

STAT 5014: Homework Two

Bobby Soule

9/12/2017

Problem 4

I think using Git will primarily help me by providing an easy-to-use backup system. I will not have to worry about losing files; and if I make a mistake while editing a project, then I can simply revert back to the previous version. Additionally, I think it will be very helpful in any future scenarios where I collaborate on a project.

Problem 5

Part A: Sensory Data

```
url <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/Sensory.dat"
sensory_data <- read.table(url, header=FALSE, skip=1, fill=TRUE, stringsAsFactors=F) %>%
  tbl_df

sensory_data <- sensory_data[-1,]
colnames(sensory_data) <- c("Item", "V1", "V2", "V3", "V4", "V5")

sensory_data_NArows <- filter(.data=sensory_data, is.na(V5)) %>%
  select(V1=Item, V2=V1, V3=V2, V4=V3, V5=V4) %>%
  mutate(Item=rep(as.character(1:(nrow(sensory_data)/3)), each=2),
         V1=as.numeric(V1)) %>%
  select(Item, V1:V5)

sensory_data <- filter(.data=sensory_data, !is.na(V5)) %>%
  bind_rows(sensory_data_NArows)
colnames(sensory_data)[2:6] <- paste("Operator", 1:5, sep="_")

sensory_final <- gather(data=sensory_data, key=Operator, value=Measure,
                      Operator_1:Operator_5) %>%
  mutate(Operator = gsub("Operator_", "", Operator)) %>%
  arrange(Item)

knitr::kable(summary(sensory_final), caption="Sensory Data Summary")
```

Table 1: Sensory Data Summary

Item	Operator	Measure
Length:150	Length:150	Min. :0.700
Class :character	Class :character	1st Qu.:3.025
Mode :character	Mode :character	Median :4.700
NA	NA	Mean :4.657
NA	NA	3rd Qu.:6.000
NA	NA	Max. :9.400

Part B: Gold Medal Olympic Long Jump Distances (Men)

```
url2 <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/LongJumpData.dat"
ljump_data <- read.table(url2, header=FALSE, skip=1, fill=TRUE, stringsAsFactors=FALSE) %>%
  tbl_df()

colnames(ljump_data) <- rep(c("Year", "Distance"), times=4)
ljump_final <- rbind(ljump_data[,1:2], ljump_data[,3:4], ljump_data[,5:6], ljump_data[,7:8]) %>%
  filter(!is.na(Year)) %>%
  mutate(Year = Year+1900)

knitr::kable(summary(ljump_final), caption="Long Jump Data Summary")
```

Table 2: Long Jump Data Summary

Year	Distance
Min. :1896	Min. :249.8
1st Qu.:1921	1st Qu.:295.4
Median :1950	Median :308.1
Mean :1945	Mean :310.3
3rd Qu.:1971	3rd Qu.:327.5
Max. :1992	Max. :350.5

Part C: Brain Weight vs Body Weight

```
url3 <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/BrainandBodyWeight.dat"
brain_body_data <- read.table(url3, header=FALSE, skip=1, fill=TRUE, stringsAsFactors=FALSE) %>%
  tbl_df()

colnames(brain_body_data) <- rep(c("Body_Wt", "Brain_Wt"), times=3)
brain_body_final <- rbind(brain_body_data[,1:2], brain_body_data[,3:4], brain_body_data[,5:6]) %>%
  filter(!is.na(Body_Wt))

knitr::kable(summary(brain_body_final), caption="Brain & Body Weight Data Summary")
```

Table 3: Brain & Body Weight Data Summary

Body_Wt	Brain_Wt
Min. : 0.005	Min. : 0.10
1st Qu.: 0.600	1st Qu.: 4.25
Median : 3.342	Median : 17.25
Mean : 198.790	Mean : 283.13
3rd Qu.: 48.203	3rd Qu.: 166.00
Max. :6654.000	Max. :5712.00

Part D: Tomato Yield vs. Variety & Planting Density

```
url4 <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/tomato.dat"
tom_data <- read.table(url4, header=FALSE, skip=2, fill=TRUE,
```

```

stringsAsFactors=FALSE, comment.char = "")
colnames(tom_data) <- c("Variety", "1000", "2000", "3000")
tom_data[1,1] <- "Ife_1"
tom_data[2,2] <- gsub("10.1,", "10.1", tom_data[2,2])

tom_final <- tom_data %>%
  gather(key=Density, value=Yield, -Variety) %>%
  separate(Yield, into=paste("Yield", 1:3, sep="_"), sep=",") %>%
  gather(key=Replicate, value=Yield, Yield_1:Yield_3) %>%
  mutate(Replicate = gsub("Yield_", "", Replicate), Yield=as.numeric(Yield)) %>%
  arrange(Variety, Density)

knitr::kable(summary(tom_final), caption="Tomato Yield Data summary")

```

Table 4: Tomato Yield Data summary

Variety	Density	Replicate	Yield
Length:18	Length:18	Length:18	Min. : 8.10
Class :character	Class :character	Class :character	1st Qu.:12.95
Mode :character	Mode :character	Mode :character	Median :15.35
NA	NA	NA	Mean :15.07
NA	NA	NA	3rd Qu.:17.88
NA	NA	NA	Max. :21.00

