```
options(repos="https://cran.rstudio.com" )
if (!require(dplyr)) install.packages("dplyr")
```

```
## Loading required package: dplyr
```

```
## Warning: package 'dplyr' was built under R version 3.6.2
```

```
##
## 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
```

```
if (!require(caret)) install.packages("caret")
```

```
## Loading required package: caret
```

```
## Warning: package 'caret' was built under R version 3.6.2
```

```
## Loading required package: lattice
```

```
## Warning: package 'lattice' was built under R version 3.6.2
```

```
## Loading required package: ggplot2
```

```
## Warning: package 'ggplot2' was built under R version 3.6.2
```

```r
library(dplyr)
library(caret)
install.packages("stringr")              # Install stringr package
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```r
library(stringr)
install.packages("cluster")
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```r
install.packages("ggplot2")
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```r
install.packages("readr")
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```r
install.packages("magrittr") # package installations are only needed the first time you use it
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```
  # alternative installation of the %>%
library(magrittr) # needs to be run every time you start R and want to use %>%
```

```
## Warning: package 'magrittr' was built under R version 3.6.2
```

```
install.packages("infotheo")
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```
library(infotheo)

library(cluster)
```

```
## Warning: package 'cluster' was built under R version 3.6.2
```

```
library(dplyr)

library(ggplot2)
library(readr)
```

```
## Warning: package 'readr' was built under R version 3.6.2
```

```
install.packages("factoextra")
```

```
##
## The downloaded binary packages are in
##  /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```
library(factoextra)
```

```
## Warning: package 'factoextra' was built under R version 3.6.2
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```r
library(Rtsne)
library(tidyr)
```

```
## Warning: package 'tidyr' was built under R version 3.6.2
```

```
##
## Attaching package: 'tidyr'
```

```
## The following object is masked from 'package:magrittr':
##
##     extract
```

```r
install.packages("ggstatsplot")
```

```
##
## The downloaded binary packages are in
##   /var/folders/yd/k28nrp9d55v4gc91gqs3kkh00000gn/T//RtmpwqqFQU/downloaded_packages
```

```r
# Load the package
library(ggstatsplot)
```

```
## Warning: package 'ggstatsplot' was built under R version 3.6.2
```

```
## You can cite this package as:
##     Patil, I. (2021). Visualizations with statistical details: The 'ggstatsplot' approach.
##     PsyArxiv. doi:10.31234/osf.io/p7mku
```

```r
install.packages("data.table")
```

```
##
##   There is a binary version available but the source version is
##   later:
##            binary source needs_compilation
## data.table 1.13.6 1.14.0            TRUE
```

```
## installing the source package 'data.table'
```

```
## Warning in install.packages("data.table"): installation of package
## 'data.table' had non-zero exit status
```

```
library(data.table)
```

```
##
## Attaching package: 'data.table'
```

```
## The following objects are masked from 'package:dplyr':
##
##     between, first, last
```

```
library(knitr)
#setwd("/Users/y
```

```
CRM_original <- read.csv("CRMServiceContracts.csv")
# View(head(CRM_original,10))     # look at data

# only look at Won & Lost rows (exclude Pending)yes

CRM_W_L <- CRM_original %>%
  filter(OpportunityStatus == 'Won' | OpportunityStatus == "Lost")
```

```
# count occurrences of values
t1 <- cbind(table(CRM_original$OpportunityStatus), round(prop.table(table(CRM_original$OpportunityStatus))*100,2
))
colnames(t1) <- c("count", "percentage")
t1
```

```
##          count percentage
## Lost    141147      50.91
## Pending  39531      14.26
## Won      96579      34.83
```

```
t2 <- cbind(table(CRM_original$SalesStage), round(prop.table(table(CRM_original$SalesStage))*100,2))
colnames(t2) <- c("count", "percentage")
t2
```

```
##              count percentage
## Closed/Lost 139376      50.27
## Closed/Won   96551      34.82
## Discovery     1626       0.59
## Identified   21796       7.86
## Negotiation    984       0.35
## Proposed     16924       6.10
```

```
CRM_clean <- subset(CRM_W_L, select = -c(LOB, BranchNo, SalesStage, CREATED_DATE, CREATED_FY, PROPOSED_DATE, PROP
OSED_FY, AWARD_CLOSED_DATE, AWARD_CLOSED_FY, ReasonWonLost, BasisOfDesign, Rise, Speed, Usage, Voltage, BaseBidQu
oteNumber, CompetitorPrice, ExistingOldContractValue, FactoryMaterialCostUnit, LaborCost, PurchaseMatrialCost, Co
ntractTermsMonths, TotalLaborHours, OpportunityProbabilityPct, UnitSerialNo, Category, OpportunityKey, Opportunit
yProductKey, AccountID, OpportunityDetailID, CRMUserID, EmployeeNo))

# FIX DATA

# change missing to 0 (zero)
CRM_clean$Capacity[CRM_clean$Capacity == "N/A"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "N/A", value =
## structure(c(61L, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "NULL"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "NULL", value =
## structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "Unknown"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Unknown", value =
## structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "Less than 25"] <- 20
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Less than 25",
## value = structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "<2100"] <- 2000
CRM_clean$Capacity[CRM_clean$Capacity == "Greater than 60000"] <- 65000
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Greater than
## 60000", : invalid factor level, NA generated
```

```
CRM_clean$FrontOpeningsCnt[CRM_clean$FrontOpeningsCnt == "NULL"] <- 0
CRM_clean$FrontOpeningsCnt[CRM_clean$FrontOpeningsCnt == "Unknown"] <- 0
CRM_clean$RearOpeningsCnt[CRM_clean$RearOpeningsCnt == "NULL"] <- 0
CRM_clean$RearOpeningsCnt[CRM_clean$RearOpeningsCnt == "Unknown"] <- 0
CRM_clean$StopsCnt[CRM_clean$StopsCnt == "NULL"] <- 0
CRM_clean$StopsCnt[CRM_clean$StopsCnt == "Unknown"] <- 0
CRM_clean$OpportunityUnitCnt[is.na(CRM_clean$OpportunityUnitCnt)] <- 0
CRM_clean$PricePerUnit[is.na(CRM_clean$PricePerUnit)] <- 0
CRM_clean$ExpectedEagleRevenue[CRM_clean$ExpectedEagleRevenue == "NULL"] <- 0
# change character to numeric
CRM_clean$Capacity <- as.numeric(gsub(",", "", CRM_clean$Capacity))
CRM_clean$FrontOpeningsCnt <- as.numeric(gsub(",", "", CRM_clean$FrontOpeningsCnt))
CRM_clean$RearOpeningsCnt <- as.numeric(gsub(",", "", CRM_clean$RearOpeningsCnt))
CRM_clean$StopsCnt <- as.numeric(gsub(",", "", CRM_clean$StopsCnt))
CRM_clean$ExpectedEagleRevenue <- as.numeric(CRM_clean$ExpectedEagleRevenue)
```

```
# barchart for Won / Loss
ggplot(CRM_W_L %>%
         count(OpportunityStatus) %>%
         mutate(pct = n/sum(n)),
       aes(OpportunityStatus, n, fill = OpportunityStatus)) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = paste0(sprintf("%1.1f", pct*100), "%")),
            position = position_stack(vjust = 0.5), check_overlap = TRUE) +
  scale_y_continuous(labels = scales::comma)
```
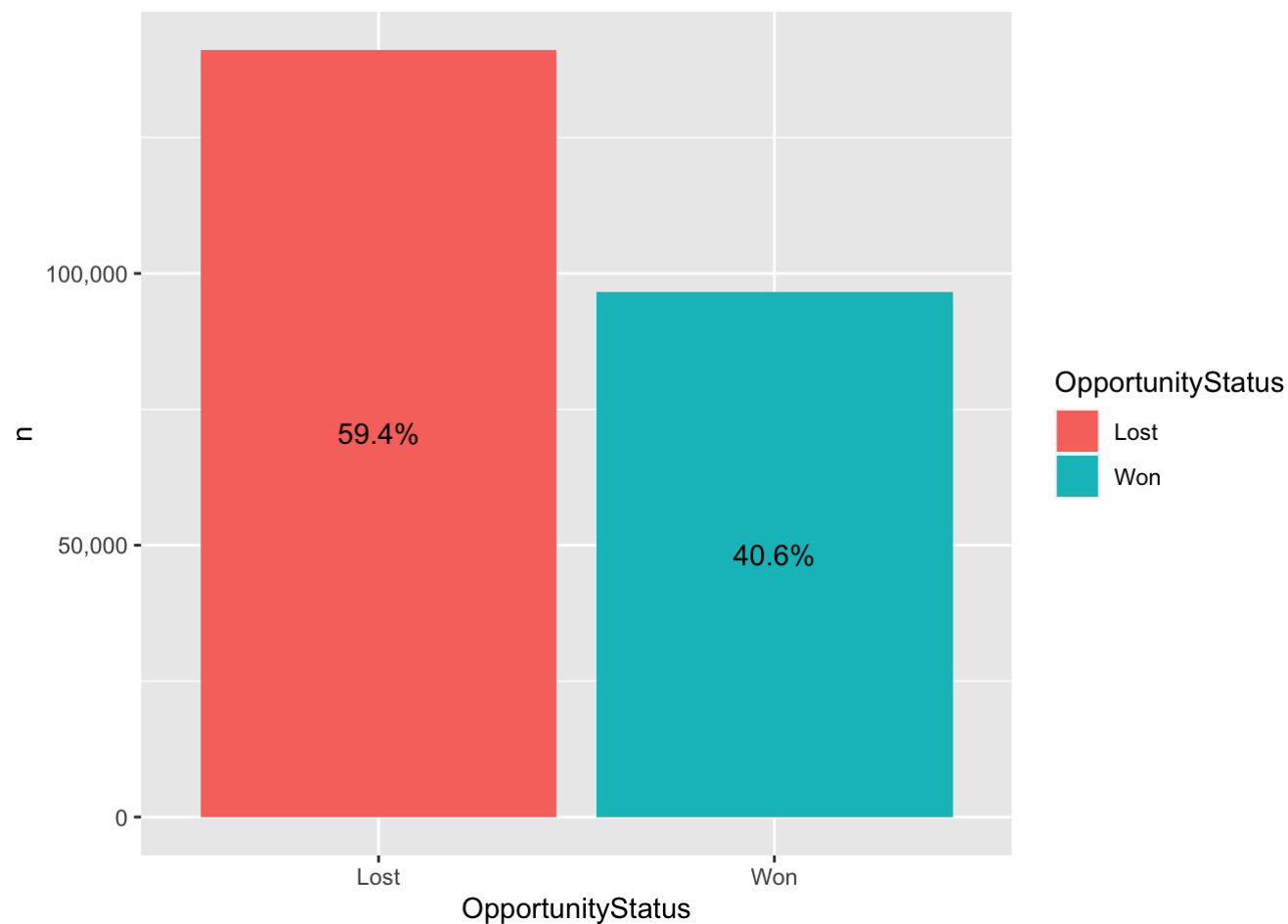
```
# stacked barchart on Region
ggplot(CRM_W_L %>%
        group_by(Region) %>%
        count(Region, OpportunityStatus) %>%
        mutate(pct=n/sum(n)),
      aes(Region, n, fill=OpportunityStatus)) +
  geom_bar(stat="identity") +
  geom_text(aes(label=paste0(sprintf("%1.1f", pct*100),"%")),
            position=position_stack(vjust=0.5), check_overlap = TRUE) +
  coord_flip()
```
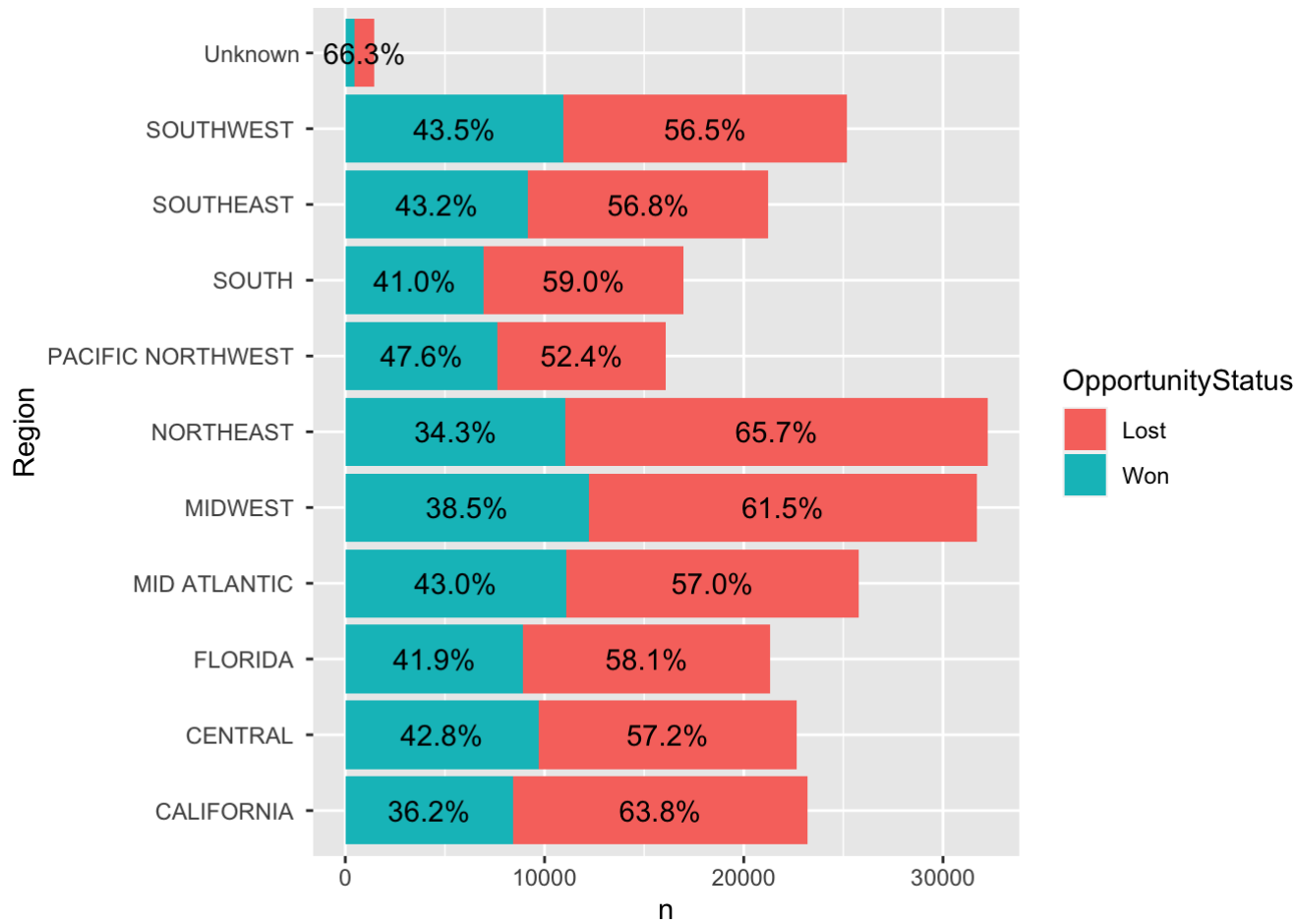
```
# stacked barchart on Type of Sale
ggplot(CRM_W_L %>%
        group_by(TypeOfSale) %>%
        count(TypeOfSale, OpportunityStatus) %>%
        mutate(pct=n/sum(n)),
    aes(TypeOfSale, n, fill=OpportunityStatus)) +
  geom_bar(stat="identity") +
  geom_text(aes(label=paste0(sprintf("%1.1f", pct*100),"%")),
            position=position_stack(vjust=0.5), check_overlap = TRUE) +
  coord_flip()
```
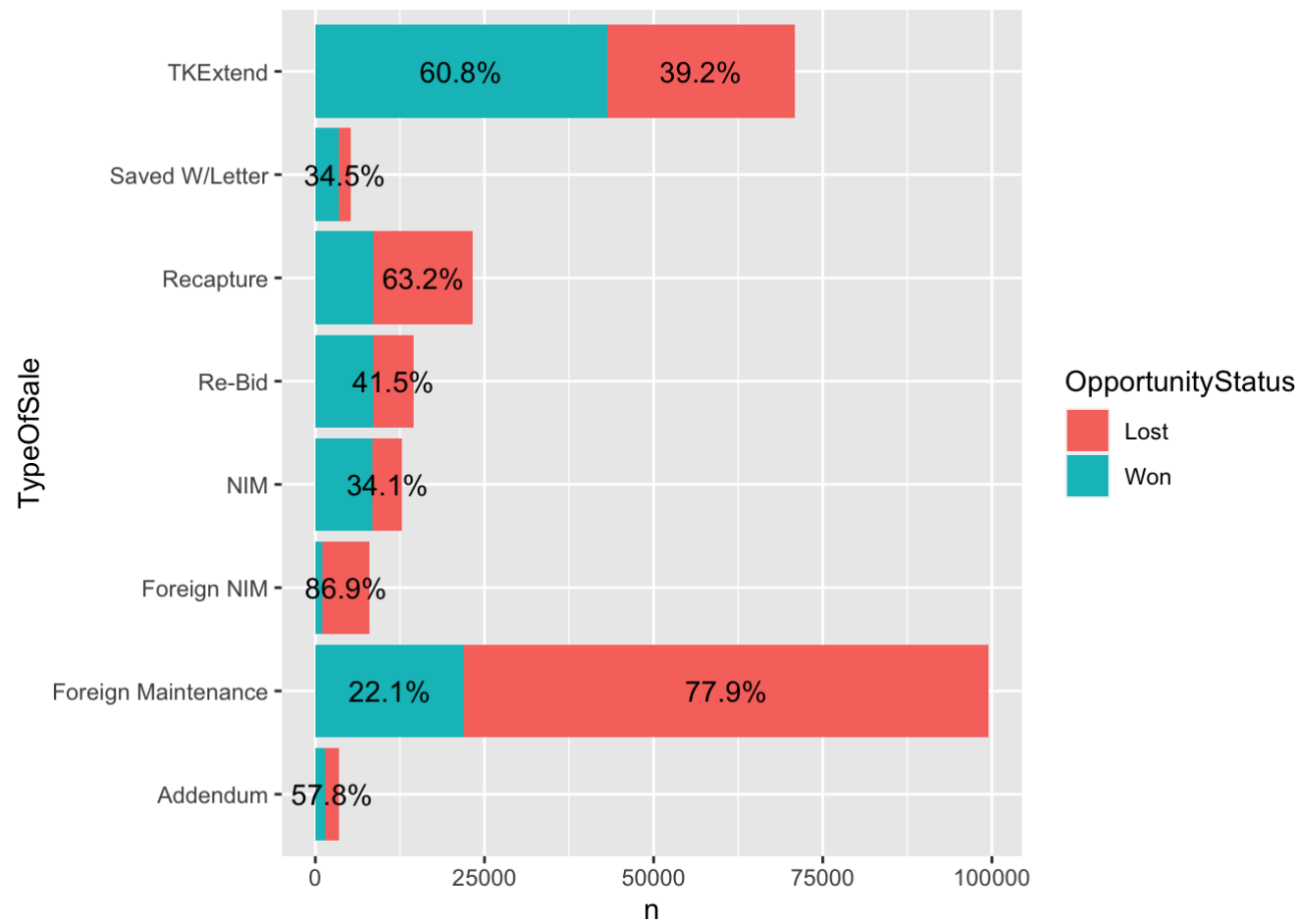
```
# stacked barchart on Competitor Name
ggplot(CRM_W_L %>%
        group_by(CompetitorName) %>%
        count(CompetitorName, OpportunityStatus) %>%
        mutate(pct=n/sum(n)),
     aes(CompetitorName, n, fill=OpportunityStatus)) +
  geom_bar(stat="identity") +
  geom_text(aes(label=paste0(sprintf("%1.1f", pct*100),"%")),
            position=position_stack(vjust=0.5), check_overlap = TRUE)
```
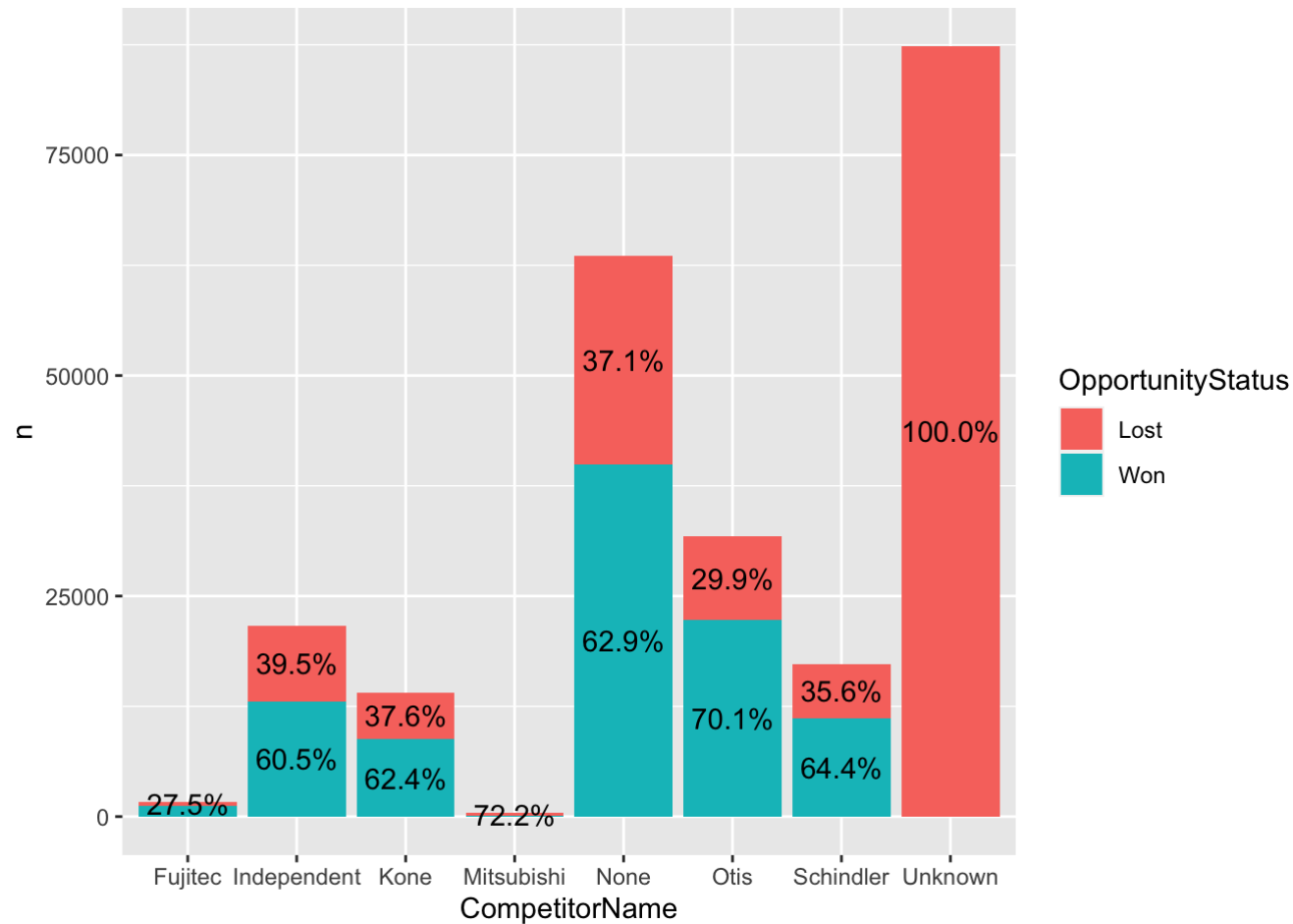
```
# stacked barchart on Market Segment
ggplot(CRM_W_L %>%
        group_by(MarketSegment) %>%
        count(MarketSegment, OpportunityStatus) %>%
        mutate(pct=n/sum(n)),
     aes(MarketSegment, n, fill=OpportunityStatus)) +
  geom_bar(stat="identity") +
  geom_text(aes(label=paste0(sprintf("%1.1f", pct*100),"%")),
          position=position_stack(vjust=0.5), check_overlap = TRUE) +
  coord_flip()
```
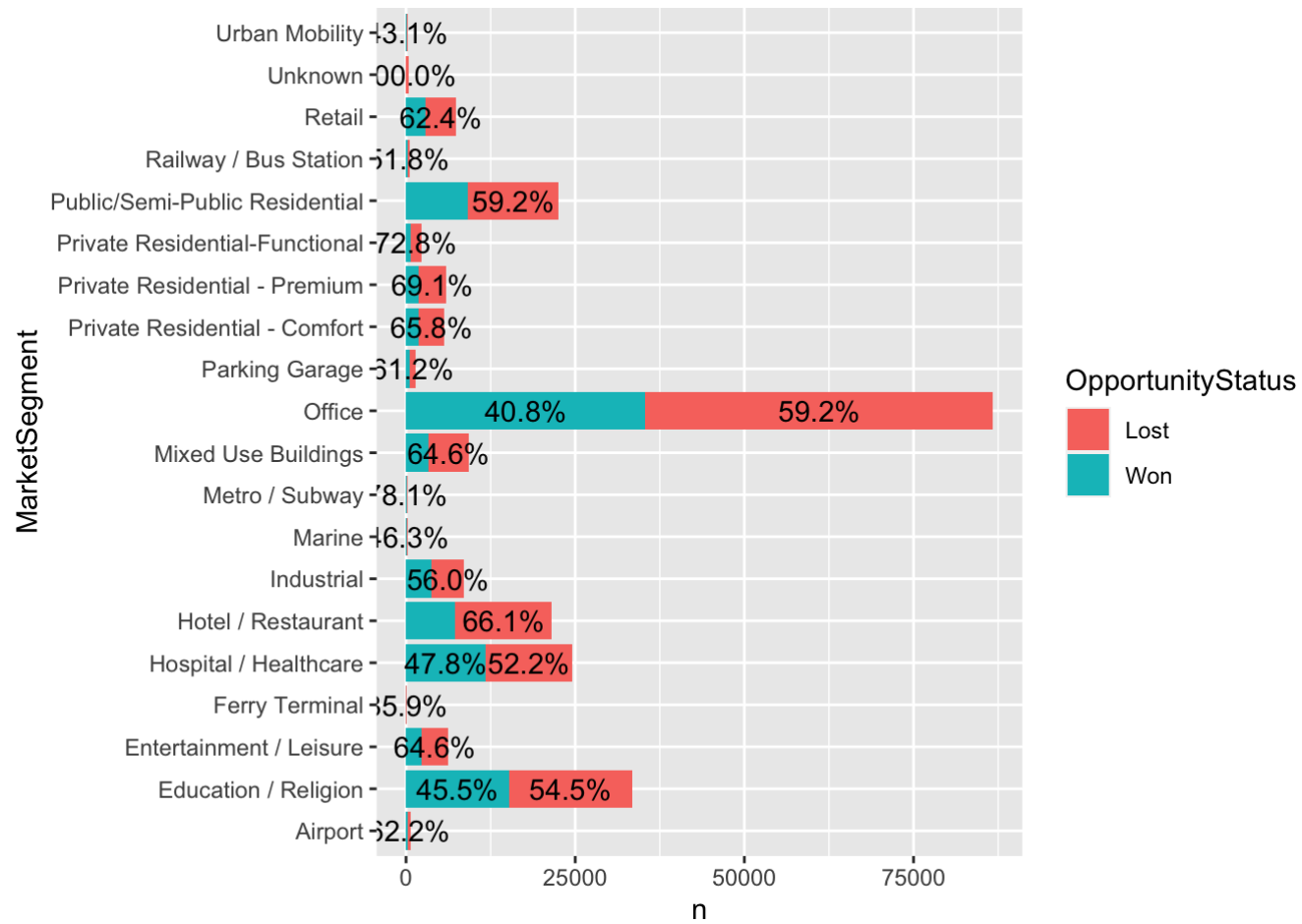
```
# Capacity
boxplot(Capacity ~ OpportunityStatus, data = CRM_clean)
```
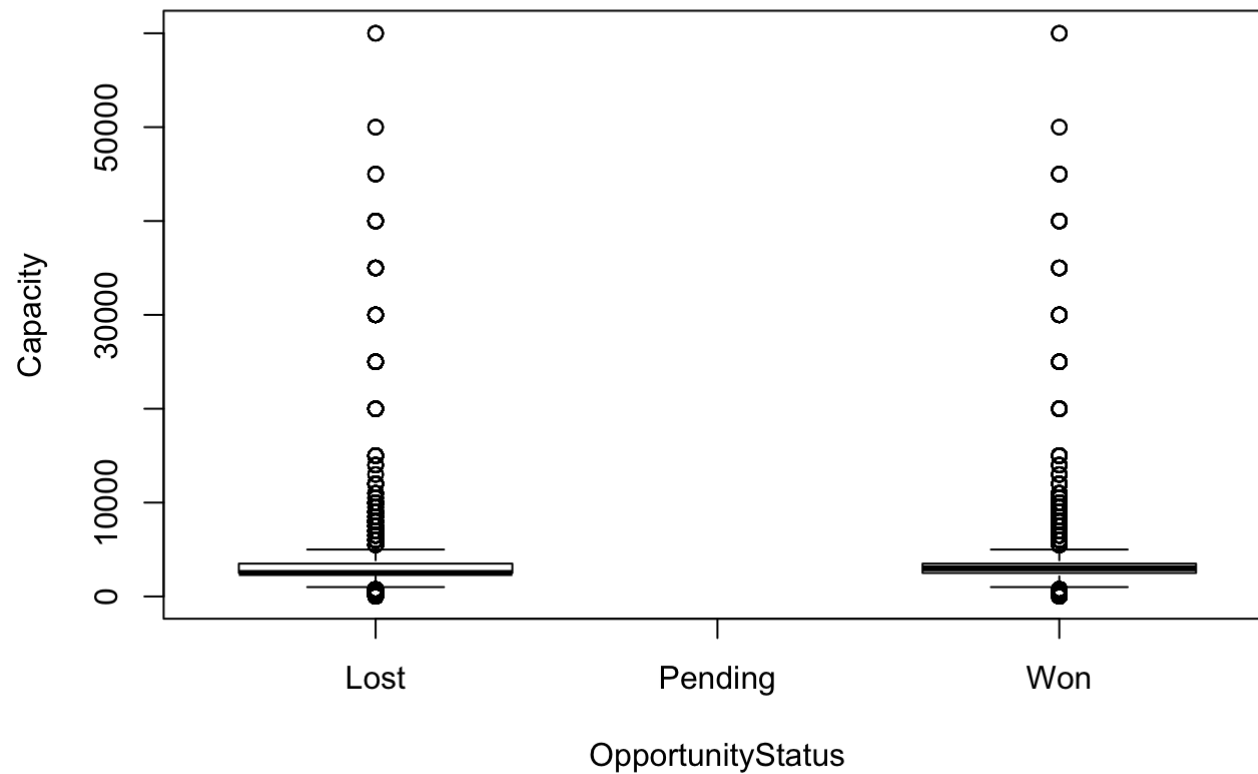
```
