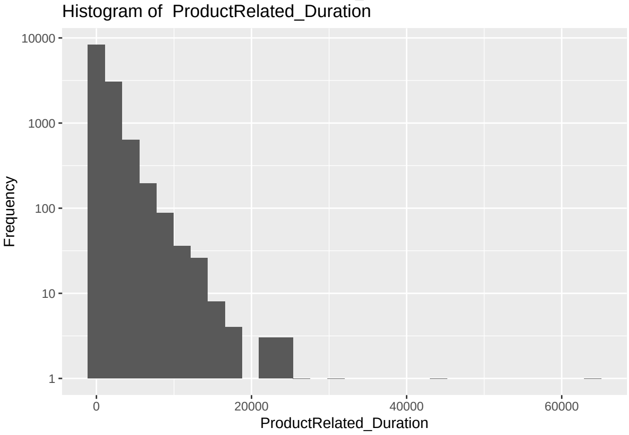

Histogram of  Administrative
Frequency
1000
100
10
1
0
10
20
Administrative

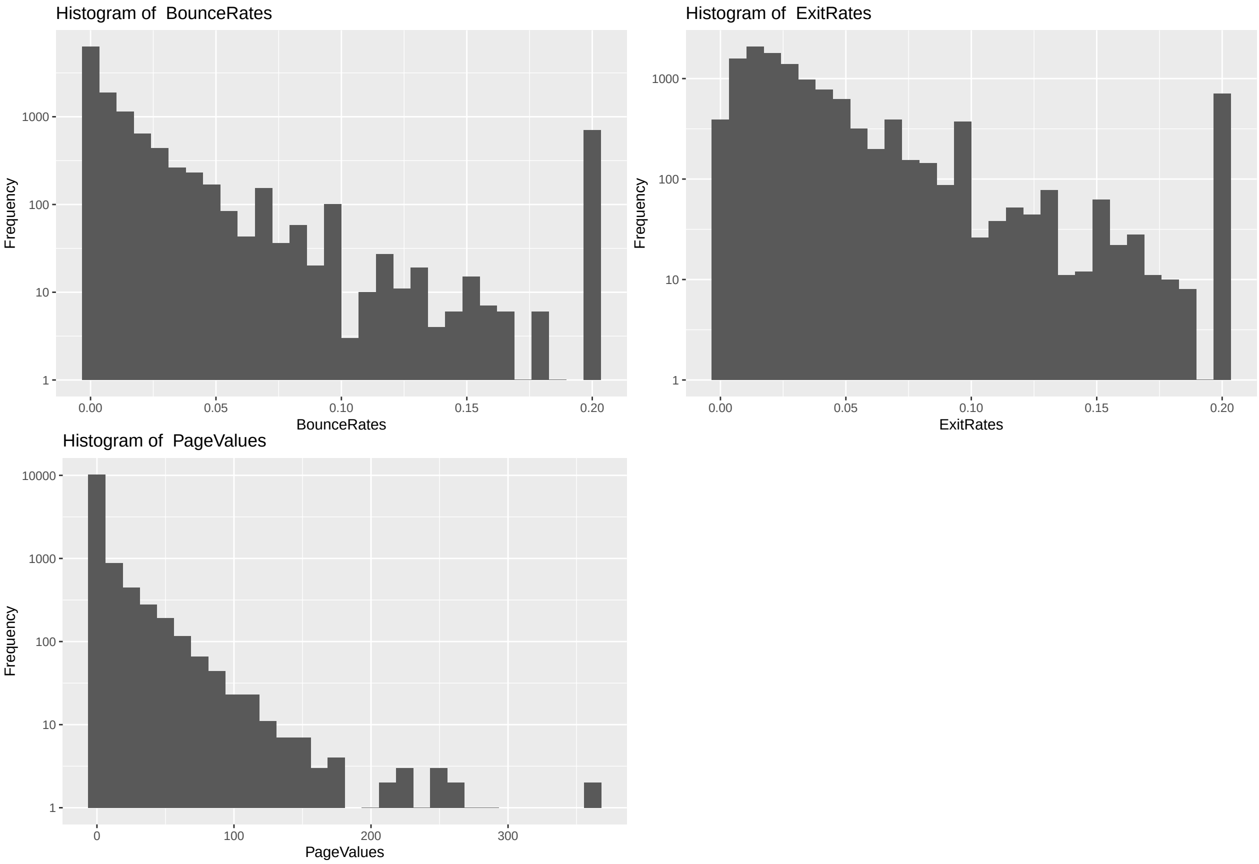

Histogram of  Administrative_Duration
Frequency
10000
1000
100
10
1
0
1000
2000
3000
Administrative_Duration


Histogram of  Informational
Frequency
10000
1000
100
10
1
0
5
10
15
20
25
Informational


Histogram of  Informational_Duration
Frequency
10000
1000
100
10
1
0
1000
2000
Informational_Duration


Histogram of  ProductRelated
Frequency
1000
100
10
1
0
200
400
600
