Analytics 502

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# ABSTRACT

NOTE TO TEAM: So this should be a complete version of the research. I have focussed on this research on passengers. And passengers care about Arrival Delay most. And they can in most cases only have airline, date and time to ’pick.

A quick summary below (not in presenatable prose, but for the teams info):

Goal: 1.) Finding out what factors influence the delay of a flight. 2.) Enabling a passenger to find when they should book a flight 3.)Let passenger predict what can be their estimated arrival delay.

EDA: -> A few snippets to get a feel for the data -> Scatterplot vs time should give a general idea of how flights delays trend over the week -> Correlation plot checks the realtionship between the ‘minutes’ based caloums and distance. The focus should be ARRIVAL\_DELAY. Specifically that it does not have much relatioship with other variables like distance. Other conclusions can be brought forth as well. Feel free. -> Histogram plot **hints** that there is something really going on about departure day/time and the delay in causes (HINT: candidate for hypothesis testing)

INFERENCE: -> Hypothesis test: As ofcourse is possible, we can do many many hypothesis tests. But for showing to prof that we CAN do it. I focussed on Saturday evening. Highest, and looks like a passenger should definitely avoid. So to make sure that I am not seeing a random manifestation of sampling and the mean delay is not in reality, ‘0’, we conducted a hypothesis test. -> ANOVA shows that the histogram above ‘has significance’. And there is significant difference between the means of the day/time groups

THE ‘BEST’ MODEL: Should be straight forward to understand if you have read the notes. BE ADVISED: Adjusted R-square is very low. Which is FINE! The reason I say is the example shared in the class notes was also low. And this is real data, so there are probably a quadrillion other factors which make up the variance. Please read this blog article to learn how to interpret the regression results:<http://blog.minitab.com/blog/adventures-in-statistics-2/how-to-interpret-a-regression-model-with-low-r-squared-and-low-p-values>

PREDICTION: Self explanatory

APPENDIX: meh…..do what you will :)

NOTE TO SELF: Clean this up for submitting to prof. #DATA LOADING & MANIPULATION ####Checking out the data

flightData <- read.csv("flights.csv", header = TRUE)  
head(flightData)

## YEAR MONTH DAY DAY\_OF\_WEEK AIRLINE FLIGHT\_NUMBER TAIL\_NUMBER  
## 1 2015 1 1 4 AS 98 N407AS  
## 2 2015 1 1 4 AA 2336 N3KUAA  
## 3 2015 1 1 4 US 840 N171US  
## 4 2015 1 1 4 AA 258 N3HYAA  
## 5 2015 1 1 4 AS 135 N527AS  
## 6 2015 1 1 4 DL 806 N3730B  
## ORIGIN\_AIRPORT DESTINATION\_AIRPORT SCHEDULED\_DEPARTURE DEPARTURE\_TIME  
## 1 ANC SEA 5 2354  
## 2 LAX PBI 10 2  
## 3 SFO CLT 20 18  
## 4 LAX MIA 20 15  
## 5 SEA ANC 25 24  
## 6 SFO MSP 25 20  
## DEPARTURE\_DELAY TAXI\_OUT WHEELS\_OFF SCHEDULED\_TIME ELAPSED\_TIME AIR\_TIME  
## 1 -11 21 15 205 194 169  
## 2 -8 12 14 280 279 263  
## 3 -2 16 34 286 293 266  
## 4 -5 15 30 285 281 258  
## 5 -1 11 35 235 215 199  
## 6 -5 18 38 217 230 206  
## DISTANCE WHEELS\_ON TAXI\_IN SCHEDULED\_ARRIVAL ARRIVAL\_TIME ARRIVAL\_DELAY  
## 1 1448 404 4 430 408 -22  
## 2 2330 737 4 750 741 -9  
## 3 2296 800 11 806 811 5  
## 4 2342 748 8 805 756 -9  
## 5 1448 254 5 320 259 -21  
## 6 1589 604 6 602 610 8  
## DIVERTED CANCELLED CANCELLATION\_REASON AIR\_SYSTEM\_DELAY SECURITY\_DELAY  
## 1 0 0 NA NA  
## 2 0 0 NA NA  
## 3 0 0 NA NA  
## 4 0 0 NA NA  
## 5 0 0 NA NA  
## 6 0 0 NA NA  
## AIRLINE\_DELAY LATE\_AIRCRAFT\_DELAY WEATHER\_DELAY  
## 1 NA NA NA  
## 2 NA NA NA  
## 3 NA NA NA  
## 4 NA NA NA  
## 5 NA NA NA  
## 6 NA NA NA

str(flightData)