# FrontOpentingsCnt
boxplot(FrontOpeningsCnt ~ OpportunityStatus, data = CRM_clean)
```
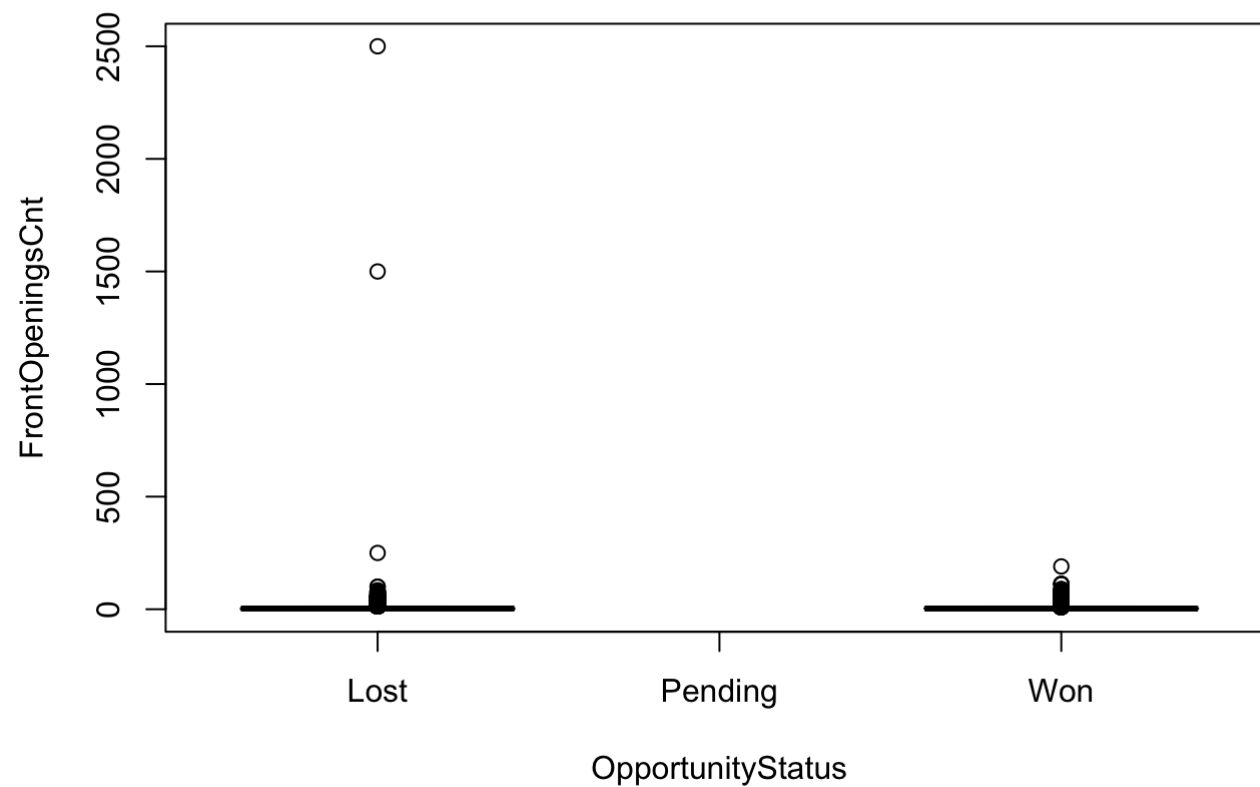
```
# OpportunityProductRevenue
boxplot(OpportunityProductRevenue ~ OpportunityStatus, data = CRM_clean)
```
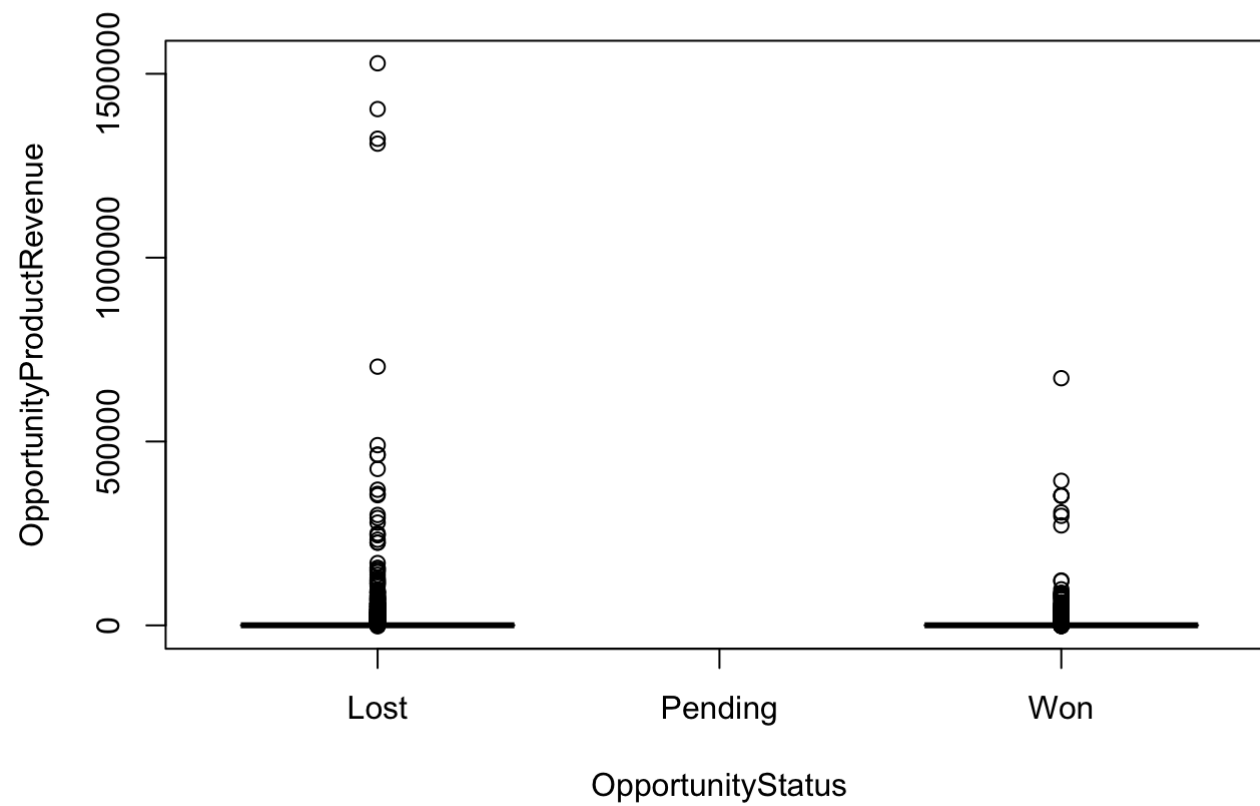
```
# MarginDollars
boxplot(MarginDollars ~ OpportunityStatus, data = CRM_clean)
```
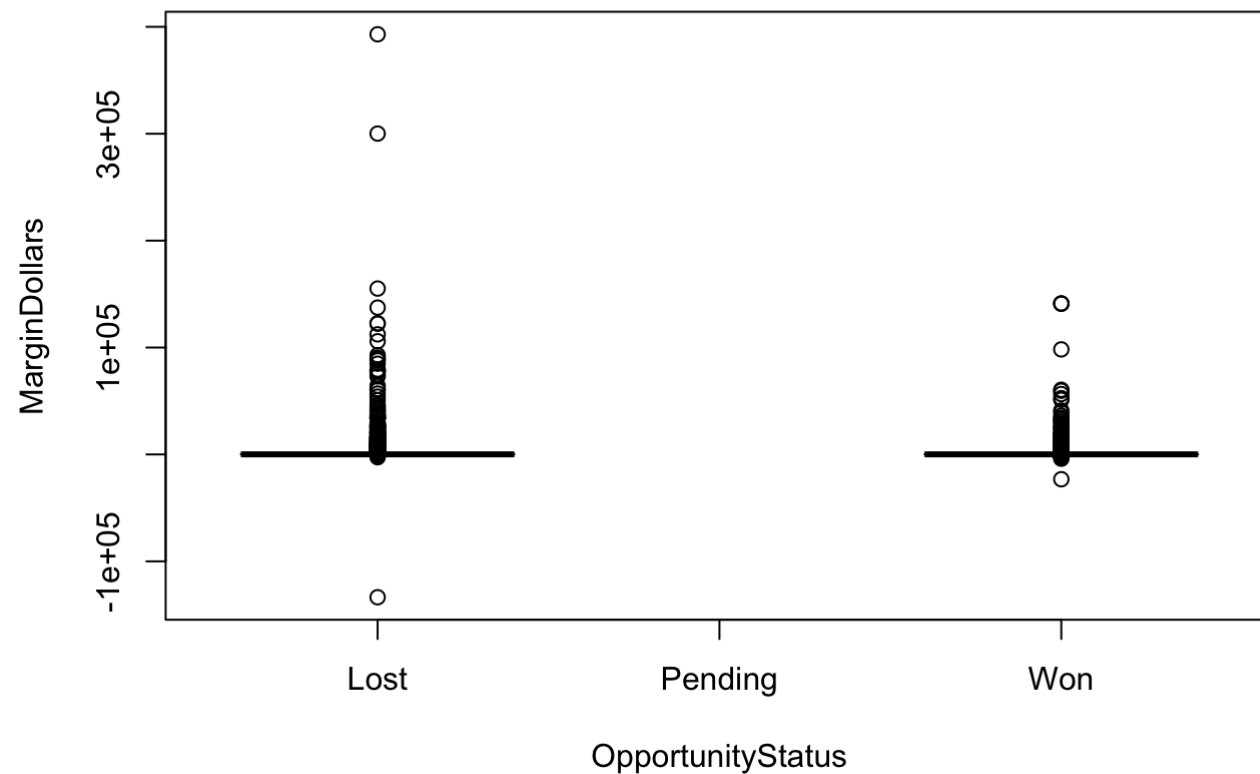
```
# stacked barchart on Product Category
ggplot(CRM_W_L %>%
        group_by(ProductCategory) %>%
        count(ProductCategory, OpportunityStatus) %>%
        mutate(pct=n/sum(n)),
      aes(ProductCategory, n, fill=OpportunityStatus)) +
  geom_bar(stat="identity") +
  geom_text(aes(label=paste0(sprintf("%1.1f", pct*100),"%")),
            position=position_stack(vjust=0.5), check_overlap = TRUE)
```
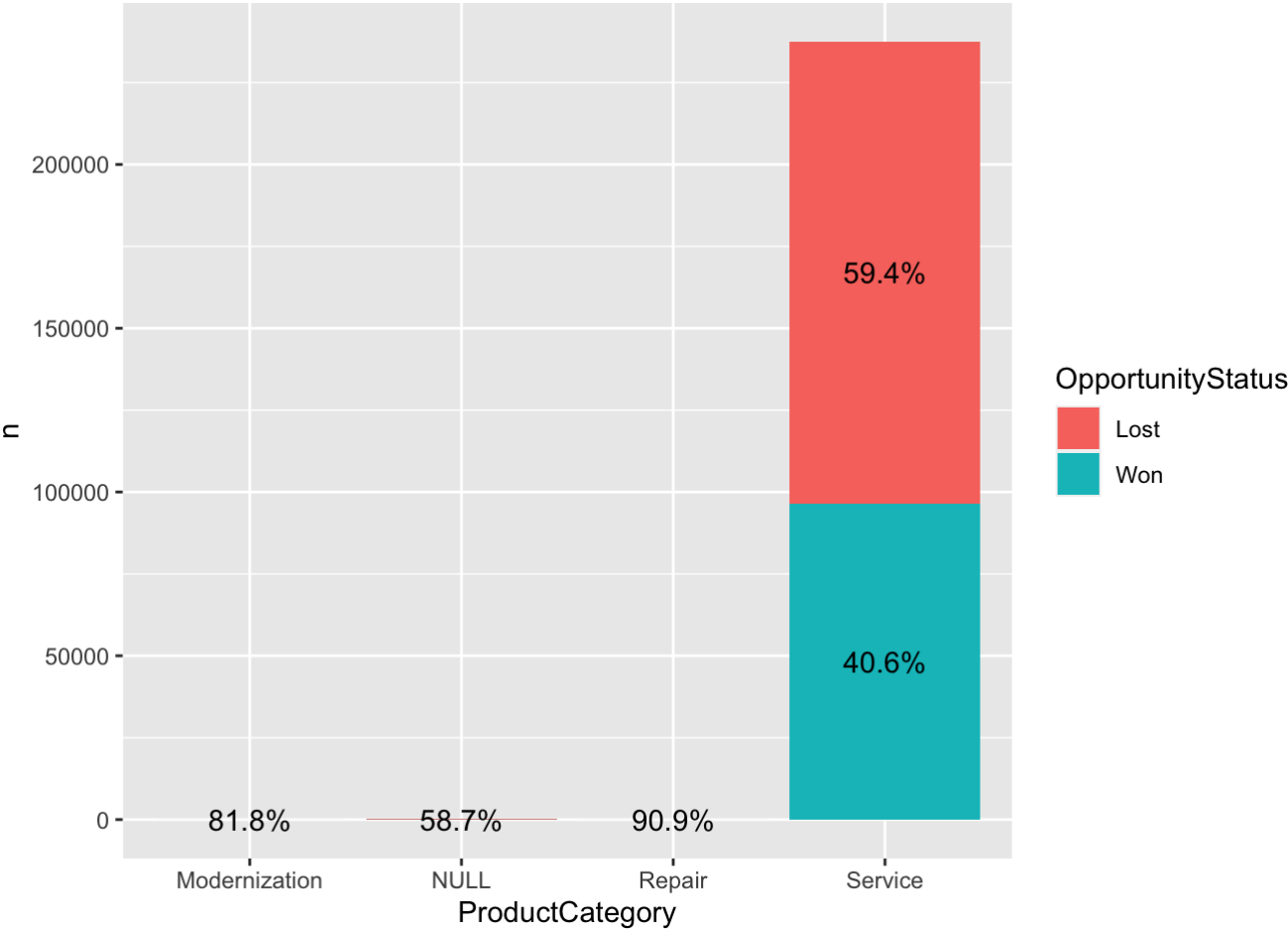
```
# only look at Won & Lost rows (exclude Pending)
CRM_W_L <- CRM_original %>%
  filter(OpportunityStatus == 'Won' | OpportunityStatus == "Lost")

### CLEAN DATA ###

# delete columns that have too much info missing or are not applicable for win/loss analysis
CRM_clean <- subset(CRM_W_L, select = -c(LOB, BranchNo, SalesStage, CREATED_DATE, CREATED_FY, PROPOSED_DATE, PROP
OSED_FY, AWARD_CLOSED_DATE, AWARD_CLOSED_FY, ReasonWonLost, BasisOfDesign, Rise, Speed, Usage, Voltage, BaseBidQu
oteNumber, CompetitorPrice, ExistingOldContractValue, FactoryMaterialCostUnit, LaborCost, PurchaseMatrialCost, Co
ntractTermsMonths, TotalLaborHours, OpportunityExpectedRevenue, OpportunityProbabilityPct, OpportunityProductProb
abilityPct, UnitSerialNo, Category, OpportunityKey, OpportunityProductKey, AccountID, OpportunityDetailID, CRMUse
rID, EmployeeNo))

# FIX DATA

# change missing to 0 (zero)
CRM_clean$Capacity[CRM_clean$Capacity == "N/A"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "N/A", value =
## structure(c(61L, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "NULL"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "NULL", value =
## structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "Unknown"] <- 0
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Unknown", value =
## structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "Less than 25"] <- 20
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Less than 25",
## value = structure(c(NA, : invalid factor level, NA generated
```

```
CRM_clean$Capacity[CRM_clean$Capacity == "<2100"] <- 2000
CRM_clean$Capacity[CRM_clean$Capacity == "Greater than 60000"] <- 65000
```

```
## Warning in `[<-.factor`(`*tmp*`, CRM_clean$Capacity == "Greater than
## 60000", : invalid factor level, NA generated
```

```
CRM_clean$FrontOpeningsCnt[CRM_clean$FrontOpeningsCnt == "NULL"] <- 0
CRM_clean$FrontOpeningsCnt[CRM_clean$FrontOpeningsCnt == "Unknown"] <- 0
CRM_clean$RearOpeningsCnt[CRM_clean$RearOpeningsCnt == "NULL"] <- 0
CRM_clean$RearOpeningsCnt[CRM_clean$RearOpeningsCnt == "Unknown"] <- 0
CRM_clean$StopsCnt[CRM_clean$StopsCnt == "NULL"] <- 0
CRM_clean$StopsCnt[CRM_clean$StopsCnt == "Unknown"] <- 0
CRM_clean$OpportunityUnitCnt[is.na(CRM_clean$OpportunityUnitCnt)] <- 0
CRM_clean$PricePerUnit[is.na(CRM_clean$PricePerUnit)] <- 0
CRM_clean$ExpectedEagleRevenue[CRM_clean$ExpectedEagleRevenue == "NULL"] <- 0
# change character to numeric
CRM_clean$Capacity <- as.numeric(gsub(",", "", CRM_clean$Capacity))
CRM_clean$FrontOpeningsCnt <- as.numeric(gsub(",", "", CRM_clean$FrontOpeningsCnt))
CRM_clean$RearOpeningsCnt <- as.numeric(gsub(",", "", CRM_clean$RearOpeningsCnt))
CRM_clean$StopsCnt <- as.numeric(gsub(",", "", CRM_clean$StopsCnt))
CRM_clean$ExpectedEagleRevenue <- as.numeric(CRM_clean$ExpectedEagleRevenue)


## REGROUP DATA FOR INTERACTION TERM ANALYSIS ##

regroup <- cbind(CRM_clean)
regroup %>% count(Region, sort = TRUE)
```

```
##             Region       n
## 1       NORTHEAST   32223
## 2         MIDWEST   31691
## 3    MID ATLANTIC   25769
## 4       SOUTHWEST   25174
## 5      CALIFORNIA   23211
## 6         CENTRAL   22645
## 7         FLORIDA   21310
## 8       SOUTHEAST   21247
## 9           SOUTH   16960
## 10 PACIFIC NORTHWEST  16064
## 11         Unknown    1432
```

```
# Region Data
regroup$Region <-gsub('Unknown', 'Other', regroup$Region)
regroup$Region <-gsub('CALIFORNIA', 'Other', regroup$Region)
regroup$Region <-gsub('CENTRAL', 'Other', regroup$Region)
regroup$Region <-gsub('FLORIDA', 'Other', regroup$Region)
regroup$Region <-gsub('SOUTHEAST', 'Other', regroup$Region)
regroup$Region <-gsub('SOUTH', 'Other', regroup$Region)
regroup$Region <-gsub('PACIFIC NORTHWEST', 'Other', regroup$Region)
regroup$Region <-str_replace(regroup$Region, 'Other.*', 'Other')

regroup %>% count(Region, sort = TRUE)
```

```
##            Region       n
## 1          Other 148043
## 2      NORTHEAST   32223
## 3        MIDWEST   31691
## 4 MID ATLANTIC   25769
```

```
# Competitor Data
regroup %>% count(CompetitorName, sort = TRUE)
```

```
##   CompetitorName      n
## 1        Unknown 87363
## 2           None 63528
## 3           Otis 31746
## 4    Independent 21603
## 5      Schindler 17318
## 6           Kone 14092
## 7        Fujitec  1684
## 8     Mitsubishi   392
```

```
regroup$CompetitorName <-gsub('Unknown', 'Other', regroup$CompetitorName)
regroup$CompetitorName <-gsub('None', 'Other', regroup$CompetitorName)
regroup$CompetitorName <-gsub('Fujitec', 'Other', regroup$CompetitorName)
regroup$CompetitorName <-gsub('Mitsubishi', 'Other', regroup$CompetitorName)

regroup %>% count(CompetitorName, sort = TRUE)
```

```
##   CompetitorName       n
## 1         Other 152967
## 2          Otis  31746
## 3   Independent  21603
## 4     Schindler  17318
## 5          Kone  14092
```

```r
# Adding dummy variable to Opportunity Status (Won=1, Lost=0)
CRM_clean <- CRM_clean %>%
  mutate(OpportunityStatus = ifelse(OpportunityStatus=="Won",1,0))


### TESTING AND TRAINING SETS ###

# ensure the results are repeatable
set.seed(123) # base seed is 123; also tried 513, 67, 8, 8753

# split data into training (80%), test (20%) sets
splitdata <- CRM_clean$Region %>%
  createDataPartition(p=0.8, list=FALSE)
#splitdata<-splitdata[splitdata<=170346]
training <- CRM_clean[splitdata,]
testing <- CRM_clean[-splitdata,]

# create dummy variables for categorical predictor variables
m <- model.matrix(OpportunityStatus~., CRM_clean)[,-1]
x.train <- m[splitdata[splitdata<=170346],]

x.test <- m[-splitdata,]
y.train <- training$OpportunityStatus
y.test <- testing$OpportunityStatus
# create data frame testing and training sets
x.test.df <- subset(testing, select = -c(OpportunityStatus))
```

```r
### FULL LOGISTIC REGRESSION ###

# train model
full_model <- glm(formula = OpportunityStatus ~. , family = binomial, data = training) # takes a couple minutes t
o run
```

```
## Warning: glm.fit: algorithm did not converge
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```r
summary(full_model)
```

```
##
## Call:
## glm(formula = OpportunityStatus ~ ., family = binomial, data = training)
##
## Deviance Residuals:
##    Min      1Q  Median      3Q     Max
##  -8.49    0.00    0.00    8.49    8.49
##
## Coefficients: (54 not defined because of singularities)
##
Estimate
## (Intercept)                                                            -
1.638e+24
## RegionCENTRAL                                                          -
2.541e+14
## RegionFLORIDA                                                          -
2.722e+14
## RegionMID ATLANTIC                                                     -
5.567e+13
## RegionMIDWEST                                                          -
1.265e+14
## RegionNORTHEAST                                                        -
1.547e+14
## RegionPACIFIC NORTHWEST                                                -
1.570e+13
## RegionSOUTH
2.106e+13
## RegionSOUTHEAST                                                        -
2.003e+14
## RegionSOUTHWEST
3.996e+13
## RegionUnknown                                                          -
2.885e+14
## TypeOfSaleForeign Maintenance                                          -
8.492e+14
## TypeOfSaleForeign NIM                                                  -
1.080e+15
## TypeOfSaleNIM
1.071e+15
## TypeOfSaleRe-Bid
```

```
1.028e+15
```
TypeOfSaleRecapture   -
```
1.187e+14
```
TypeOfSaleSaved W/Letter
```
2.653e+14
```
TypeOfSaleTKExtend
```
1.719e+14
```
ProductCategoryNULL
```
1.638e+24
```
ProductCategoryRepair
```
1.638e+24
```
ProductCategoryService
```
1.638e+24
```
ProductNameUS-MD-Standard Geared
```
1.638e+24
```
ProductNameUS-MD-Standard Gearless
```
1.638e+24
```
ProductNameUS-REPAIR QUOTED
```
NA
```
ProductNameUS-SV-Amortized-Repair   -
```
3.967e+14
```
ProductNameUS-SV-BR-OG-PM   -
```
1.950e+14
```
ProductNameUS-SV-EL-BR-OG   -
```
3.436e+14
```
ProductNameUS-SV-EL-BR-OG-PM   -
```
3.216e+14
```
ProductNameUS-SV-EL-GL-FM-NOT   -
```
3.355e+14
```
ProductNameUS-SV-EL-GL-FM-NOT-PM   -
```
4.862e+14
```
ProductNameUS-SV-EL-NIM-MOD
```
2.176e+15
```
ProductNameUS-SV-EL-PL-FM-TD   -
```
3.740e+14
```
ProductNameUS-SV-EL-PL-FM-TD-PM   -
```
3.496e+14
```
ProductNameUS-SV-EL-PM
```
2.013e+13
```
ProductNameUS-SV-EL-PP-FM-24CB   -
```
3.774e+14
```