ProductRelated

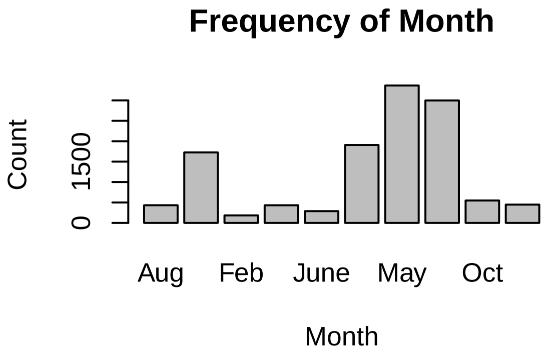

Histogram of  ProductRelated_Duration
Frequency
10000
1000
100
10
1
0
20000
40000
60000
ProductRelated_Duration

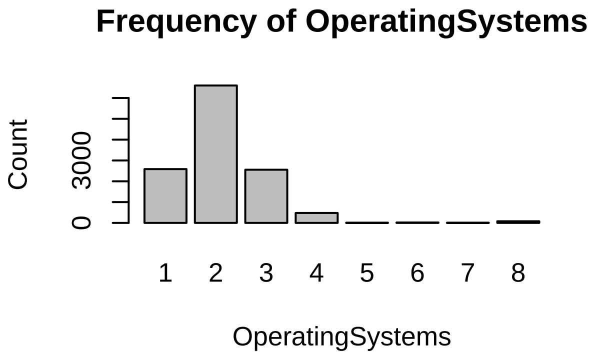


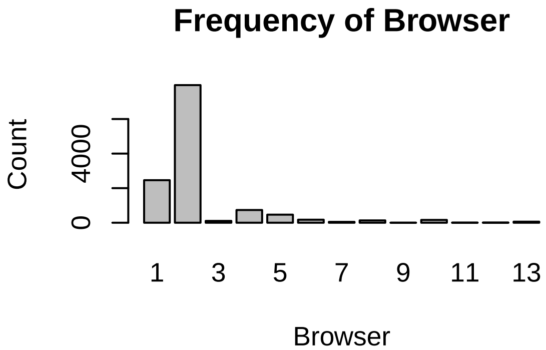
Notes:

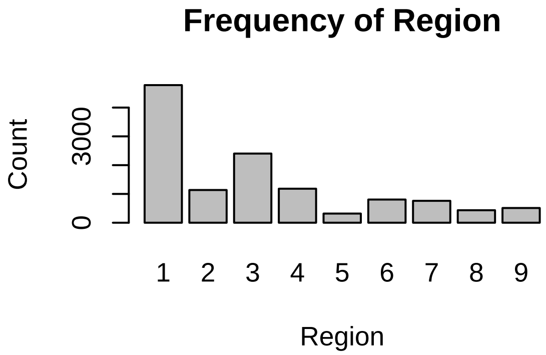
- I logged the scale of the y-axes because they were all heavily zero-inflated
- After log transforming the scale, it appears the duration graphs follow a somewhat exponential distribution
- The rates appear to be a little left skewed