Problem 6

```

# Path to data
library(swirl)

##
## | Hi! I see that you have some variables saved in your workspace. To keep
## | things running smoothly, I recommend you clean up before starting swirl.
##
## | Type ls() to see a list of the variables in your workspace. Then, type
## | rm(list=ls()) to clear your workspace.
##
## | Type swirl() when you are ready to begin.

datapath <- file.path(path.package('swirl'), 'Courses', 'R_Programming_E',
                      'Looking_at_Data', 'plant-data.txt')
plants <- read.csv(datapath, strip.white=TRUE, na.strings="") %>%
  tbl_df
detach(package:swirl)

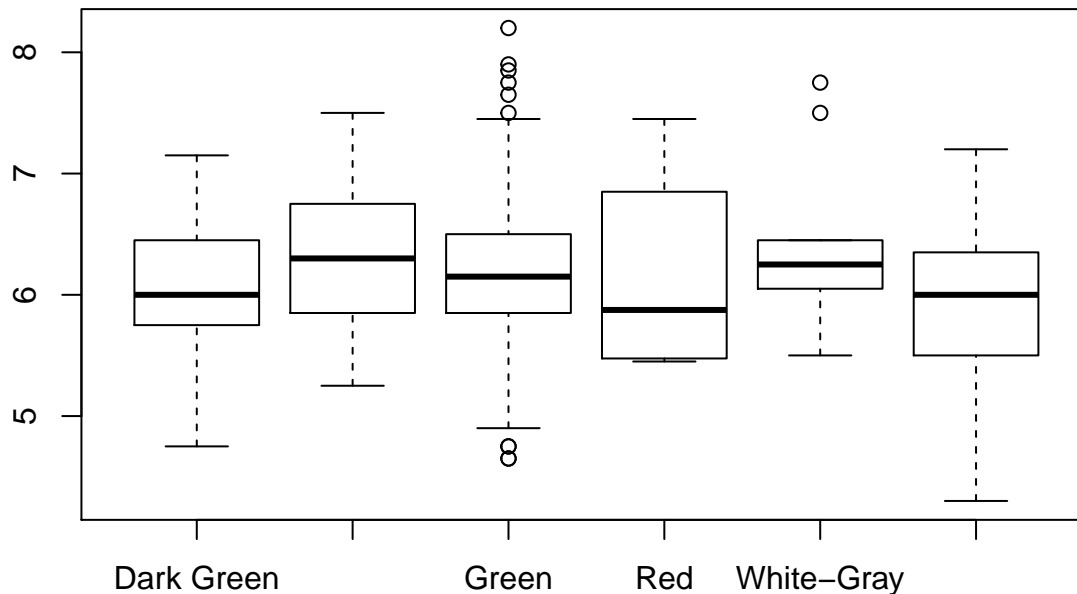
# Remove annoying columns
cols2rm <- c('Accepted.Symbol', 'Synonym.Symbol')
plants <- plants[, !(names(plants) %in% cols2rm)]

# Make names pretty
names(plants) <- c('Scientific_Name', 'Duration', 'Active_Growth_Period',
                  'Foliage_Color', 'pH_Min', 'pH_Max', 'Precip_Min',
                  'Precip_Max', 'Shade_Tolerance', 'Temp_Min_F')

```

```
plants_final <- plants %>%
  mutate(pH_Mid = (pH_Max+pH_Min)/2) %>%
  select(Scientific_Name, Foliage_Color, pH_Mid) %>%
  filter(!is.na(Foliage_Color) | !is.na(pH_Mid))

plot(plants_final$Foliage_Color, plants_final$pH_Mid)
```



```
plants_reg <- lm(formula = pH_Mid ~ Foliage_Color, data = plants_final)
plants_anova <- anova(plants_reg)
```

```
knitr::kable(summary(plants_reg)$coef, caption="Regression Coefficients")
```

Table 5: Regression Coefficients

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	5.9993902	0.0595117	100.8102732	0.0000000
Foliage_ColorGray-Green	0.4126098	0.1231188	3.3513153	0.0008408
Foliage_ColorGreen	0.1847138	0.0629390	2.9348073	0.0034300
Foliage_ColorRed	0.1631098	0.2759444	0.5910965	0.5546175
Foliage_ColorWhite-Gray	0.4450542	0.1892351	2.3518582	0.0189138
Foliage_ColorYellow-Green	-0.0618902	0.1343963	-0.4605055	0.6452747

```
knitr::kable(plants_anova, caption="ANOVA Table")
```

Table 6: ANOVA Table

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Foliage_Color	5	5.747631	1.1495262	3.958224	0.0014895
Residuals	826	239.882486	0.2904146	NA	NA

Problem 7

```
#defect code, defect comment
Car_Gebreken <- fread(input = "Open_Data_RDW_Gebreken.csv",
                      header = T, select=c(1,6), showProgress=F) %>% tbl_df
colnames(Car_Gebreken) <- c("Code", "Comment")
#license plate, inspection date, defect code
Car_Geconstat <- fread(input = "Open_Data_RDW_Geconstateerde_Gebreken.csv",
                      header=T, select=c(1,3,5),showProgress=F) %>% tbl_df
colnames(Car_Geconstat) <- c("Plate", "Inspect_Date", "Code")
Car_Geconstat <- mutate(Car_Geconstat, Inspect_Date = ymd(Inspect_Date)) %>%
  filter(year(Inspect_Date) == 2017)
#license plate, make, model
Car_Person <- fread(input = "Personenauto_basisdata.csv",
                    header=T, showProgress = F, select = c(1,3,4)) %>% tbl_df
colnames(Car_Person) <- c("Plate", "Make", "Model")

Car_Final <- full_join(x = Car_Geconstat, y = Car_Person, by = "Plate") %>%
  full_join(y = Car_Gebreken, by = "Code")
Car_Final <- Car_Final[complete.cases(Car_Final),]

unique_make <- n_distinct(Car_Final$Make)
unique_make

## [1] 503

unique_model <- n_distinct(Car_Final$Model)
unique_model

## [1] 33470

Car_byCode <- group_by(Car_Final, Code, Comment)
Freq_Defects <- summarize(Car_byCode, Count=n()) %>%
  arrange(desc(Count)) %>%
  head(5)
top5_defects <- Freq_Defects$Code

Car_byCodeMakeModel <- group_by(Car_Final, Code, Make, Model)
Freq_Defects2 <- summarize(Car_byCodeMakeModel, Count=n()) %>%
  filter(Code %in% top5_defects) %>%
  arrange(desc(Count))

for (code in top5_defects) {
  assign(code,
    filter(Freq_Defects2, Code==code) %>%
    arrange(desc(Count)) %>%
    head(5) %>% ungroup %>%
    mutate(Tot_Count = sum(Count))
  )
}

Freq_Defects_Final <- get(top5_defects[1])
for (i in 2:length(top5_defects)) {
  Freq_Defects_Final <- rbind(Freq_Defects_Final, get(top5_defects[i]))
}
```

```

tot_counts <- Freq_Defects$Count
names(tot_counts) <- Freq_Defects$Code
Freq_Defects_Final <- mutate(Freq_Defects_Final, Tot_Count = tot_counts[Code])

knitr::kable(Freq_Defects_Final, caption="Top Five Defects")