ProductNameUS-SV-EL-PP-FM-24CB-PM –
2.530e+14
ProductNameUS-SV-EL-PP-FM-24CB-WTC
2.621e+14
ProductNameUS-SV-ES-BR-OG –
6.209e+14
ProductNameUS-SV-ES-GL-FM-NOT
9.342e+14
ProductNameUS-SV-ES-PL-FM-TD –
9.235e+13
ProductNameUS-SV-ES-PP-FM-24CB
4.966e+14
ProductNameUS-SV-ExtWarranty
3.937e+14
ProductNameUS-SV-HEL-SI-LM-2C –
9.320e+14
ProductNameUS-SV-HEL-SI-LM-2C-PM
2.047e+14
ProductNameUS-SV-O-BR-OG
1.559e+14
ProductNameUS-SV-O-GL-FM-NOT –
2.903e+14
ProductNameUS-SV-O-PL-FM-TD –
3.221e+14
ProductNameUS-SV-O-PP-FM-24CB
NA
ParentCategoryGeared
NA
ParentCategoryGearless
NA
ParentCategoryGold
NA
ParentCategoryHydraulic
NA
ParentCategoryNIM
NA
ParentCategoryNULL
NA
ParentCategoryPlatinum
NA
ParentCategoryPlatinum Premier