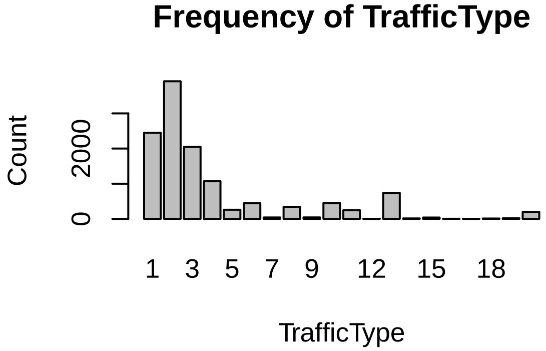
```
# Bar Charts of Categorical Variables
par(mfrow = c(2, 2))

for (i in 1:length(categorical_var)) {
  current_var_count <- shopping_uci %>% group_by(across(all_of(categorical_var[i]))) %>% summarize(coun

  barplot(height = current_var_count$count,
          names.arg = current_var_count %>% pull(1),
          xlab = categorical_var[i],
          ylab = "Count",
          main = paste("Frequency of", categorical_var[i]))
}
```

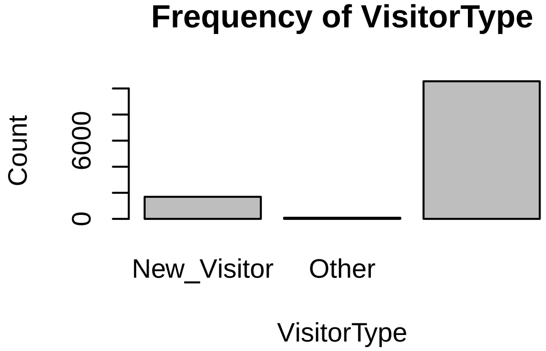

Frequency of Month
Count
0
1500
Aug
Feb
June
May
Oct
Month

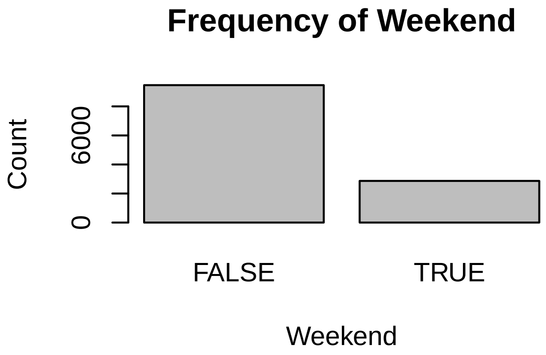

Frequency of OperatingSystems
Count
0
3000
1
2
3
4
5
6
7
8
OperatingSystems