## 'data.frame': 1048575 obs. of 31 variables:  
## $ YEAR : int 2015 2015 2015 2015 2015 2015 2015 2015 2015 2015 ...  
## $ MONTH : int 1 1 1 1 1 1 1 1 1 1 ...  
## $ DAY : int 1 1 1 1 1 1 1 1 1 1 ...  
## $ DAY\_OF\_WEEK : int 4 4 4 4 4 4 4 4 4 4 ...  
## $ AIRLINE : Factor w/ 14 levels "AA","AS","B6",..: 2 1 12 1 2 4 9 12 1 4 ...  
## $ FLIGHT\_NUMBER : int 98 2336 840 258 135 806 612 2013 1112 1173 ...  
## $ TAIL\_NUMBER : Factor w/ 4523 levels "","D942DN","N001AA",..: 1523 1472 384 1432 2017 1061 2623 2282 1477 3690 ...  
## $ ORIGIN\_AIRPORT : Factor w/ 315 levels "ABE","ABI","ABQ",..: 16 172 273 172 272 273 170 172 273 170 ...  
## $ DESTINATION\_AIRPORT: Factor w/ 315 levels "ABE","ABI","ABQ",..: 272 230 65 199 16 212 212 65 85 19 ...  
## $ SCHEDULED\_DEPARTURE: int 5 10 20 20 25 25 25 30 30 30 ...  
## $ DEPARTURE\_TIME : int 2354 2 18 15 24 20 19 44 19 33 ...  
## $ DEPARTURE\_DELAY : int -11 -8 -2 -5 -1 -5 -6 14 -11 3 ...  
## $ TAXI\_OUT : int 21 12 16 15 11 18 11 13 17 12 ...  
## $ WHEELS\_OFF : int 15 14 34 30 35 38 30 57 36 45 ...  
## $ SCHEDULED\_TIME : int 205 280 286 285 235 217 181 273 195 221 ...  
## $ ELAPSED\_TIME : int 194 279 293 281 215 230 170 249 193 203 ...  
## $ AIR\_TIME : int 169 263 266 258 199 206 154 228 173 186 ...  
## $ DISTANCE : int 1448 2330 2296 2342 1448 1589 1299 2125 1464 1747 ...  
## $ WHEELS\_ON : int 404 737 800 748 254 604 504 745 529 651 ...  
## $ TAXI\_IN : int 4 4 11 8 5 6 5 8 3 5 ...  
## $ SCHEDULED\_ARRIVAL : int 430 750 806 805 320 602 526 803 545 711 ...  
## $ ARRIVAL\_TIME : int 408 741 811 756 259 610 509 753 532 656 ...  
## $ ARRIVAL\_DELAY : int -22 -9 5 -9 -21 8 -17 -10 -13 -15 ...  
## $ DIVERTED : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ CANCELLED : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ CANCELLATION\_REASON: Factor w/ 5 levels "","A","B","C",..: 1 1 1 1 1 1 1 1 1 1 ...  
## $ AIR\_SYSTEM\_DELAY : int NA NA NA NA NA NA NA NA NA NA ...  
## $ SECURITY\_DELAY : int NA NA NA NA NA NA NA NA NA NA ...  
## $ AIRLINE\_DELAY : int NA NA NA NA NA NA NA NA NA NA ...  
## $ LATE\_AIRCRAFT\_DELAY: int NA NA NA NA NA NA NA NA NA NA ...  
## $ WEATHER\_DELAY : int NA NA NA NA NA NA NA NA NA NA ...