```

Table 7: Top Five Defects

Code	Make	Model	Count	Tot_Count
AC1	VOLKSWAGEN	POLO	5744	385621
AC1	VOLKSWAGEN	GOLF	4312	385621
AC1	TOYOTA	TOYOTA AYGO	4103	385621
AC1	PEUGEOT	PEUGEOT 107	3769	385621
AC1	OPEL	CORSA	3516	385621
K04	VOLKSWAGEN	POLO	3389	271259
K04	OPEL	CORSA	3263	271259
K04	RENAULT	TWINGO	2864	271259
K04	RENAULT	CLIO	2656	271259
K04	TOYOTA	TOYOTA AYGO	2613	271259
RA2	PEUGEOT	206; 1.4 3DRS	2913	223142
RA2	FIAT	FIAT PUNTO; 1.2	2518	223142
RA2	OPEL	ASTRA-G-CC; X1.6SZR	2268	223142
RA2	PEUGEOT	206; 1.4 5DRS	2126	223142
RA2	OPEL	CORSA-C; Z1.2XE	2022	223142
205	VOLKSWAGEN	POLO	2474	171244
205	PEUGEOT	PEUGEOT 107	2174	171244
205	TOYOTA	TOYOTA AYGO	2130	171244
205	VOLKSWAGEN	GOLF	1832	171244
205	CITROEN	CITROEN C1	1831	171244
497	OPEL	CORSA	2352	139980
497	VOLKSWAGEN	POLO	1971	139980
497	RENAULT	TWINGO	1800	139980
497	PEUGEOT	PEUGEOT 107	1796	139980
497	RENAULT	MEGANE	1770	139980

```

cars_reg <- lm(formula = Count ~ Make, data = Freq_Defects2)
cars_anova <- anova(cars_reg)

knitr::kable(summary(cars_reg)$coef, caption="Regression Coefficients")

```

Table 8: Regression Coefficients

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.0000000	108.3822	0.0092266	0.9926384
MakeA.M.C.	-0.0000001	132.7406	0.0000000	1.0000000
MakeACCUBUILT	0.0000000	132.7406	0.0000000	1.0000000
MakeACM	0.0000000	153.2756	0.0000000	1.0000000
MakeACURA	0.0000000	121.1750	0.0000000	1.0000000
MakeADRIA	0.3870967	110.1165	0.0035153	0.9971952
MakeADRIA MOBIL	1.1444444	108.9827	0.0105012	0.9916215
MakeAIXAM	0.0000000	132.7406	0.0000000	1.0000000

	Estimate	Std. Error	t value	Pr(> t)
MakeALFA ROMEO	8.7142857	108.4400	0.0803604	0.9359509
MakeALKO	0.3181818	109.6069	0.0029029	0.9976838
MakeALPINA	0.0000000	111.9367	0.0000000	1.0000000
MakeALPINE-RENAULT	0.3076923	112.4736	0.0027357	0.9978173
MakeALVIS	0.0000000	153.2756	0.0000000	1.0000000
MakeAMC JEEP	0.0000000	125.1490	0.0000000	1.0000000
MakeAMERICAN	0.0000000	153.2756	0.0000000	1.0000000
MakeAMERICAN CUSTOM COACHWORK	0.0000000	153.2756	0.0000000	1.0000000
MakeAMERICAN MOTORS	0.0000000	121.1750	0.0000000	1.0000000
MakeARCA	0.0000000	132.7406	0.0000000	1.0000000
MakeARIEL	0.0000000	132.7406	0.0000000	1.0000000
MakeARMBRUSTER/STAGEWAY	0.0000000	153.2756	0.0000000	1.0000000
MakeASIA	0.0000000	132.7406	0.0000000	1.0000000
MakeASTON-MARTIN	0.7750000	109.7287	0.0070629	0.9943647
MakeAUDI	11.3865058	108.4065	0.1050353	0.9163481
MakeAUDI/PORSCHE	0.0000000	153.2756	0.0000000	1.0000000
MakeAUSTIN	0.2238806	109.1881	0.0020504	0.9983640
MakeAUSTIN-HEALEY	0.0000000	115.8655	0.0000000	1.0000000
MakeAUSTIN-VANDEN PLAS	0.0000000	153.2756	0.0000000	1.0000000
MakeAUTO BIANCHI	0.3846153	112.4736	0.0034196	0.9972716
MakeAUTO UNION	2.0540540	108.5153	0.0189287	0.9848980
MakeAUTOSTAR	0.3000000	113.6723	0.0026392	0.9978943
MakeBALZER/APAL	0.0000000	153.2756	0.0000000	1.0000000
MakeBARTAN	0.0000000	153.2756	0.0000000	1.0000000
MakeBAVARIA	0.0000000	117.0662	0.0000000	1.0000000
MakeBEARDMORE	0.0000000	153.2756	0.0000000	1.0000000
MakeBEAUFORD	0.0000000	153.2756	0.0000000	1.0000000
MakeBEDFORD	0.2222222	110.3711	0.0020134	0.9983935
MakeBEDFORD-HYMERMOBIL	0.5000000	121.1750	0.0041263	0.9967077
MakeBENIMAR	0.1000000	113.6723	0.0008797	0.9992981
MakeBENTLEY	0.3877551	109.4826	0.0035417	0.9971741
MakeBERTONE	0.2000000	118.7268	0.0016845	0.9986559
MakeBINZ	0.7500000	121.1750	0.0061894	0.9950616
MakeBLUE BIRD	0.0000000	153.2756	0.0000000	1.0000000
MakeBMW	12.2687302	108.4013	0.1131788	0.9098892
MakeBMW I	0.0000000	153.2756	0.0000000	1.0000000
MakeBOMBARDIER	0.0000000	153.2756	0.0000000	1.0000000
MakeBOONACKER	0.1428571	115.8655	0.0012330	0.9990162
MakeBORGWARD	0.3333333	125.1490	0.0026635	0.9978749
MakeBOSMAL	1.0000000	125.1490	0.0079905	0.9936246
MakeBOVA	0.0000000	132.7406	0.0000000	1.0000000
MakeBREMACH	0.0000000	132.7406	0.0000000	1.0000000
MakeBUERSTNER	0.8135593	108.8405	0.0074748	0.9940361
MakeBUICK	0.6301369	109.1221	0.0057746	0.9953926
MakeBYD	0.0000000	153.2756	0.0000000	1.0000000
MakeCADILLAC	1.5478723	108.6701	0.0142438	0.9886355
MakeCAPRON	0.4000000	109.9197	0.0036390	0.9970965
MakeCAR CRAFT	0.0000000	153.2756	0.0000000	1.0000000
MakeCARAVANS INTERNAT. SPA	0.0000000	115.8655	0.0000000	1.0000000
MakeCARBODIES	0.0000000	132.7406	0.0000000	1.0000000
MakeCARTHAGO	0.3448275	110.2351	0.0031281	0.9975041
MakeCATERHAM	0.6250000	114.9567	0.0054368	0.9956621