NA
ParentCategoryQuoted
NA
ParentCategorySilver
NA
ParentCategoryTeleservice
NA
ProductDescAmortized repair line
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator - With Phone Monitoring
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Escalator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Other
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - With Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - No Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - with Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Escalator
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Other
NA
ProductDescNULL
NA
ProductDescPhone Monitoring Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator - With Phone Monitoring
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Escalator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Other
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - No Phone Monitoring
NA

ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - with Phone Monitoring
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Escalator
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Other
NA
ProductDescRefurbish existing geared machine or replacing with like.
NA
ProductDescRefurbish existing gearless machine or replacing with like.
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, No Phone Monitoring
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, Phone Monitoring
NA
ProductDescTKE MOD NIM ELEVATOR
NA
CompetitorNameIndependent
5.127e+14
CompetitorNameKone
8.459e+14
CompetitorNameMitsubishi
5.401e+14
CompetitorNameNone   -
1.831e+14
CompetitorNameOtis
4.077e+14
CompetitorNameSchindler
2.219e+14
CompetitorNameUnknown   -
1.396e+15
MarketSegmentEducation / Religion   -
2.926e+14
MarketSegmentEntertainment / Leisure   -
2.494e+14
MarketSegmentFerry Terminal   -
3.755e+14
MarketSegmentHospital / Healthcare   -
3.259e+14
MarketSegmentHotel / Restaurant   -
3.365e+14
MarketSegmentIndustrial   -