summary(flightData)

## YEAR MONTH DAY DAY\_OF\_WEEK   
## Min. :2015 Min. :1.000 Min. : 1.00 Min. :1.000   
## 1st Qu.:2015 1st Qu.:1.000 1st Qu.: 6.00 1st Qu.:2.000   
## Median :2015 Median :2.000 Median :13.00 Median :4.000   
## Mean :2015 Mean :1.694 Mean :13.82 Mean :3.953   
## 3rd Qu.:2015 3rd Qu.:2.000 3rd Qu.:21.00 3rd Qu.:6.000   
## Max. :2015 Max. :3.000 Max. :31.00 Max. :7.000   
##   
## AIRLINE FLIGHT\_NUMBER TAIL\_NUMBER ORIGIN\_AIRPORT   
## WN :221586 Min. : 1 : 7750 ATL : 66599   
## DL :147486 1st Qu.: 755 N477HA : 809 ORD : 52961   
## EV :111206 Median :1725 N488HA : 799 DFW : 50933   
## OO :107099 Mean :2257 N476HA : 773 LAX : 38473   
## AA : 97549 3rd Qu.:3485 N485HA : 767 DEN : 38254   
## UA : 87606 Max. :9794 N486HA : 741 IAH : 29802   
## (Other):276043 (Other):1036936 (Other):771553   
## DESTINATION\_AIRPORT SCHEDULED\_DEPARTURE DEPARTURE\_TIME DEPARTURE\_DELAY   
## ATL : 66741 Min. : 1 Min. : 1 Min. : -61.00   
## ORD : 53060 1st Qu.: 920 1st Qu.: 928 1st Qu.: -5.00   
## DFW : 51037 Median :1319 Median :1329 Median : -1.00   
## LAX : 38463 Mean :1323 Mean :1334 Mean : 11.33   
## DEN : 38300 3rd Qu.:1720 3rd Qu.:1731 3rd Qu.: 11.00   
## IAH : 29820 Max. :2359 Max. :2400 Max. :1988.00   
## (Other):771154 NA's :39515 NA's :39515   
## TAXI\_OUT WHEELS\_OFF SCHEDULED\_TIME ELAPSED\_TIME   
## Min. : 1.00 Min. : 1 Min. : 20.0 Min. : 15.0   
## 1st Qu.: 11.00 1st Qu.: 944 1st Qu.: 85.0 1st Qu.: 82.0   
## Median : 14.00 Median :1342 Median :122.0 Median :119.0   
## Mean : 16.65 Mean :1357 Mean :140.3 Mean :136.9   
## 3rd Qu.: 19.00 3rd Qu.:1745 3rd Qu.:173.0 3rd Qu.:169.0   
## Max. :225.00 Max. :2400 Max. :718.0 Max. :766.0   
## NA's :40229 NA's :40229 NA's :2 NA's :43071   
## AIR\_TIME DISTANCE WHEELS\_ON TAXI\_IN   
## Min. : 7.0 Min. : 31.0 Min. : 1 Min. : 1.00   
## 1st Qu.: 60.0 1st Qu.: 368.0 1st Qu.:1110 1st Qu.: 4.00   
## Median : 94.0 Median : 641.0 Median :1516 Median : 6.00   
## Mean :112.8 Mean : 803.4 Mean :1486 Mean : 7.55   
## 3rd Qu.:144.0 3rd Qu.:1046.0 3rd Qu.:1911 3rd Qu.: 9.00   
## Max. :687.0 Max. :4983.0 Max. :2400 Max. :202.00   
## NA's :43071 NA's :41296 NA's :41296   
## SCHEDULED\_ARRIVAL ARRIVAL\_TIME ARRIVAL\_DELAY DIVERTED   
## Min. : 1 Min. : 1 Min. : -82.00 Min. :0.000000   
## 1st Qu.:1120 1st Qu.:1115 1st Qu.: -12.00 1st Qu.:0.000000   
## Median :1524 Median :1521 Median : -3.00 Median :0.000000   
## Mean :1505 Mean :1492 Mean : 7.61 Mean :0.002426   
## 3rd Qu.:1915 3rd Qu.:1917 3rd Qu.: 12.00 3rd Qu.:0.000000   
## Max. :2359 Max. :2400 Max. :1971.00 Max. :1.000000   
## NA's :41296 NA's :43071   
## CANCELLED CANCELLATION\_REASON AIR\_SYSTEM\_DELAY SECURITY\_DELAY   
## Min. :0.00000 :1008048 Min. : 0.0 Min. : 0.0   
## 1st Qu.:0.00000 A: 6974 1st Qu.: 0.0 1st Qu.: 0.0   
## Median :0.00000 B: 28260 Median : 4.0 Median : 0.0   
## Mean :0.03865 C: 5291 Mean : 13.7 Mean : 0.1   
## 3rd Qu.:0.00000 D: 2 3rd Qu.: 19.0 3rd Qu.: 0.0   
## Max. :1.00000 Max. :830.0 Max. :241.0   
## NA's :820047 NA's :820047   
## AIRLINE\_DELAY LATE\_AIRCRAFT\_DELAY WEATHER\_DELAY   
## Min. : 0.0 Min. : 0.0 Min. : 0.0   
## 1st Qu.: 0.0 1st Qu.: 0.0 1st Qu.: 0.0   
## Median : 2.0 Median : 4.0 Median : 0.0   
## Mean : 18.2 Mean : 22.9 Mean : 3.5   
## 3rd Qu.: 18.0 3rd Qu.: 29.0 3rd Qu.: 0.0   
## Max. :1971.0 Max. :1313.0 Max. :1152.0   
## NA's :820047 NA's :820047 NA's :820047