	Estimate	Std. Error	t value	Pr(> t)
MakeCBT	0.0000000	115.8655	0.0000000	1.0000000
MakeCHALLENGER	0.0000000	153.2756	0.0000000	1.0000000
MakeCHALLENGER	0.2222222	110.3711	0.0020134	0.9983935
MakeCHAMONIX	0.0000000	153.2756	0.0000000	1.0000000
MakeCHATEAU	0.5000000	121.1750	0.0041263	0.9967077
MakeCHAUSSON	0.4067796	109.2969	0.0037218	0.9970305
MakeCHECKER	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET	16.4337837	108.4554	0.1515257	0.8795616
MakeCHEVROLET DAEWOO	0.5000000	132.7406	0.0037667	0.9969946
MakeCHEVROLET ITALIA	0.5000000	132.7406	0.0037667	0.9969946
MakeCHEVROLET-CRUISE MASTER	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET-EDSON	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET-EL DORADO	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET-ITASCA	0.3333333	125.1490	0.0026635	0.9978749
MakeCHEVROLET-JAYCO	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET-LINDY	0.0000000	132.7406	0.0000000	1.0000000
MakeCHEVROLET-SOUTHWIND	0.0000000	153.2756	0.0000000	1.0000000
MakeCHEVROLET-STARCRAFT	0.0000000	132.7406	0.0000000	1.0000000
MakeCHEVROLET-WINNEBAGO	0.0000000	153.2756	0.0000000	1.0000000
MakeCHRYSLER	7.7699805	108.4878	0.0716208	0.9429040
MakeCHRYSLER-SIMCA	0.0000000	153.2756	0.0000000	1.0000000
MakeCITROEN	23.6607284	108.4037	0.2182650	0.8272234
MakeCITY-VAN	0.0000000	153.2756	0.0000000	1.0000000
MakeCMC	0.0000000	153.2756	0.0000000	1.0000000
MakeCOLLINS	0.0000000	153.2756	0.0000000	1.0000000
MakeCOMMER	0.2000000	118.7268	0.0016845	0.9986559
MakeCONCORDE	0.0000000	112.8078	0.0000000	1.0000000
MakeCONCORDE REISEMOBILE GMBH	0.0000000	153.2756	0.0000000	1.0000000
MakeCRISTALL	0.0000000	121.1750	0.0000000	1.0000000
MakeD.K.W.	0.0000000	118.7268	0.0000000	1.0000000
MakeDACIA	85.1081081	109.8371	0.7748575	0.4384270
MakeDAEWOO	19.5009380	108.4839	0.1797589	0.8573425
MakeDAF	0.7205882	109.1763	0.0066002	0.9947338
MakeDAIHATSU	39.9488817	108.5552	0.3680051	0.7128708
MakeDAIMLER	1.0547945	109.1221	0.0096662	0.9922877
MakeDAIMLER BENZ	0.0000000	118.7268	0.0000000	1.0000000
MakeDAIMLERCHRYSLER AG	0.0952381	110.9328	0.0008585	0.9993150
MakeDATSUN	0.1052631	111.1978	0.0009466	0.9992447
MakeDAX	0.0000000	118.7268	0.0000000	1.0000000
MakeDAX COBRA	0.1666666	117.0662	0.0014237	0.9988641
MakeDE LOREAN	0.0000000	153.2756	0.0000000	1.0000000
MakeDE TOMASO	0.0000000	153.2756	0.0000000	1.0000000
MakeDEN OUDSTEN	0.0000000	153.2756	0.0000000	1.0000000
MakeDERCKS	0.7777777	114.2449	0.0068080	0.9945681
MakeDETHLEFFS	0.4456521	108.6764	0.0041007	0.9967281
MakeDODGE	4.1102941	108.7800	0.0377854	0.9698589
MakeDODGE-EDSON	0.0000000	153.2756	0.0000000	1.0000000
MakeDODGE-MIDAS	0.0000000	153.2756	0.0000000	1.0000000
MakeDONKERVVOORT(JD)	0.2142857	112.1863	0.0019101	0.9984760
MakeDREAM	0.0000000	132.7406	0.0000000	1.0000000
MakeDUTTON	0.0000000	125.1490	0.0000000	1.0000000
MakeE.B.S.	0.0000000	153.2756	0.0000000	1.0000000