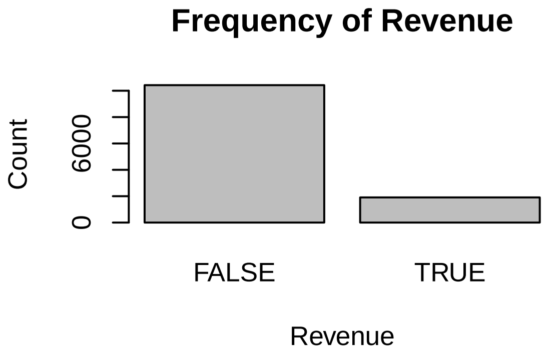

Frequency of Browser
Count
0
4000
1
3
5
7
9
11
13
Browser


Frequency of Region
Count
0
3000
1
2
3
4
5
6
7
8
9
Region


Frequency of TrafficType
Count
0
2000
1
3
5
7
9
12
15
18
TrafficType

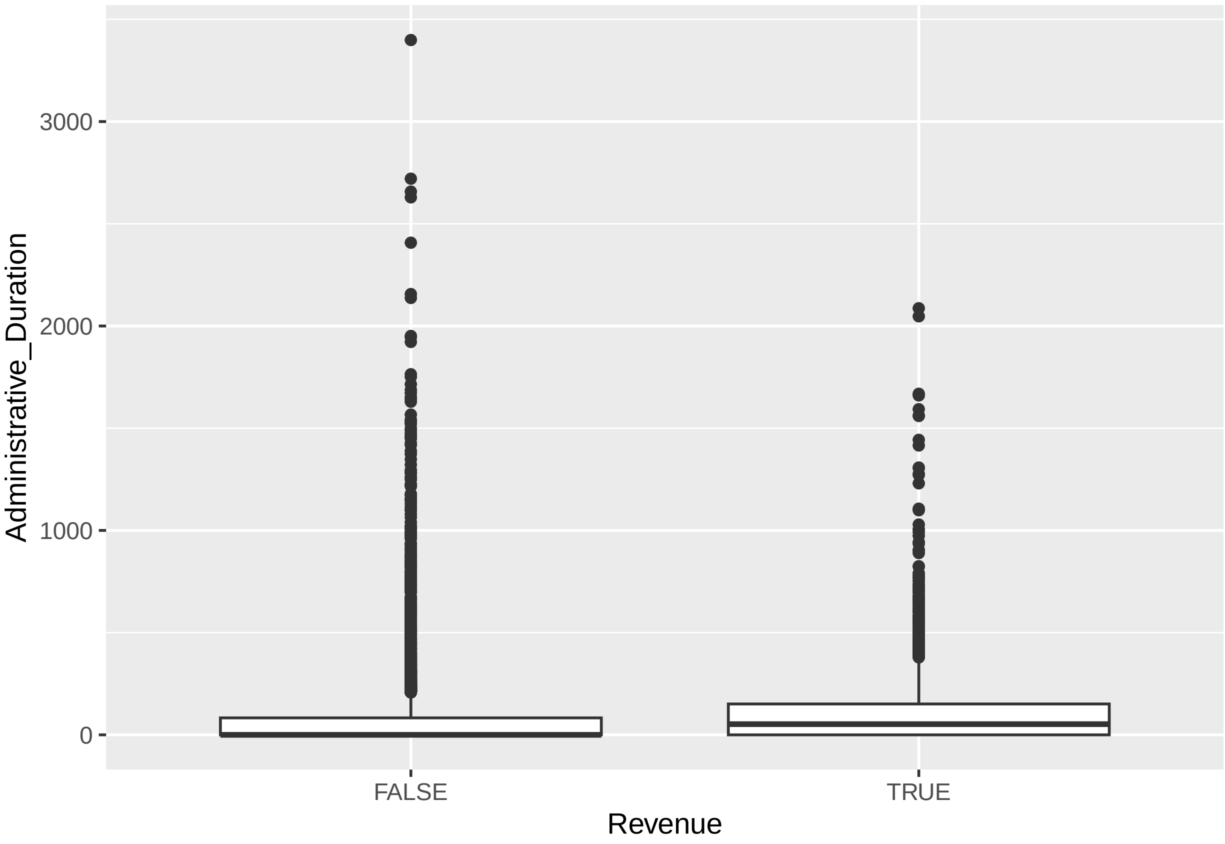

Frequency of VisitorType
Count
0
6000
New_Visitor
Other
VisitorType


Frequency of Weekend
Count
0
6000
FALSE
TRUE
Weekend


Frequency of Revenue
Count
0
6000
FALSE
TRUE
Revenue

### Seeing if I can combine the durations

```
# Box plots
admin_duration <- ggplot(data = shopping_uci, mapping = aes(x = Revenue, y = Administrative_Duration))
  geom_boxplot()

admin_duration
```


Administrative_Duration
FALSE
TRUE
Revenue