#### Modifying the dataset

flightData <- mutate(flightData, DAY\_OF\_WEEK = as.factor(DAY\_OF\_WEEK))  
flightData$DAY\_OF\_WEEK <- ordered(flightData$DAY\_OF\_WEEK, levels = c("1","2","3","4","5","6","7"))  
levels(flightData$DAY\_OF\_WEEK) <- c("Sunday","Monday","Tuesday","Wednesday","Thursday","Friday","Saturday")

#### Additional modification

Modifying the dataset convert integer time to HH:MM format time

flightData <- mutate(flightData, SCHEDULED\_DEPARTURE = format(strptime(sprintf("%04d",SCHEDULED\_DEPARTURE), format="%H%M"), format = "%H:%M"))  
flightData <- mutate(flightData, DEPARTURE\_TIME = format(strptime(sprintf("%04d",DEPARTURE\_TIME), format="%H%M"), format = "%H:%M"))

Modifying the dataset to have, a column for morning to night clasification for *scheduled* departure time

flightData <- mutate(flightData, DEP\_TIME\_OF\_DAY =   
 ifelse (SCHEDULED\_DEPARTURE >= "18:00","Evening",  
 ifelse (SCHEDULED\_DEPARTURE >= "12:00","Afternoon",  
 ifelse (SCHEDULED\_DEPARTURE >= "06:00","Morning","Night")))  
 )

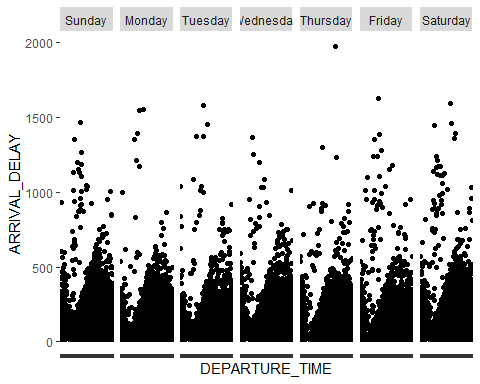
Ordering the factors in Time of day

flightData <- mutate(flightData, DEP\_TIME\_OF\_DAY = as.factor(DEP\_TIME\_OF\_DAY))  
flightData$DEP\_TIME\_OF\_DAY <- ordered(flightData$DEP\_TIME\_OF\_DAY, levels = c("Morning","Afternoon", "Evening","Night"))