	Estimate	Std. Error	t value	Pr(> t)
MakeE.W.B	0.0000000	132.7406	0.0000000	1.0000000
MakeEIGENBOUW	0.0000000	153.2756	0.0000000	1.0000000
MakeELNAGH	0.4545454	110.8181	0.0041017	0.9967273
MakeESTEREL	0.0000000	153.2756	0.0000000	1.0000000
MakeEURA MOBIL	0.0000000	111.7179	0.0000000	1.0000000
MakeEVM	0.0000000	153.2756	0.0000000	1.0000000
MakeEXCALIBUR	0.0000000	121.1750	0.0000000	1.0000000
MakeEXECUTIVE COACH BUILDERS	0.0000000	153.2756	0.0000000	1.0000000
MakeFENDT	0.5000000	132.7406	0.0037667	0.9969946
MakeFERRARI	0.4000000	109.1024	0.0036663	0.9970748
MakeFIAT	27.8287139	108.4123	0.2566934	0.7974164
MakeFIAT/CHALLENGER	1.0000000	153.2756	0.0065242	0.9947945
MakeFISKER	1.5000000	132.7406	0.0113002	0.9909839
MakeFLEETWOOD	0.0000000	125.1490	0.0000000	1.0000000
MakeFLEURETTE	0.0000000	121.1750	0.0000000	1.0000000
MakeFORD	32.8904854	108.4033	0.3034086	0.7615796
MakeFORD-CASUAL	0.0000000	153.2756	0.0000000	1.0000000
MakeFORD-CNG-TECHNIK	3.6666666	114.2449	0.0320948	0.9743966
MakeFORD-RAMBLER	1.0000000	153.2756	0.0065242	0.9947945
MakeFRANKIA	0.1428571	112.1863	0.0012734	0.9989840
MakeFSM	0.3333333	125.1490	0.0026635	0.9978749
MakeG.M.C.	0.3466666	109.1024	0.0031774	0.9974648
MakeGALLOPER	0.0000000	132.7406	0.0000000	1.0000000
MakeGARDNER DOUGLAS	0.0000000	132.7406	0.0000000	1.0000000
MakeGAZ	0.0000000	132.7406	0.0000000	1.0000000
MakeGENERAL MOTORS-GMC	0.0000000	153.2756	0.0000000	1.0000000
MakeGEO	0.5000000	121.1750	0.0041263	0.9967077
MakeGINETTA	0.0000000	153.2756	0.0000000	1.0000000
MakeGIOTTILINE	0.3333333	117.0662	0.0028474	0.9977281
MakeGM DAEWOO	0.0000000	118.7268	0.0000000	1.0000000
MakeGMC	0.0000000	153.2756	0.0000000	1.0000000
MakeGMC-EDSON	0.2000000	118.7268	0.0016845	0.9986559
MakeGMC-MIDAS	0.6000000	113.6723	0.0052783	0.9957885
MakeGMC-TIOGA	0.0000000	153.2756	0.0000000	1.0000000
MakeGOGGOMOBIL	0.0000000	153.2756	0.0000000	1.0000000
MakeGORGUS	0.0000000	153.2756	0.0000000	1.0000000
MakeGURGEL	0.0000000	153.2756	0.0000000	1.0000000
MakeHAMMOND & THIEDE	0.0000000	132.7406	0.0000000	1.0000000
MakeHANOMAG	0.0000000	153.2756	0.0000000	1.0000000
MakeHANOMAG-HENSCHEL	0.0909090	110.8181	0.0008203	0.9993455
MakeHEALEY	0.0000000	153.2756	0.0000000	1.0000000
MakeHESS EN EISENHARDT	0.0000000	132.7406	0.0000000	1.0000000
MakeHILLMAN	0.0000000	153.2756	0.0000000	1.0000000
MakeHINDUSTAN	0.0000000	153.2756	0.0000000	1.0000000
MakeHOBBY	0.5833333	110.6172	0.0052734	0.9957924
MakeHOME CAR	0.0000000	115.8655	0.0000000	1.0000000
MakeHONDA	8.9554140	108.4315	0.0825905	0.9341774
MakeHOTCHKISS	0.0000000	132.7406	0.0000000	1.0000000
MakeHUISKAMP	0.0000000	125.1490	0.0000000	1.0000000
MakeHUMBER	0.0000000	125.1490	0.0000000	1.0000000
MakeHUMMER	0.3750000	111.7179	0.0033567	0.9973218
MakeHYMER	0.7638888	108.6328	0.0070318	0.9943895