2.359e+14

MarketSegmentMarine

5.254e+13

MarketSegmentMetro / Subway   -

1.730e+15

MarketSegmentMixed Use Buildings   -

2.478e+14

MarketSegmentOffice   -

2.588e+14

MarketSegmentParking Garage   -

2.804e+14

MarketSegmentPrivate Residential - Comfort   -

6.408e+14

MarketSegmentPrivate Residential - Premium   -

6.847e+14

MarketSegmentPrivate Residential-Functional   -

5.776e+14

MarketSegmentPublic/Semi-Public Residential   -

3.324e+14

MarketSegmentRailway / Bus Station

1.402e+14

MarketSegmentRetail   -

1.866e+14

MarketSegmentUnknown   -

2.375e+15

MarketSegmentUrban Mobility

2.487e+14

Capacity   -

5.120e+09

FrontOpeningsCnt   -

9.051e+12

RearOpeningsCnt   -

1.467e+11

StopsCnt

1.661e+11

OpportunityProductRevenue   -

2.403e+10

MarginDollars   -

2.456e+09

GrossMarginPct

4.324e+10

OpportunityProductExpectedRevenue

1.969e+11

OpportunityUnitCnt   –

2.412e+12

PricePerUnit   –

1.464e+10

ExpectedEagleRevenue   –

4.915e+09

OpportunityProductUnitCnt   –

3.514e+12

MaintenanceTypeAmortized repair line

NA

MaintenanceTypeFull Maintenace, Overtime portion not covered

NA

MaintenanceTypeFull Maintenance w/ 24 Hour Callbacks

NA

MaintenanceTypeFull Maintenance, Customer pays full amount of Overtime

NA

MaintenanceTypeHydraulic Elevators, Limited Maintenance, 2 Callbacks

NA

MaintenanceTypeNULL

NA

MaintenanceTypeOil & Grease ONLY, Pay for all Callbacks

NA

MaintenanceTypeRefurbish existing geared machine or replacing with like.

NA

MaintenanceTypeRefurbish existing gearless machine or replacing with like.

NA

MaintenanceTypeTKE MOD NIM

NA

TypeEscalator

NA

TypeNULL

NA

TypeOther

NA

PhoneNULL

NA

PhonePhone Monitoring

NA

PhoneWith Phone Monitoring

```
NA
##                                                              S
td. Error
## (Intercept)
2.087e+17
## RegionCENTRAL
8.733e+05
## RegionFLORIDA
8.646e+05
## RegionMID ATLANTIC
8.305e+05
## RegionMIDWEST
7.957e+05
## RegionNORTHEAST
8.175e+05
## RegionPACIFIC NORTHWEST
9.053e+05
## RegionSOUTH
9.432e+05
## RegionSOUTHEAST
8.811e+05
## RegionSOUTHWEST
8.403e+05
## RegionUnknown
2.392e+06
## TypeOfSaleForeign Maintenance
1.531e+06
## TypeOfSaleForeign NIM
2.012e+06
## TypeOfSaleNIM
1.722e+06
## TypeOfSaleRe-Bid
1.658e+06
## TypeOfSaleRecapture
1.604e+06
## TypeOfSaleSaved W/Letter
1.878e+06
## TypeOfSaleTKExtend
1.532e+06
## ProductCategoryNULL
2.087e+17
```

ProductCategoryRepair

2.087e+17

ProductCategoryService

2.087e+17

ProductNameUS-MD-Standard Geared

2.087e+17

ProductNameUS-MD-Standard Gearless

2.087e+17

ProductNameUS-REPAIR QUOTED

NA

ProductNameUS-SV-Amortized-Repair

2.397e+07

ProductNameUS-SV-BR-OG-PM

6.434e+06

ProductNameUS-SV-EL-BR-OG

3.504e+06

ProductNameUS-SV-EL-BR-OG-PM

3.540e+06

ProductNameUS-SV-EL-GL-FM-NOT

3.388e+06

ProductNameUS-SV-EL-GL-FM-NOT-PM

3.389e+06

ProductNameUS-SV-EL-NIM-MOD

7.750e+07

ProductNameUS-SV-EL-PL-FM-TD

3.401e+06

ProductNameUS-SV-EL-PL-FM-TD-PM

3.400e+06

ProductNameUS-SV-EL-PM

9.371e+06

ProductNameUS-SV-EL-PP-FM-24CB

3.418e+06

ProductNameUS-SV-EL-PP-FM-24CB-PM

3.430e+06

ProductNameUS-SV-EL-PP-FM-24CB-WTC

1.712e+07

ProductNameUS-SV-ES-BR-OG

2.560e+07

ProductNameUS-SV-ES-GL-FM-NOT

1.027e+07

ProductNameUS-SV-ES-PL-FM-TD

```
9.907e+06
```

ProductNameUS-SV-ES-PP-FM-24CB

```
9.235e+06
```

ProductNameUS-SV-ExtWarranty

```
3.945e+07
```

ProductNameUS-SV-HEL-SI-LM-2C

```
1.411e+07
```

ProductNameUS-SV-HEL-SI-LM-2C-PM

```
1.067e+07
```

ProductNameUS-SV-O-BR-OG

```
3.643e+06
```

ProductNameUS-SV-O-GL-FM-NOT

```
3.910e+06
```

ProductNameUS-SV-O-PL-FM-TD

```
4.565e+06
```

ProductNameUS-SV-O-PP-FM-24CB

```
NA
```

ParentCategoryGeared

```
NA
```

ParentCategoryGearless

```
NA
```

ParentCategoryGold

```
NA
```

ParentCategoryHydraulic

```
NA
```

ParentCategoryNIM

```
NA
```

ParentCategoryNULL

```
NA
```

ParentCategoryPlatinum

```
NA
```

ParentCategoryPlatinum Premier

```
NA
```

ParentCategoryQuoted

```
NA
```

ParentCategorySilver

```
NA
```

ParentCategoryTeleservice

```
NA
```

ProductDescAmortized repair line

```
NA
```

ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator - With Phone Monitoring
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Escalator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Other
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - With Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - No Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - with Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Escalator
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Other
NA
ProductDescNULL
NA
ProductDescPhone Monitoring Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator - With Phone Monitoring
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Escalator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Other
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - No Phone Monitoring
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - with Phone Monitoring
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Escalator
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Other
NA
ProductDescRefurbish existing geared machine or replacing with like.
NA
ProductDescRefurbish existing gearless machine or replacing with like.

NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, No Phone Monitoring
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, Phone Monitoring
NA
ProductDescTKE MOD NIM ELEVATOR
NA
CompetitorNameIndependent
2.051e+06
CompetitorNameKone
2.103e+06
CompetitorNameMitsubishi
5.405e+06
CompetitorNameNone
1.991e+06
CompetitorNameOtis
2.027e+06
CompetitorNameSchindler
2.080e+06
CompetitorNameUnknown
1.992e+06
MarketSegmentEducation / Religion
4.006e+06
MarketSegmentEntertainment / Leisure
4.156e+06
MarketSegmentFerry Terminal
1.057e+07
MarketSegmentHospital / Healthcare
4.011e+06
MarketSegmentHotel / Restaurant
4.019e+06
MarketSegmentIndustrial
4.085e+06
MarketSegmentMarine
6.299e+06
MarketSegmentMetro / Subway
9.014e+06
MarketSegmentMixed Use Buildings
4.082e+06
MarketSegmentOffice
3.984e+06

MarketSegmentParking Garage
4.608e+06
MarketSegmentPrivate Residential - Comfort
4.143e+06
MarketSegmentPrivate Residential - Premium
4.132e+06
MarketSegmentPrivate Residential-Functional
4.341e+06
MarketSegmentPublic/Semi-Public Residential
4.016e+06
MarketSegmentRailway / Bus Station
6.267e+06
MarketSegmentRetail
4.134e+06
MarketSegmentUnknown
6.340e+06
MarketSegmentUrban Mobility
7.955e+06
Capacity
9.681e+01
FrontOpeningsCnt
3.785e+04
RearOpeningsCnt
5.396e+03
StopsCnt
1.658e+04
OpportunityProductRevenue
4.830e+01
MarginDollars
2.189e+02
GrossMarginPct
6.084e+03
OpportunityProductExpectedRevenue
1.716e+02
OpportunityUnitCnt
1.247e+04
PricePerUnit
1.526e+02
ExpectedEagleRevenue
1.304e+02
OpportunityProductUnitCnt

```
4.394e+04
## MaintenanceTypeAmortized repair line
NA
## MaintenanceTypeFull Maintenace, Overtime portion not covered
NA
## MaintenanceTypeFull Maintenance w/ 24 Hour Callbacks
NA
## MaintenanceTypeFull Maintenance, Customer pays full amount of Overtime
NA
## MaintenanceTypeHydraulic Elevators, Limited Maintenance, 2 Callbacks
NA
## MaintenanceTypeNULL
NA
## MaintenanceTypeOil & Grease ONLY, Pay for all Callbacks
NA
## MaintenanceTypeRefurbish existing geared machine or replacing with like.
NA
## MaintenanceTypeRefurbish existing gearless machine or replacing with like.
NA
## MaintenanceTypeTKE MOD NIM
NA
## TypeEscalator
NA
## TypeNULL
NA
## TypeOther
NA
## PhoneNULL
NA
## PhonePhone Monitoring
NA
## PhoneWith Phone Monitoring
NA
##
z value
## (Intercept)
-7848643
## RegionCENTRAL                                                                -
290916496
## RegionFLORIDA                                                                -
314808047
```

RegionMID ATLANTIC

-67028513

RegionMIDWEST -

158947730

RegionNORTHEAST -

189187215

RegionPACIFIC NORTHWEST

-17343436

RegionSOUTH

22331311

RegionSOUTHEAST -

227348128

RegionSOUTHWEST

47550190

RegionUnknown -

120599895

TypeOfSaleForeign Maintenance -

554537244

TypeOfSaleForeign NIM -

536660077

TypeOfSaleNIM

622018203

TypeOfSaleRe-Bid

620010154

TypeOfSaleRecapture

-73991718

TypeOfSaleSaved W/Letter

141221440

TypeOfSaleTKExtend

112216155

ProductCategoryNULL

7848643

ProductCategoryRepair

7848643

ProductCategoryService

7848643

ProductNameUS-MD-Standard Geared

7848643

ProductNameUS-MD-Standard Gearless

7848643

ProductNameUS-REPAIR QUOTED

```
NA
## ProductNameUS-SV-Amortized-Repair
-16551137
## ProductNameUS-SV-BR-OG-PM
-30310852
## ProductNameUS-SV-EL-BR-OG
-98081920
## ProductNameUS-SV-EL-BR-OG-PM
-90859093
## ProductNameUS-SV-EL-GL-FM-NOT
-99030823
## ProductNameUS-SV-EL-GL-FM-NOT-PM                                      -
143433436
## ProductNameUS-SV-EL-NIM-MOD
28075330
## ProductNameUS-SV-EL-PL-FM-TD                                          -
109970510
## ProductNameUS-SV-EL-PL-FM-TD-PM                                       -
102848073
## ProductNameUS-SV-EL-PM
2148478
## ProductNameUS-SV-EL-PP-FM-24CB                                        -
110434029
## ProductNameUS-SV-EL-PP-FM-24CB-PM
-73747225
## ProductNameUS-SV-EL-PP-FM-24CB-WTC
15313395
## ProductNameUS-SV-ES-BR-OG
-24253504
## ProductNameUS-SV-ES-GL-FM-NOT
90998393
## ProductNameUS-SV-ES-PL-FM-TD
-9322089
## ProductNameUS-SV-ES-PP-FM-24CB
53768408
## ProductNameUS-SV-ExtWarranty
9981053
## ProductNameUS-SV-HEL-SI-LM-2C
-66044261
## ProductNameUS-SV-HEL-SI-LM-2C-PM
19182365
```