# EXPLORATORY DATA ANALYSIS

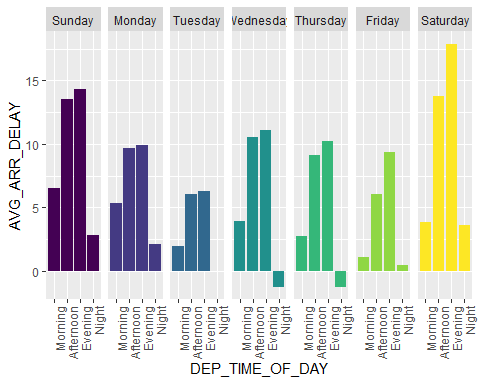
This section should have more graphs, charts and bits ‘n pieces of other small studies. More so to make the report and presentation look ’fuller’. In my next version of this doc, I will add more. But feel free to suggest. ####Scatterplot of arrival delay vs time x-axix each day is from 00:00 to 23:59. But I cant figure out a way to display the time without nasty overlapping so I just hid it.

scat.plot <- ggplot(data = drop\_na(flightData), aes(x = DEPARTURE\_TIME, y = ARRIVAL\_DELAY)) + geom\_point() + facet\_grid(cols = vars(DAY\_OF\_WEEK))  
scat.plot + theme(axis.text.x=element\_blank())



#### Plot of arrival delay vs Day of the week + Time of the day

groupByDayTime <- group\_by(select(flightData, DAY\_OF\_WEEK, DEP\_TIME\_OF\_DAY, ARRIVAL\_DELAY),DAY\_OF\_WEEK,DEP\_TIME\_OF\_DAY)  
groupByDayTime <- groupByDayTime[complete.cases(groupByDayTime),]  
delayByDayTime <- summarise(groupByDayTime, AVG\_ARR\_DELAY = mean(ARRIVAL\_DELAY))  
ggplot(data = delayByDayTime, aes(x = DEP\_TIME\_OF\_DAY, y = AVG\_ARR\_DELAY, fill = DAY\_OF\_WEEK)) + geom\_bar(stat = "identity") + guides(fill = FALSE) + facet\_wrap(vars(DAY\_OF\_WEEK),nrow = 1) + theme(axis.text.x = element\_text(angle = 90, hjust = 1))



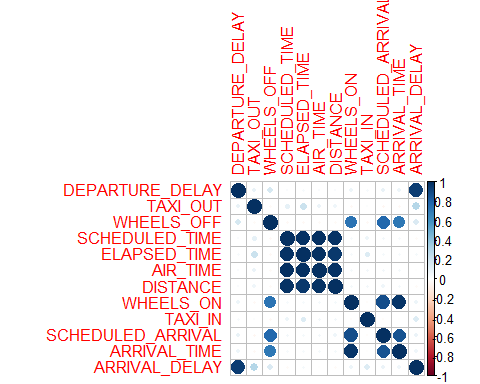
#### Correlation plot of all the time based variables

Modification to subset data into a data frame for those time realted columns + Distance. Then, correlation, then plot.

flightDataTime <- select(flightData, DEPARTURE\_DELAY:ARRIVAL\_DELAY)  
flightDataTime.corr <- round(cor(flightDataTime, use = "complete.obs"),2)  
flightDataTime.corr