	Estimate	Std. Error	t value	Pr(> t)
MakeHYUNDAI	39.9568862	108.4471	0.3684458	0.7125422
MakeI.V.R.	0.0000000	125.1490	0.0000000	1.0000000
MakeIAV	1.5000000	121.1750	0.0123788	0.9901235
MakeIMPERIAL	0.0000000	153.2756	0.0000000	1.0000000
MakeINFINITI	0.8863636	109.6069	0.0080867	0.9935478
MakeINNOCENTI	0.0000000	153.2756	0.0000000	1.0000000
MakeINTERNATIONAL	0.1428571	115.8655	0.0012330	0.9990162
MakeISUZU	0.5714285	115.8655	0.0049318	0.9960650
MakeITINEO	0.0000000	125.1490	0.0000000	1.0000000
MakeIVECO	0.2788461	108.9021	0.0025605	0.9979570
MakeIVECO FIAT	0.0000000	153.2756	0.0000000	1.0000000
MakeJAGO	0.0000000	153.2756	0.0000000	1.0000000
MakeJAGUAR	2.5905660	108.4844	0.0238796	0.9809487
MakeJAGUAR CARS	6.0344827	109.0033	0.0553605	0.9558514
MakeJAGUAR LAND ROVER	0.5000000	114.9567	0.0043495	0.9965297
MakeJCSPORTCAR	0.0000000	153.2756	0.0000000	1.0000000
MakeJEEP	3.7251308	108.5240	0.0343254	0.9726178
MakeJENSEN	0.6666666	117.0662	0.0056948	0.9954563
MakeJIANGLING	0.0000000	153.2756	0.0000000	1.0000000
MakeJOINT	0.1052631	111.1978	0.0009466	0.9992447
MakeKAISER	0.3333333	125.1490	0.0026635	0.9978749
MakeKARMANN MOBIL	0.5294117	111.5244	0.0047470	0.9962124
MakeKIA	47.8233995	108.5018	0.4407613	0.6593874
MakeKIA MOTORS	0.1250000	114.9567	0.0010874	0.9991324
MakeKIAMASTER	0.2500000	121.1750	0.0020631	0.9983539
MakeKNAUS	0.8235294	109.1763	0.0075431	0.9939815
MakeKNAUS TABBERT	0.2222222	114.2449	0.0019451	0.9984480
MakeKTM	0.0000000	153.2756	0.0000000	1.0000000
MakeL.T.I.CARBODIES	0.0000000	132.7406	0.0000000	1.0000000
MakeLA STRADA	2.0000000	132.7406	0.0150670	0.9879788
MakeLADA	0.2857142	109.9197	0.0025993	0.9979261
MakeLADA-VAZ	0.6250000	111.7179	0.0055944	0.9955363
MakeLAIKA	0.1111111	114.2449	0.0009726	0.9992240
MakeLAIKA CARAVANS S.P.A.	0.0000000	115.8655	0.0000000	1.0000000
MakeLAMBORGHINI	0.0000000	114.9567	0.0000000	1.0000000
MakeLANCIA	4.2040816	108.5401	0.0387330	0.9691034
MakeLAND ROVER	5.8561643	108.5059	0.0539709	0.9569585
MakeLANDWIND	1.4000000	118.7268	0.0117918	0.9905918
MakeLDV	0.0000000	153.2756	0.0000000	1.0000000
MakeLE VOYAGEUR	0.0000000	132.7406	0.0000000	1.0000000
MakeLEXUS	6.1700680	108.7503	0.0567361	0.9547556
MakeLEYLAND	0.0000000	125.1490	0.0000000	1.0000000
MakeLEYLAND-DEN OUDSTEN	0.0000000	153.2756	0.0000000	1.0000000
MakeLINCOLN	1.1836734	109.4826	0.0108115	0.9913739
MakeLINER	0.0000000	153.2756	0.0000000	1.0000000
MakeLMC	0.1315789	109.7991	0.0011984	0.9990439
MakeLOCOST	0.0000000	153.2756	0.0000000	1.0000000
MakeLOCUST	0.0000000	153.2756	0.0000000	1.0000000
MakeLOMAX	0.0000000	132.7406	0.0000000	1.0000000
MakeLOTUS	0.4509803	109.4397	0.0041208	0.9967121
MakeLTI VEHICLES	0.0000000	153.2756	0.0000000	1.0000000
MakeM.A.N.	0.0000000	153.2756	0.0000000	1.0000000

	Estimate	Std. Error	t value	Pr(> t)
MakeMACK	0.0000000	132.7406	0.0000000	1.0000000
MakeMAHINDRA	0.0000000	132.7406	0.0000000	1.0000000
MakeMAN	0.0000000	153.2756	0.0000000	1.0000000
MakeMARLIN	0.0000000	125.1490	0.0000000	1.0000000
MakeMARUTI	0.6666666	125.1490	0.0053270	0.9957497
MakeMASERATI	0.6428571	109.3457	0.0058791	0.9953092
MakeMATRA	0.3333333	114.2449	0.0029177	0.9976720
MakeMATRA SPORTS	0.0000000	153.2756	0.0000000	1.0000000
MakeMAYBACH	0.0000000	153.2756	0.0000000	1.0000000
MakeMAZDA	12.9799857	108.4210	0.1197184	0.9047066
MakeMC LOUIS	0.3333333	117.0662	0.0028474	0.9977281
MakeMC LOUIS SPA	0.3809523	110.9328	0.0034341	0.9972600
MakeMEGA	0.0000000	132.7406	0.0000000	1.0000000
MakeMERCEDES-AMG	0.2666666	111.9367	0.0023823	0.9980992
MakeMERCEDES-BENZ	8.0288888	108.3973	0.0740691	0.9409557
MakeMERCEDES-HYMER	0.0000000	132.7406	0.0000000	1.0000000
MakeMERCEDES-RAPIDO	0.0000000	153.2756	0.0000000	1.0000000
MakeMERCURY	0.3095238	109.6649	0.0028225	0.9977480
MakeMG	3.6591928	108.6250	0.0336865	0.9731273
MakeMICRO COMPACT CAR	38.1666666	117.0662	0.3260263	0.7444056
MakeMICRO COMPACT CAR SMART	224.1666666	117.0662	1.9148709	0.0555138
MakeMIDAS	0.0000000	132.7406	0.0000000	1.0000000
MakeMIDDLEBRIDGE SCIMITAR	0.0000000	153.2756	0.0000000	1.0000000
MakeMIDSTATES	0.0000000	153.2756	0.0000000	1.0000000
MakeMINERVA	0.0000000	132.7406	0.0000000	1.0000000
MakeMINI	20.1645569	108.5193	0.1858153	0.8525902
MakeMITSUBISHI	11.8111195	108.4235	0.1089350	0.9132544
MakeMK INDY	0.0000000	153.2756	0.0000000	1.0000000
MakeMOBIL PARTNER	0.0000000	121.1750	0.0000000	1.0000000
MakeMOBILVETTA	0.2000000	113.6723	0.0017594	0.9985962
MakeMOHR	0.0000000	125.1490	0.0000000	1.0000000
MakeMOKE	0.0000000	153.2756	0.0000000	1.0000000
MakeMOLONEY	0.0000000	153.2756	0.0000000	1.0000000
MakeMONCAYO	0.2857142	110.9328	0.0025756	0.9979450
MakeMOOVEO	0.0000000	153.2756	0.0000000	1.0000000
MakeMORGAN	0.6571428	109.9197	0.0059784	0.9952300
MakeMORRIS	0.6666666	110.9328	0.0060096	0.9952050
MakeMOSKVITCH	0.0000000	132.7406	0.0000000	1.0000000
MakeMOTO GUZZI	0.0000000	153.2756	0.0000000	1.0000000
MakeMOWAG	0.0000000	153.2756	0.0000000	1.0000000
MakeN.S.U.	0.4285714	115.8655	0.0036989	0.9970487
MakeNEKAF	0.4000000	111.9367	0.0035734	0.9971488
MakeNIESMANN-BISCHOFF	0.3076923	112.4736	0.0027357	0.9978173
MakeNILSSON	0.0000000	125.1490	0.0000000	1.0000000
MakeNISSAN	21.6637168	108.4302	0.1997941	0.8416423
MakeOLDSMOBILE	0.3500000	109.7287	0.0031897	0.9974550
MakeOPEL	30.7930944	108.3964	0.2840785	0.7763512
MakeOVERLAND	0.0000000	153.2756	0.0000000	1.0000000
MakePANHARD	0.0000000	132.7406	0.0000000	1.0000000
MakePANTHER	0.0000000	132.7406	0.0000000	1.0000000
MakePEUGEOT	34.8020710	108.3983	0.3210574	0.7481680
MakePIAGGIO	0.0000000	153.2756	0.0000000	1.0000000