ProductNameUS-SV-O-BR-OG
42797567
ProductNameUS-SV-O-GL-FM-NOT
-74228444
ProductNameUS-SV-O-PL-FM-TD
-70573414
ProductNameUS-SV-O-PP-FM-24CB
NA
ParentCategoryGeared
NA
ParentCategoryGearless
NA
ParentCategoryGold
NA
ParentCategoryHydraulic
NA
ParentCategoryNIM
NA
ParentCategoryNULL
NA
ParentCategoryPlatinum
NA
ParentCategoryPlatinum Premier
NA
ParentCategoryQuoted
NA
ParentCategorySilver
NA
ParentCategoryTeleservice
NA
ProductDescAmortized repair line
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator - With Phone Monitoring
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Escalator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Other
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - With Phone Monitoring

NA
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime - Elevator - No Phone Monitoring
NA
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime - Elevator - with Phone Monitoring
NA
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime - Escalator
NA
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime - Other
NA
ProductDescNULL
NA
ProductDescPhone Monitoring Elevator
NA
ProductDescPlatinum – Full Maintenace, Overtime portion not covered - Elevator
NA
ProductDescPlatinum – Full Maintenace, Overtime portion not covered - Elevator - With Phone Monitoring
NA
ProductDescPlatinum – Full Maintenace, Overtime portion not covered - Escalator
NA
ProductDescPlatinum – Full Maintenace, Overtime portion not covered - Other
NA
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks - Elevator - No Phone Monitoring
NA
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks - Elevator - with Phone Monitoring
NA
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks - Escalator
NA
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks - Other
NA
ProductDescRefurbish existing geared machine or replacing with like.
NA
ProductDescRefurbish existing gearless machine or replacing with like.
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, No Phone Monitoring
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, Phone Monitoring
NA
ProductDescTKE MOD NIM ELEVATOR
NA
CompetitorNameIndependent
250010059

CompetitorNameKone
402262811
CompetitorNameMitsubishi
99923812
CompetitorNameNone
-91991610
CompetitorNameOtis
201132917
CompetitorNameSchindler
106695022
CompetitorNameUnknown
700872366
MarketSegmentEducation / Religion
-73043109
MarketSegmentEntertainment / Leisure
-59995293
MarketSegmentFerry Terminal
-35515441
MarketSegmentHospital / Healthcare
-81235805
MarketSegmentHotel / Restaurant
-83721252
MarketSegmentIndustrial
-57729502
MarketSegmentMarine
8342291
MarketSegmentMetro / Subway
191977077
MarketSegmentMixed Use Buildings
-60704784
MarketSegmentOffice
-64951361
MarketSegmentParking Garage
-60857668
MarketSegmentPrivate Residential - Comfort
154663175
MarketSegmentPrivate Residential - Premium
165700229
MarketSegmentPrivate Residential-Functional
133070955
MarketSegmentPublic/Semi-Public Residential

-82748476
MarketSegmentRailway / Bus Station
22364903
MarketSegmentRetail
-45144593
MarketSegmentUnknown   -
374649651
MarketSegmentUrban Mobility
31264190
Capacity
-52889073
FrontOpeningsCnt   -
239119570
RearOpeningsCnt
-27183277
StopsCnt
10015666
OpportunityProductRevenue   -
497508327
MarginDollars
-11220570
GrossMarginPct
7106893
OpportunityProductExpectedRevenue   1
147801538
OpportunityUnitCnt   -
193431009
PricePerUnit
-95940720
ExpectedEagleRevenue
-37690510
OpportunityProductUnitCnt
-79974215
MaintenanceTypeAmortized repair line
NA
MaintenanceTypeFull Maintenace, Overtime portion not covered
NA
MaintenanceTypeFull Maintenance w/ 24 Hour Callbacks
NA
MaintenanceTypeFull Maintenance, Customer pays full amount of Overtime
NA

MaintenanceTypeHydraulic Elevators, Limited Maintenance, 2 Callbacks
NA
MaintenanceTypeNULL
NA
MaintenanceTypeOil & Grease ONLY, Pay for all Callbacks
NA
MaintenanceTypeRefurbish existing geared machine or replacing with like.
NA
MaintenanceTypeRefurbish existing gearless machine or replacing with like.
NA
MaintenanceTypeTKE MOD NIM
NA
TypeEscalator
NA
TypeNULL
NA
TypeOther
NA
PhoneNULL
NA
PhonePhone Monitoring
NA
PhoneWith Phone Monitoring
NA
P
r(>|z|)
(Intercept)
<2e-16
RegionCENTRAL
<2e-16
RegionFLORIDA
<2e-16
RegionMID ATLANTIC
<2e-16
RegionMIDWEST
<2e-16
RegionNORTHEAST
<2e-16
RegionPACIFIC NORTHWEST
<2e-16
RegionSOUTH

```
<2e-16
## RegionSOUTHEAST
<2e-16
## RegionSOUTHWEST
<2e-16
## RegionUnknown
<2e-16
## TypeOfSaleForeign Maintenance
<2e-16
## TypeOfSaleForeign NIM
<2e-16
## TypeOfSaleNIM
<2e-16
## TypeOfSaleRe-Bid
<2e-16
## TypeOfSaleRecapture
<2e-16
## TypeOfSaleSaved W/Letter
<2e-16
## TypeOfSaleTKExtend
<2e-16
## ProductCategoryNULL
<2e-16
## ProductCategoryRepair
<2e-16
## ProductCategoryService
<2e-16
## ProductNameUS-MD-Standard Geared
<2e-16
## ProductNameUS-MD-Standard Gearless
<2e-16
## ProductNameUS-REPAIR QUOTED
NA
## ProductNameUS-SV-Amortized-Repair
<2e-16
## ProductNameUS-SV-BR-OG-PM
<2e-16
## ProductNameUS-SV-EL-BR-OG
<2e-16
## ProductNameUS-SV-EL-BR-OG-PM
<2e-16
```

```
## ProductNameUS-SV-EL-GL-FM-NOT
<2e-16
## ProductNameUS-SV-EL-GL-FM-NOT-PM
<2e-16
## ProductNameUS-SV-EL-NIM-MOD
<2e-16
## ProductNameUS-SV-EL-PL-FM-TD
<2e-16
## ProductNameUS-SV-EL-PL-FM-TD-PM
<2e-16
## ProductNameUS-SV-EL-PM
<2e-16
## ProductNameUS-SV-EL-PP-FM-24CB
<2e-16
## ProductNameUS-SV-EL-PP-FM-24CB-PM
<2e-16
## ProductNameUS-SV-EL-PP-FM-24CB-WTC
<2e-16
## ProductNameUS-SV-ES-BR-OG
<2e-16
## ProductNameUS-SV-ES-GL-FM-NOT
<2e-16
## ProductNameUS-SV-ES-PL-FM-TD
<2e-16
## ProductNameUS-SV-ES-PP-FM-24CB
<2e-16
## ProductNameUS-SV-ExtWarranty
<2e-16
## ProductNameUS-SV-HEL-SI-LM-2C
<2e-16
## ProductNameUS-SV-HEL-SI-LM-2C-PM
<2e-16
## ProductNameUS-SV-O-BR-OG
<2e-16
## ProductNameUS-SV-O-GL-FM-NOT
<2e-16
## ProductNameUS-SV-O-PL-FM-TD
<2e-16
## ProductNameUS-SV-O-PP-FM-24CB
NA
## ParentCategoryGeared
```

NA
ParentCategoryGearless
NA
ParentCategoryGold
NA
ParentCategoryHydraulic
NA
ParentCategoryNIM
NA
ParentCategoryNULL
NA
ParentCategoryPlatinum
NA
ParentCategoryPlatinum Premier
NA
ParentCategoryQuoted
NA
ParentCategorySilver
NA
ParentCategoryTeleservice
NA
ProductDescAmortized repair line
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator - With Phone Monitoring
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Escalator
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Other
NA
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - With Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - No Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Elevator - with Phone Monitoring
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Escalator
NA
ProductDescGold - Full Maintenance, Customer pays full amount of Overtime - Other
NA

ProductDescNULL
NA
ProductDescPhone Monitoring Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Elevator - With Phone Monitoring
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Escalator
NA
ProductDescPlatinum - Full Maintenace, Overtime portion not covered - Other
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - No Phone Monitoring
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Elevator - with Phone Monitoring
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Escalator
NA
ProductDescPlatinum Premiere - Full Maintenance w/ 24 Hour Callbacks - Other
NA
ProductDescRefurbish existing geared machine or replacing with like.
NA
ProductDescRefurbish existing gearless machine or replacing with like.
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, No Phone Monitoring
NA
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, Phone Monitoring
NA
ProductDescTKE MOD NIM ELEVATOR
NA
CompetitorNameIndependent
<2e-16
CompetitorNameKone
<2e-16
CompetitorNameMitsubishi
<2e-16
CompetitorNameNone
<2e-16
CompetitorNameOtis
<2e-16
CompetitorNameSchindler

```
<2e-16
## CompetitorNameUnknown
<2e-16
## MarketSegmentEducation / Religion
<2e-16
## MarketSegmentEntertainment / Leisure
<2e-16
## MarketSegmentFerry Terminal
<2e-16
## MarketSegmentHospital / Healthcare
<2e-16
## MarketSegmentHotel / Restaurant
<2e-16
## MarketSegmentIndustrial
<2e-16
## MarketSegmentMarine
<2e-16
## MarketSegmentMetro / Subway
<2e-16
## MarketSegmentMixed Use Buildings
<2e-16
## MarketSegmentOffice
<2e-16
## MarketSegmentParking Garage
<2e-16
## MarketSegmentPrivate Residential - Comfort
<2e-16
## MarketSegmentPrivate Residential - Premium
<2e-16
## MarketSegmentPrivate Residential-Functional
<2e-16
## MarketSegmentPublic/Semi-Public Residential
<2e-16
## MarketSegmentRailway / Bus Station
<2e-16
## MarketSegmentRetail
<2e-16
## MarketSegmentUnknown
<2e-16
## MarketSegmentUrban Mobility
<2e-16
```

Capacity
<2e-16
FrontOpeningsCnt
<2e-16
RearOpeningsCnt
<2e-16
StopsCnt
<2e-16
OpportunityProductRevenue
<2e-16
MarginDollars
<2e-16
GrossMarginPct
<2e-16
OpportunityProductExpectedRevenue
<2e-16
OpportunityUnitCnt
<2e-16
PricePerUnit
<2e-16
ExpectedEagleRevenue
<2e-16
OpportunityProductUnitCnt
<2e-16
MaintenanceTypeAmortized repair line
NA
MaintenanceTypeFull Maintenace, Overtime portion not covered
NA
MaintenanceTypeFull Maintenance w/ 24 Hour Callbacks
NA
MaintenanceTypeFull Maintenance, Customer pays full amount of Overtime
NA
MaintenanceTypeHydraulic Elevators, Limited Maintenance, 2 Callbacks
NA
MaintenanceTypeNULL
NA
MaintenanceTypeOil & Grease ONLY, Pay for all Callbacks
NA
MaintenanceTypeRefurbish existing geared machine or replacing with like.
NA
MaintenanceTypeRefurbish existing gearless machine or replacing with like.

```
NA
## MaintenanceTypeTKE MOD NIM
NA
## TypeEscalator
NA
## TypeNULL
NA
## TypeOther
NA
## PhoneNULL
NA
## PhonePhone Monitoring
NA
## PhoneWith Phone Monitoring
NA
##
## (Intercept)                                                          *
**
## RegionCENTRAL                                                        *
**
## RegionFLORIDA                                                        *
**
## RegionMID ATLANTIC                                                   *
**
## RegionMIDWEST                                                        *
**
## RegionNORTHEAST                                                      *
**
## RegionPACIFIC NORTHWEST                                              *
**
## RegionSOUTH                                                          *
**
## RegionSOUTHEAST                                                      *
**
## RegionSOUTHWEST                                                      *
**
## RegionUnknown                                                        *
**
## TypeOfSaleForeign Maintenance                                        *
**
## TypeOfSaleForeign NIM                                                *
```

**

TypeOfSaleNIM   *

**

TypeOfSaleRe-Bid   *

**

TypeOfSaleRecapture   *

**

TypeOfSaleSaved W/Letter   *

**

TypeOfSaleTKExtend   *

**

ProductCategoryNULL   *

**

ProductCategoryRepair   *

**

ProductCategoryService   *

**

ProductNameUS-MD-Standard Geared   *

**

ProductNameUS-MD-Standard Gearless   *

**

ProductNameUS-REPAIR QUOTED
ProductNameUS-SV-Amortized-Repair   *

**

ProductNameUS-SV-BR-OG-PM   *

**

ProductNameUS-SV-EL-BR-OG   *

**

ProductNameUS-SV-EL-BR-OG-PM   *

**

ProductNameUS-SV-EL-GL-FM-NOT   *

**

ProductNameUS-SV-EL-GL-FM-NOT-PM   *

**

ProductNameUS-SV-EL-NIM-MOD   *

**

ProductNameUS-SV-EL-PL-FM-TD   *

**

ProductNameUS-SV-EL-PL-FM-TD-PM   *

**

ProductNameUS-SV-EL-PM   *

**
ProductNameUS-SV-EL-PP-FM-24CB   *
**
ProductNameUS-SV-EL-PP-FM-24CB-PM   *
**
ProductNameUS-SV-EL-PP-FM-24CB-WTC   *
**
ProductNameUS-SV-ES-BR-OG   *
**
ProductNameUS-SV-ES-GL-FM-NOT   *
**
ProductNameUS-SV-ES-PL-FM-TD   *
**
ProductNameUS-SV-ES-PP-FM-24CB   *
**
ProductNameUS-SV-ExtWarranty   *
**
ProductNameUS-SV-HEL-SI-LM-2C   *
**
ProductNameUS-SV-HEL-SI-LM-2C-PM   *
**
ProductNameUS-SV-O-BR-OG   *
**
ProductNameUS-SV-O-GL-FM-NOT   *
**
ProductNameUS-SV-O-PL-FM-TD   *
**
ProductNameUS-SV-O-PP-FM-24CB
ParentCategoryGeared
ParentCategoryGearless
ParentCategoryGold
ParentCategoryHydraulic
ParentCategoryNIM
ParentCategoryNULL
ParentCategoryPlatinum
ParentCategoryPlatinum Premier
ParentCategoryQuoted
ParentCategorySilver
ParentCategoryTeleservice
ProductDescAmortized repair line
ProductDescBronze - Oil & Grease ONLY, Pay for all Callbacks - Elevator