	Estimate	Std. Error	t value	Pr(> t)
MakePILGRIM	0.0000000	125.1490	0.0000000	1.0000000
MakePILOTE	0.0000000	111.9367	0.0000000	1.0000000
MakePININFARINA	1.0000000	153.2756	0.0065242	0.9947945
MakePLA	0.0000000	153.2756	0.0000000	1.0000000
MakePLYMOUTH	0.2000000	111.9367	0.0017867	0.9985744
MakePOESSL	1.0344827	110.2351	0.0093843	0.9925125
MakePOLSKI FIAT	0.0000000	118.7268	0.0000000	1.0000000
MakePONTIAC	0.6380952	108.8971	0.0058596	0.9953248
MakePORSCHÉ	2.3759750	108.4668	0.0219051	0.9825237
MakePROTON	0.0000000	132.7406	0.0000000	1.0000000
MakePUCH	0.3333333	125.1490	0.0026635	0.9978749
MakeQUANTUM	0.0000000	153.2756	0.0000000	1.0000000
MakeQUATTRO	1.0909090	110.0121	0.0099163	0.9920881
MakeRAM	0.0000000	153.2756	0.0000000	1.0000000
MakeRANGER	0.0000000	153.2756	0.0000000	1.0000000
MakeRANGEROVER	0.0000000	132.7406	0.0000000	1.0000000
MakeRAPIDO	0.3076923	109.7630	0.0028032	0.9977633
MakeRELIANT	0.0000000	115.8655	0.0000000	1.0000000
MakeREMETZ	0.1250000	114.9567	0.0010874	0.9991324
MakeRENAULT	27.9816694	108.3975	0.2581394	0.7963003
MakeRENAULT SPORT	0.0000000	153.2756	0.0000000	1.0000000
MakeRICKMAN	0.0000000	153.2756	0.0000000	1.0000000
MakeRILEY	0.0000000	153.2756	0.0000000	1.0000000
MakeRIMOR	0.2857142	112.1863	0.0025468	0.9979680
MakeRIMOR S.P.A.	0.3571428	110.3007	0.0032379	0.9974165
MakeROBIN HOOD	0.0000000	125.1490	0.0000000	1.0000000
MakeROLLER TEAM	0.1000000	113.6723	0.0008797	0.9992981
MakeROLLS ROYCE	1.3750000	110.0627	0.0124929	0.9900324
MakeROVER	3.0019455	108.4876	0.0276709	0.9779248
MakeS&S COACH	0.0000000	125.1490	0.0000000	1.0000000
MakeSAAB	6.8522935	108.4319	0.0631944	0.9496119
MakeSACHSEN RING	0.0000000	125.1490	0.0000000	1.0000000
MakeSAM	0.0000000	153.2756	0.0000000	1.0000000
MakeSANTANA	0.0000000	125.1490	0.0000000	1.0000000
MakeSAURER	0.0000000	153.2756	0.0000000	1.0000000
MakeSCANIA	0.0000000	153.2756	0.0000000	1.0000000
MakeSCHULZ	0.0000000	153.2756	0.0000000	1.0000000
MakeSCION	0.0000000	153.2756	0.0000000	1.0000000
MakeSEA	0.1333333	111.9367	0.0011911	0.9990496
MakeSEAT	20.8391105	108.4177	0.1922114	0.8475773
MakeSIATA	0.0000000	153.2756	0.0000000	1.0000000
MakeSIMCA	0.0833333	112.8078	0.0007387	0.9994106
MakeSKODA	26.3919860	108.4766	0.2432966	0.8077765
MakeSMART	14.7079646	108.8608	0.1351081	0.8925269
MakeSPARTAN	0.0000000	153.2756	0.0000000	1.0000000
MakeSSANGYONG	2.5000000	108.9338	0.0229497	0.9816905
MakeSTERKENS	0.0000000	153.2756	0.0000000	1.0000000
MakeSTEYR D PUCH	0.0000000	153.2756	0.0000000	1.0000000
MakeSTEYR-PUCH	0.0000000	132.7406	0.0000000	1.0000000
MakeSTIMULA	0.0000000	153.2756	0.0000000	1.0000000
MakeSTUART TAYLOR	0.0000000	153.2756	0.0000000	1.0000000
MakeSTUDEBAKER	0.0000000	125.1490	0.0000000	1.0000000