ProductDescBronze – Oil & Grease ONLY, Pay for all Callbacks – Elevator – With Phone Monitoring
ProductDescBronze – Oil & Grease ONLY, Pay for all Callbacks – Escalator
ProductDescBronze – Oil & Grease ONLY, Pay for all Callbacks – Other
ProductDescBronze – Oil & Grease ONLY, Pay for all Callbacks – With Phone Monitoring
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime – Elevator – No Phone Monitoring
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime – Elevator – with Phone Monitoring
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime – Escalator
ProductDescGold – Full Maintenance, Customer pays full amount of Overtime – Other
ProductDescNULL
ProductDescPhone Monitoring Elevator
ProductDescPlatinum – Full Maintenace, Overtime portion not covered – Elevator
ProductDescPlatinum – Full Maintenace, Overtime portion not covered – Elevator – With Phone Monitoring
ProductDescPlatinum – Full Maintenace, Overtime portion not covered – Escalator
ProductDescPlatinum – Full Maintenace, Overtime portion not covered – Other
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks – Elevator – No Phone Monitoring
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks – Elevator – with Phone Monitoring
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks – Escalator
ProductDescPlatinum Premiere – Full Maintenance w/ 24 Hour Callbacks – Other
ProductDescRefurbish existing geared machine or replacing with like.
ProductDescRefurbish existing gearless machine or replacing with like.
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, No Phone Monitoring
ProductDescSilver-Hydraulic Elevators, Limited Maintenance, 2 Callbacks, Phone Monitoring
ProductDescTKE MOD NIM ELEVATOR
CompetitorNameIndependent   *
**
CompetitorNameKone   *
**
CompetitorNameMitsubishi   *
**
CompetitorNameNone   *
**
CompetitorNameOtis   *
**
CompetitorNameSchindler   *
**
CompetitorNameUnknown   *
**
MarketSegmentEducation / Religion   *
**
MarketSegmentEntertainment / Leisure   *
**