	Estimate	Std. Error	t value	Pr(> t)
MakeSUBARU	6.4351464	108.4956	0.0593125	0.9527034
MakeSUN LIVING	0.0000000	125.1490	0.0000000	1.0000000
MakeSUNBEAM	0.7142857	115.8655	0.0061648	0.9950813
MakeSUPER SEVEN	0.0000000	153.2756	0.0000000	1.0000000
MakeSUPERFORMANCE	0.0000000	153.2756	0.0000000	1.0000000
MakeSUPERIOR	0.0000000	132.7406	0.0000000	1.0000000
MakeSUZUKI	29.6867891	108.4296	0.2737885	0.7842481
MakeSWIFT	0.0000000	153.2756	0.0000000	1.0000000
MakeSYLVA	0.0000000	153.2756	0.0000000	1.0000000
MakeT AND J	0.0000000	153.2756	0.0000000	1.0000000
MakeTALBOT	0.0000000	132.7406	0.0000000	1.0000000
MakeTATRA	0.0000000	121.1750	0.0000000	1.0000000
MakeTEAL	0.0000000	153.2756	0.0000000	1.0000000
MakeTEC	0.0833333	110.6172	0.0007533	0.9993989
MakeTESLA	0.7500000	121.1750	0.0061894	0.9950616
MakeTESLA MOTORS	7.3333333	125.1490	0.0585968	0.9532735
MakeTHOR	0.0000000	153.2756	0.0000000	1.0000000
MakeTIFFANY COACHWORKS	0.0000000	153.2756	0.0000000	1.0000000
MakeTIFFANY ENTERPRISES	0.0000000	153.2756	0.0000000	1.0000000
MakeTIGER	0.0000000	153.2756	0.0000000	1.0000000
MakeTOYOTA	24.4682472	108.4052	0.2257110	0.8214270
MakeTOYOTA-CHINOOK	0.0000000	153.2756	0.0000000	1.0000000
MakeTRABANT	0.9473684	109.7991	0.0086282	0.9931158
MakeTRANSEUROP ENGINEERING	0.0000000	153.2756	0.0000000	1.0000000
MakeTRIGANO	0.1750000	109.7287	0.0015948	0.9987275
MakeTRIUMPH	2.2037037	108.8829	0.0202392	0.9838526
MakeTURRI	0.0000000	153.2756	0.0000000	1.0000000
MakeTURRI & BOARI	0.0000000	153.2756	0.0000000	1.0000000
MakeTVR	0.3529411	109.9645	0.0032096	0.9974391
MakeUAZ	0.0000000	153.2756	0.0000000	1.0000000
MakeUNIMOG	0.0000000	153.2756	0.0000000	1.0000000
MakeVALIANT	0.0000000	132.7406	0.0000000	1.0000000
MakeVAN HOOL	0.0000000	153.2756	0.0000000	1.0000000
MakeVANDEN PLAS PRINCESS	0.0000000	153.2756	0.0000000	1.0000000
MakeVAUXHALL	0.1250000	110.6172	0.0011300	0.9990984
MakeVEB	0.0000000	153.2756	0.0000000	1.0000000
MakeVIELHAUSER MENSCH VM	0.0000000	153.2756	0.0000000	1.0000000
MakeVINTAGE	0.0000000	153.2756	0.0000000	1.0000000
MakeVM	0.1428571	115.8655	0.0012330	0.9990162
MakeVOLGA	0.0000000	125.1490	0.0000000	1.0000000
MakeVOLKSWAGEN	23.9350547	108.3928	0.2208177	0.8252352
MakeVOLKSWAGEN-TABBERT	0.0000000	153.2756	0.0000000	1.0000000
MakeVOLVO	15.7701628	108.4028	0.1454775	0.8843344
MakeVW	0.7368421	111.1978	0.0066264	0.9947130
MakeVW-PORSCHE	0.4545454	113.2016	0.0040154	0.9967962
MakeWARTBURG	0.1428571	115.8655	0.0012330	0.9990162
MakeWEINSBERG	0.2000000	118.7268	0.0016845	0.9986559
MakeWESTFALIA	0.0000000	132.7406	0.0000000	1.0000000
MakeWESTFALIA VAN CONVERSION	0.5000000	132.7406	0.0037667	0.9969946
MakeWESTFIELD	0.0714285	112.1863	0.0006367	0.9994920
MakeWIESMANN	0.0000000	121.1750	0.0000000	1.0000000
MakeWILLYS	0.7142857	115.8655	0.0061648	0.9950813

	Estimate	Std. Error	t value	Pr(> t)
MakeWINNEBAGO	0.0000000	132.7406	0.0000000	1.0000000
MakeWOLSELEY	0.0000000	121.1750	0.0000000	1.0000000
MakeYUGO	0.0000000	153.2756	0.0000000	1.0000000
MakeZASTAVA	0.3333333	125.1490	0.0026635	0.9978749
MakeZIE BIJZONDERHEDEN	0.0000000	125.1490	0.0000000	1.0000000

```
knitr::kable(cars_anova, caption="ANOVA Table")
```

Table 9: ANOVA Table

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Make	376	7633474	20301.79	1.728296	0
Residuals	58493	687100346	11746.71	NA	NA