MarketSegmentFerry Terminal   *
**
MarketSegmentHospital / Healthcare   *
**
MarketSegmentHotel / Restaurant   *
**
MarketSegmentIndustrial   *
**
MarketSegmentMarine   *
**
MarketSegmentMetro / Subway   *
**
MarketSegmentMixed Use Buildings   *
**
MarketSegmentOffice   *
**
MarketSegmentParking Garage   *
**
MarketSegmentPrivate Residential – Comfort   *
**
MarketSegmentPrivate Residential – Premium   *
**
MarketSegmentPrivate Residential–Functional   *
**
MarketSegmentPublic/Semi–Public Residential   *
**
MarketSegmentRailway / Bus Station   *
**
MarketSegmentRetail   *
**
MarketSegmentUnknown   *
**
MarketSegmentUrban Mobility   *
**
Capacity   *
**
FrontOpeningsCnt   *
**
RearOpeningsCnt   *
**
StopsCnt   *

```
      **
      ## OpportunityProductRevenue                                                        *
      **
      ## MarginDollars                                                                     *
      **
      ## GrossMarginPct                                                                    *
      **
      ## OpportunityProductExpectedRevenue                                                 *
      **
      ## OpportunityUnitCnt                                                                *
      **
      ## PricePerUnit                                                                      *
      **
      ## ExpectedEagleRevenue                                                              *
      **
      ## OpportunityProductUnitCnt                                                         *
      **
      ## MaintenanceTypeAmortized repair line
      ## MaintenanceTypeFull Maintenace, Overtime portion not covered
      ## MaintenanceTypeFull Maintenance w/ 24 Hour Callbacks
      ## MaintenanceTypeFull Maintenance, Customer pays full amount of Overtime
      ## MaintenanceTypeHydraulic Elevators, Limited Maintenance, 2 Callbacks
      ## MaintenanceTypeNULL
      ## MaintenanceTypeOil & Grease ONLY, Pay for all Callbacks
      ## MaintenanceTypeRefurbish existing geared machine or replacing with like.
      ## MaintenanceTypeRefurbish existing gearless machine or replacing with like.
      ## MaintenanceTypeTKE MOD NIM
      ## TypeEscalator
      ## TypeNULL
      ## TypeOther
      ## PhoneNULL
      ## PhonePhone Monitoring
      ## PhoneWith Phone Monitoring
      ## ---
      ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
      ##
      ## (Dispersion parameter for binomial family taken to be 1)
      ##
      ##     Null deviance:  187375  on 136218  degrees of freedom
      ## Residual deviance: 3062629  on 136135  degrees of freedom
      ##   (53966 observations deleted due to missingness)
```

```
## AIC: 3062797
##
## Number of Fisher Scoring iterations: 25
```

```
# output results to a csv file
# out_log <- summary.glm(full_model)$coefficients
# write.csv(out_log, "fullmodel_output.csv")

# predict on test data
probabilities <- full_model %>% predict(x.test.df, type = "response")
```

```
## Warning in predict.lm(object, newdata, se.fit, scale = 1, type = if (type
## == : prediction from a rank-deficient fit may be misleading
```

```
predicted.classes <- ifelse(probabilities > mean(training$OpportunityStatus), 1, 0)

# model accuracy
observed.classes <- y.test
mean(predicted.classes == observed.classes)
```

```
## [1] NA
```

```
confusion <- table(predicted.classes, observed.classes)
confusion
```

```
##                  observed.classes
## predicted.classes     0      1
##                 0 16974   8564
##                 1  2005   6584
```

```
sum(diag(confusion)) / sum(confusion)
```

```
## [1] 0.6903039
```

```
confusion[1,1] / sum(confusion[,1])   # PCP for 0 - Lost
```

```
## [1] 0.8943569
```

```
confusion[2,2] / sum(confusion[,2])   # PCP for 1 - Won
```

```
## [1] 0.4346448
```

```
# removed insignificant variables and re-ran the model

final_model <- glm(formula = OpportunityStatus ~ Region+TypeOfSale+CompetitorName+MarketSegment+Capacity+FrontOpe
ningsCnt+OpportunityProductRevenue+MarginDollars+GrossMarginPct+OpportunityProductExpectedRevenue+PricePerUnit+Ex
pectedEagleRevenue+OpportunityProductUnitCnt, family = binomial, data = training)
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(final_model)
```

```
##
## Call:
## glm(formula = OpportunityStatus ~ Region + TypeOfSale + CompetitorName +
##     MarketSegment + Capacity + FrontOpeningsCnt + OpportunityProductRevenue +
##     MarginDollars + GrossMarginPct + OpportunityProductExpectedRevenue +
##     PricePerUnit + ExpectedEagleRevenue + OpportunityProductUnitCnt,
##     family = binomial, data = training)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -8.4904   0.0000   0.0000   0.6969   3.2583
##
## Coefficients:
##                                       Estimate Std. Error z value
## (Intercept)                          2.967e+00  2.241e-01  13.238
## RegionCENTRAL                       -1.685e-01  3.611e-02  -4.666
## RegionFLORIDA                        1.257e-01  3.690e-02   3.406
## RegionMID ATLANTIC                   4.884e-01  3.733e-02  13.084
## RegionMIDWEST                       -1.067e-01  3.414e-02  -3.125
## RegionNORTHEAST                      1.974e-01  3.599e-02   5.484
## RegionPACIFIC NORTHWEST              1.733e-01  3.835e-02   4.520
## RegionSOUTH                         -7.199e-03  3.998e-02  -0.180
## RegionSOUTHEAST                      1.700e-01  3.774e-02   4.504
## RegionSOUTHWEST                      1.094e-01  3.626e-02   3.017
## RegionUnknown                       -4.415e-01  9.874e-02  -4.472
## TypeOfSaleForeign Maintenance       -2.300e+00  9.585e-02 -23.994
## TypeOfSaleForeign NIM               -2.440e+00  1.092e-01 -22.351
## TypeOfSaleNIM                       -7.250e-01  1.004e-01  -7.220
## TypeOfSaleRe-Bid                    -1.088e+00  9.862e-02 -11.034
## TypeOfSaleRecapture                 -1.509e+00  9.774e-02 -15.435
## TypeOfSaleSaved W/Letter            -6.673e-01  1.059e-01  -6.301
## TypeOfSaleTKExtend                  -6.792e-01  9.571e-02  -7.096
## CompetitorNameIndependent           -5.228e-01  7.285e-02  -7.177
## CompetitorNameKone                  -1.320e-01  7.462e-02  -1.769
## CompetitorNameMitsubishi            -1.947e+00  1.935e-01 -10.063
## CompetitorNameNone                  -5.828e-01  7.103e-02  -8.205
## CompetitorNameOtis                   3.546e-02  7.247e-02   0.489
## CompetitorNameSchindler              1.652e-02  7.416e-02   0.223
## CompetitorNameUnknown               -1.414e+02  3.108e+05   0.000
## MarketSegmentEducation / Religion   -5.246e-01  1.885e-01  -2.783
```

```
## MarketSegmentEntertainment / Leisure          -7.546e-01  1.946e-01  -3.879
## MarketSegmentFerry Terminal                    -1.081e+00  4.794e-01  -2.255
## MarketSegmentHospital / Healthcare             -3.662e-01  1.889e-01  -1.938
## MarketSegmentHotel / Restaurant                -7.816e-01  1.892e-01  -4.132
## MarketSegmentIndustrial                        -3.235e-01  1.919e-01  -1.686
## MarketSegmentMarine                             2.972e-01  3.284e-01   0.905
## MarketSegmentMetro / Subway                    -2.014e+00  3.902e-01  -5.160
## MarketSegmentMixed Use Buildings               -5.224e-01  1.914e-01  -2.730
## MarketSegmentOffice                            -5.259e-01  1.879e-01  -2.799
## MarketSegmentParking Garage                    -5.931e-01  2.104e-01  -2.819
## MarketSegmentPrivate Residential - Comfort     -8.074e-01  1.934e-01  -4.174
## MarketSegmentPrivate Residential - Premium     -9.274e-01  1.928e-01  -4.810
## MarketSegmentPrivate Residential-Functional    -9.788e-01  2.026e-01  -4.832
## MarketSegmentPublic/Semi-Public Residential    -6.707e-01  1.890e-01  -3.548
## MarketSegmentRailway / Bus Station             -3.668e-02  2.874e-01  -0.128
## MarketSegmentRetail                            -3.389e-01  1.935e-01  -1.751
## MarketSegmentUnknown                           -1.781e+01  2.148e+02  -0.083
## MarketSegmentUrban Mobility                     7.623e-01  3.912e-01   1.949
## Capacity                                       -2.214e-06  4.204e-06  -0.527
## FrontOpeningsCnt                               -2.571e-02  1.511e-03 -17.016
## OpportunityProductRevenue                      -2.286e-04  1.446e-05 -15.806
## MarginDollars                                   6.008e-06  3.065e-05   0.196
## GrossMarginPct                                  5.030e-04  3.305e-04   1.522
## OpportunityProductExpectedRevenue               2.121e-03  7.847e-05  27.032
## PricePerUnit                                   -7.235e-05  1.866e-05  -3.876
## ExpectedEagleRevenue                            3.503e-05  5.522e-06   6.343
## OpportunityProductUnitCnt                      -1.914e-02  4.102e-03  -4.667
##                                                Pr(>|z|)
## (Intercept)                                     < 2e-16 ***
## RegionCENTRAL                                  3.07e-06 ***
## RegionFLORIDA                                  0.000659 ***
## RegionMID ATLANTIC                              < 2e-16 ***
## RegionMIDWEST                                  0.001781 **
## RegionNORTHEAST                                4.15e-08 ***
## RegionPACIFIC NORTHWEST                        6.19e-06 ***
## RegionSOUTH                                    0.857089
## RegionSOUTHEAST                                6.66e-06 ***
## RegionSOUTHWEST                                0.002555 **
## RegionUnknown                                  7.76e-06 ***
## TypeOfSaleForeign Maintenance                   < 2e-16 ***
## TypeOfSaleForeign NIM                           < 2e-16 ***
```

```
## TypeOfSaleNIM                                   5.21e-13 ***
## TypeOfSaleRe-Bid                                < 2e-16 ***
## TypeOfSaleRecapture                             < 2e-16 ***
## TypeOfSaleSaved W/Letter                        2.96e-10 ***
## TypeOfSaleTKExtend                              1.28e-12 ***
## CompetitorNameIndependent                       7.11e-13 ***
## CompetitorNameKone                              0.076943 .
## CompetitorNameMitsubishi                        < 2e-16 ***
## CompetitorNameNone                              2.31e-16 ***
## CompetitorNameOtis                              0.624642
## CompetitorNameSchindler                         0.823735
## CompetitorNameUnknown                           0.999637
## MarketSegmentEducation / Religion               0.005389 **
## MarketSegmentEntertainment / Leisure            0.000105 ***
## MarketSegmentFerry Terminal                     0.024145 *
## MarketSegmentHospital / Healthcare              0.052634 .
## MarketSegmentHotel / Restaurant                 3.60e-05 ***
## MarketSegmentIndustrial                         0.091836 .
## MarketSegmentMarine                             0.365341
## MarketSegmentMetro / Subway                     2.47e-07 ***
## MarketSegmentMixed Use Buildings                0.006335 **
## MarketSegmentOffice                             0.005122 **
## MarketSegmentParking Garage                     0.004822 **
## MarketSegmentPrivate Residential - Comfort      2.99e-05 ***
## MarketSegmentPrivate Residential - Premium      1.51e-06 ***
## MarketSegmentPrivate Residential-Functional     1.35e-06 ***
## MarketSegmentPublic/Semi-Public Residential     0.000388 ***
## MarketSegmentRailway / Bus Station              0.898461
## MarketSegmentRetail                             0.079931 .
## MarketSegmentUnknown                            0.933917
## MarketSegmentUrban Mobility                     0.051333 .
## Capacity                                        0.598443
## FrontOpeningsCnt                                < 2e-16 ***
## OpportunityProductRevenue                       < 2e-16 ***
## MarginDollars                                   0.844573
## GrossMarginPct                                  0.127976
## OpportunityProductExpectedRevenue               < 2e-16 ***
## PricePerUnit                                    0.000106 ***
## ExpectedEagleRevenue                            2.25e-10 ***
## OpportunityProductUnitCnt                       3.06e-06 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 187375  on 136218  degrees of freedom
## Residual deviance:  99099  on 136166  degrees of freedom
##   (53966 observations deleted due to missingness)
## AIC: 99205
##
## Number of Fisher Scoring iterations: 16
```

```
# predict on test data
probabilities2 <- predict(final_model, type = "response", newdata = x.test.df)
predicted.classes2 <- ifelse(probabilities2 > mean(training$OpportunityStatus), 1, 0)

# model accuracy
observed.classes2 <- y.test
mean(predicted.classes2 == observed.classes2)
```

```
## [1] NA
```

```
confusion2 <- table(predicted.classes2, observed.classes2)
confusion2
```

```
##                   observed.classes2
## predicted.classes2     0      1
##                  0 13358    559
##                  1  5621 14589
```

```
sum(diag(confusion2)) / sum(confusion2)
```

```
## [1] 0.8189117
```

```
#confusion2[1,1] / sum(confusion2[,1])  # PCP for 0 - Lost
#confusion2[2,2] / sum(confusion2[,2])  # PCP for 1 - Won

# Feature Importance for final model

importance <- varImp(final_model)
importance
```

```
##                                                        Overall
## RegionCENTRAL                                      4.666334e+00
## RegionFLORIDA                                      3.405999e+00
## RegionMID ATLANTIC                                 1.308428e+01
## RegionMIDWEST                                      3.124518e+00
## RegionNORTHEAST                                    5.484422e+00
## RegionPACIFIC NORTHWEST                            4.519641e+00
## RegionSOUTH                                        1.800808e-01
## RegionSOUTHEAST                                    4.504396e+00
## RegionSOUTHWEST                                    3.016751e+00
## RegionUnknown                                      4.471679e+00
## TypeOfSaleForeign Maintenance                      2.399351e+01
## TypeOfSaleForeign NIM                              2.235080e+01
## TypeOfSaleNIM                                      7.219690e+00
## TypeOfSaleRe-Bid                                   1.103398e+01
## TypeOfSaleRecapture                                1.543490e+01
## TypeOfSaleSaved W/Letter                           6.300692e+00
## TypeOfSaleTKExtend                                 7.095970e+00
## CompetitorNameIndependent                          7.177239e+00
## CompetitorNameKone                                 1.768703e+00
## CompetitorNameMitsubishi                           1.006339e+01
## CompetitorNameNone                                 8.204598e+00
## CompetitorNameOtis                                 4.892826e-01
## CompetitorNameSchindler                            2.227436e-01
## CompetitorNameUnknown                              4.549791e-04
## MarketSegmentEducation / Religion                  2.782800e+00
## MarketSegmentEntertainment / Leisure               3.878783e+00
## MarketSegmentFerry Terminal                        2.254811e+00
## MarketSegmentHospital / Healthcare                 1.937910e+00
## MarketSegmentHotel / Restaurant                    4.131753e+00
## MarketSegmentIndustrial                            1.685789e+00
## MarketSegmentMarine                                9.052358e-01
## MarketSegmentMetro / Subway                        5.160182e+00
## MarketSegmentMixed Use Buildings                   2.729927e+00
## MarketSegmentOffice                                2.799267e+00
## MarketSegmentParking Garage                        2.818696e+00
## MarketSegmentPrivate Residential - Comfort   4.174032e+00
## MarketSegmentPrivate Residential - Premium   4.809727e+00
## MarketSegmentPrivate Residential-Functional  4.831682e+00
## MarketSegmentPublic/Semi-Public Residential  3.548015e+00
```

```
## MarketSegmentRailway / Bus Station        1.276057e-01
## MarketSegmentRetail                       1.751089e+00
## MarketSegmentUnknown                       8.291706e-02
## MarketSegmentUrban Mobility               1.948681e+00
## Capacity                                   5.266406e-01
## FrontOpeningsCnt                           1.701614e+01
## OpportunityProductRevenue                 1.580625e+01
## MarginDollars                              1.960471e-01
## GrossMarginPct                            1.522134e+00
## OpportunityProductExpectedRevenue         2.703201e+01
## PricePerUnit                               3.876046e+00
## ExpectedEagleRevenue                       6.343476e+00
## OpportunityProductUnitCnt                 4.666751e+00
```

```
# write.csv(importance, "feature_importance.csv")


# save final model
# saveRDS(final_model, "prediction_model.rds")
```

```
# Creating Customer Segmentation

#CRM_original <- read.csv("crmdata.csv")
CRM_original <- read.csv("crmdata.csv")




Region<- CRM_original$Region.DESC
Subtype<- CRM_original$Unit.Subtype.DESC
Market <- CRM_original$Market.Segment.DESC
coveragetype<-CRM_original$Coverage.Type.DESC
sizeofcustomer<- CRM_original$CustomerSize
price <- CRM_original$pricepucrm
Quantity<-1:nrow(CRM_original)
```

```
df = data.frame(region=Region,subtype=Subtype,market=Market,coveragetype=coveragetype,price=price)
df<-df[!(df$market=="Unknown"),]
df<-na.omit(df)
#boxplot(df$price,plot = FALSE)$out


#clustering and segmentation


allrows<-1:nrow(df)




trainrows <- sample(allrows, replace = F, size = 0.15*length(allrows))
df<-df[trainrows,]

gower_df <- daisy(df, metric = "gower")
```

```
silhouette <- c()
silhouette = c(silhouette, NA)

#silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
#cluster size=2

pam_clusters = pam(gower_df, diss = TRUE, k = 2)
df[pam_clusters$medoids,]
```

```
##              region       subtype               market coveragetype price
## 62903     NORTHEAST EL HYDRAULIC               OFFICE         GOLD   215
## 37172 MID ATLANTIC EL HYDRAULIC EDUCATION / RELIGION     PLATINUM   349
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 3)
df[pam_clusters$medoids,]
```

```
##                region       subtype              market        coveragetype
## 43087 MID ATLANTIC EL HYDRAULIC EDUCATION / RELIGION          PLATINUM
## 46631        MIDWEST EL HYDRAULIC                  OFFICE             GOLD
## 68925      NORTHEAST EL TR GEARED  MIXED USE BUILDINGS PLATINUM PREMIERE
##        price
## 43087   200
## 46631   240
## 68925   475
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 4)
df[pam_clusters$medoids,]
```

```
##                region       subtype              market        coveragetype
## 68404      NORTHEAST EL HYDRAULIC  MIXED USE BUILDINGS PLATINUM PREMIERE
## 57510        MIDWEST EL HYDRAULIC                  OFFICE             GOLD
## 84816          SOUTH EL TR GEARED                  OFFICE         PLATINUM
## 33470 MID ATLANTIC EL HYDRAULIC EDUCATION / RELIGION          PLATINUM
##         price
## 68404 337.55
## 57510 215.00
## 84816 489.27
## 33470 190.00
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 5)
df[pam_clusters$medoids,]
```

```
##              region       subtype                 market         coveragetype
## 821      CALIFORNIA EL HYDRAULIC   MIXED USE BUILDINGS                 PLATINUM
## 20781       FLORIDA EL HYDRAULIC                   OFFICE                 GOLD
## 68787     NORTHEAST EL TR GEARED HOSPITAL / HEALTHCARE PLATINUM PREMIERE
## 43135 MID ATLANTIC EL HYDRAULIC  EDUCATION / RELIGION                 GOLD
## 56020       MIDWEST EL TR GEARED                   OFFICE             PLATINUM
##          price
## 821     258.30
## 20781   225.00
## 68787   587.53
## 43135   175.00
## 56020   450.00
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 6)
df[pam_clusters$medoids,]
```

```
##               region       subtype                 market         coveragetype
## 65465      NORTHEAST EL HYDRAULIC   MIXED USE BUILDINGS                 GOLD
## 112719     SOUTHWEST EL HYDRAULIC                   OFFICE                 GOLD
## 21934        FLORIDA EL TR GEARED HOSPITAL / HEALTHCARE PLATINUM PREMIERE
## 43359  MID ATLANTIC EL HYDRAULIC  EDUCATION / RELIGION              PLATINUM
## 51931        MIDWEST EL HYDRAULIC  EDUCATION / RELIGION                 GOLD
## 56020        MIDWEST EL TR GEARED                   OFFICE             PLATINUM
##          price
## 65465    250.0
## 112719   200.0
## 21934    508.4
## 43359    274.0
## 51931    165.0
## 56020    450.0
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 7)
df[pam_clusters$medoids,]
```

```
##              region      subtype              market        coveragetype
## 1681     CALIFORNIA EL HYDRAULIC   MIXED USE BUILDINGS                GOLD
## 112719    SOUTHWEST EL HYDRAULIC               OFFICE                GOLD
## 62260     NORTHEAST EL TR GEARED   MIXED USE BUILDINGS PLATINUM PREMIERE
## 28117       FLORIDA EL HYDRAULIC HOSPITAL / HEALTHCARE PLATINUM PREMIERE
## 33504  MID ATLANTIC EL HYDRAULIC   EDUCATION / RELIGION            PLATINUM
## 44670       MIDWEST EL HYDRAULIC   EDUCATION / RELIGION                GOLD
## 56020       MIDWEST EL TR GEARED               OFFICE            PLATINUM
##          price
## 1681    230.00
## 112719  200.00
## 62260   646.91
## 28117   310.00
## 33504   250.00
## 44670   160.00
## 56020   450.00
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 8)
df[pam_clusters$medoids,]
```

```
##              region      subtype                   market      coveragetype
## 111739    SOUTHWEST EL HYDRAULIC    MIXED USE BUILDINGS                 GOLD
## 58365       MIDWEST EL HYDRAULIC                   OFFICE                GOLD
## 62260     NORTHEAST EL TR GEARED    MIXED USE BUILDINGS PLATINUM PREMIERE
## 20402       FLORIDA EL HYDRAULIC HOSPITAL / HEALTHCARE PLATINUM PREMIERE
## 3766      CALIFORNIA EL HYDRAULIC    MIXED USE BUILDINGS           PLATINUM
## 34112  MID ATLANTIC EL HYDRAULIC   EDUCATION / RELIGION           PLATINUM
## 100975    SOUTHEAST EL HYDRAULIC   EDUCATION / RELIGION               GOLD
## 88705         SOUTH EL TR GEARED                   OFFICE           PLATINUM
##          price
## 111739 200.00
## 58365  225.00
## 62260  646.91
## 20402  316.63
## 3766   285.00
## 34112  210.00
## 100975 160.00
## 88705  450.00
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
pam_clusters = pam(gower_df, diss = TRUE, k = 9)
df[pam_clusters$medoids,]
```

```
##              region        subtype                  market      coveragetype
## 65533      NORTHEAST EL HYDRAULIC   MIXED USE BUILDINGS               GOLD
## 112719     SOUTHWEST EL HYDRAULIC                  OFFICE               GOLD
## 59778      NORTHEAST EL TR GEARED                  OFFICE PLATINUM PREMIERE
## 27296        FLORIDA EL HYDRAULIC HOSPITAL / HEALTHCARE PLATINUM PREMIERE
## 49618        MIDWEST EL TR GEARED HOSPITAL / HEALTHCARE          PLATINUM
## 50700        MIDWEST EL HYDRAULIC  EDUCATION / RELIGION               GOLD
## 34097  MID ATLANTIC EL HYDRAULIC  EDUCATION / RELIGION          PLATINUM
## 84814         SOUTH EL HYDRAULIC                  OFFICE          PLATINUM
## 463      CALIFORNIA EL HYDRAULIC   MIXED USE BUILDINGS          PLATINUM
##            price
## 65533     240.00
## 112719 200.00
## 59778   677.00
## 27296   275.00
## 49618   400.00
## 50700   155.00
## 34097   220.00
## 84814   489.27
## 463      300.00
```

```
silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```r
#pam_clusters = pam(gower_df, diss = TRUE, k = 10)
#df[pam_clusters$medoids,]

dd <- cbind(df, cluster = pam_clusters$cluster)

silhouette = c(silhouette ,pam_clusters$silinfo$avg.width)
```

```
write.csv(dd,"all_clusters.csv")
write.csv(df[pam_clusters$medoids,],"cluster_centroids.csv")

silhouette[0]<-0
#pam_clusters$data<-df

#fviz_cluster(pam_clusters)

plot(2:9, silhouette[2:9],
     xlab = "Clusters",
     ylab = "Silhouette Width")



lines(2:9,silhouette[2:9],color='black')
```

```
## Warning in plot.xy(xy.coords(x, y), type = type, ...): "color" is not a
## graphical parameter
```