## DEPARTURE\_DELAY TAXI\_OUT WHEELS\_OFF SCHEDULED\_TIME  
## DEPARTURE\_DELAY 1.00 0.09 0.17 0.02  
## TAXI\_OUT 0.09 1.00 -0.03 0.10  
## WHEELS\_OFF 0.17 -0.03 1.00 -0.04  
## SCHEDULED\_TIME 0.02 0.10 -0.04 1.00  
## ELAPSED\_TIME 0.03 0.21 -0.04 0.98  
## AIR\_TIME 0.02 0.08 -0.03 0.99  
## DISTANCE 0.02 0.06 -0.03 0.98  
## WHEELS\_ON 0.07 -0.04 0.73 0.03  
## TAXI\_IN 0.03 0.01 -0.04 0.07  
## SCHEDULED\_ARRIVAL 0.09 -0.05 0.78 0.05  
## ARRIVAL\_TIME 0.07 -0.04 0.71 0.03  
## ARRIVAL\_DELAY 0.94 0.28 0.16 -0.03  
## ELAPSED\_TIME AIR\_TIME DISTANCE WHEELS\_ON TAXI\_IN  
## DEPARTURE\_DELAY 0.03 0.02 0.02 0.07 0.03  
## TAXI\_OUT 0.21 0.08 0.06 -0.04 0.01  
## WHEELS\_OFF -0.04 -0.03 -0.03 0.73 -0.04  
## SCHEDULED\_TIME 0.98 0.99 0.98 0.03 0.07  
## ELAPSED\_TIME 1.00 0.99 0.96 0.03 0.14  
## AIR\_TIME 0.99 1.00 0.98 0.04 0.05  
## DISTANCE 0.96 0.98 1.00 0.04 0.05  
## WHEELS\_ON 0.03 0.04 0.04 1.00 -0.02  
## TAXI\_IN 0.14 0.05 0.05 -0.02 1.00  
## SCHEDULED\_ARRIVAL 0.04 0.05 0.06 0.88 -0.02  
## ARRIVAL\_TIME 0.03 0.04 0.04 0.97 -0.01  
## ARRIVAL\_DELAY 0.04 -0.01 -0.03 0.07 0.15  
## SCHEDULED\_ARRIVAL ARRIVAL\_TIME ARRIVAL\_DELAY  
## DEPARTURE\_DELAY 0.09 0.07 0.94  
## TAXI\_OUT -0.05 -0.04 0.28  
## WHEELS\_OFF 0.78 0.71 0.16  
## SCHEDULED\_TIME 0.05 0.03 -0.03  
## ELAPSED\_TIME 0.04 0.03 0.04  
## AIR\_TIME 0.05 0.04 -0.01  
## DISTANCE 0.06 0.04 -0.03  
## WHEELS\_ON 0.88 0.97 0.07  
## TAXI\_IN -0.02 -0.01 0.15  
## SCHEDULED\_ARRIVAL 1.00 0.86 0.08  
## ARRIVAL\_TIME 0.86 1.00 0.06  
## ARRIVAL\_DELAY 0.08 0.06 1.00

corrplot(flightDataTime.corr, method = "circle")



# INFERENCE

This is to prove that for flights departing on saturday evenings, there is definitely a delay on arrival and it is not a result of sample variance.

#### Hypothesis Test

H0 : Mean arrival delay on Sat-Evening <= 0 H1 : Mean arival delay on Sat-Evening > 0

Putting saturday arrival delays in a vector and then running the above hypothesis tests

arrdelaySat <- filter(flightData, DAY\_OF\_WEEK == "Saturday", DEP\_TIME\_OF\_DAY == "Evening")$ARRIVAL\_DELAY  
summary(arrdelaySat)

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## -69.00 -9.00 3.00 17.89 28.00 1016.00 2186

test\_res <- t.test(arrdelaySat, mu = 0, alternative = "greater")  
test\_res

##   
## One Sample t-test  
##   
## data: arrdelaySat  
## t = 66.843, df = 31428, p-value < 2.2e-16  
## alternative hypothesis: true mean is greater than 0  
## 95 percent confidence interval:  
## 17.45432 Inf  
## sample estimates:  
## mean of x   
## 17.89468

#### ANOVA on DAY + TIME of DAY

flightData.aov <- mutate(flightData, DAY\_TIME = paste(DAY\_OF\_WEEK,"\_",DEP\_TIME\_OF\_DAY))  
res.flightData.aov <- aov(ARRIVAL\_DELAY ~ DAY\_TIME, data = flightData.aov)  
summary(res.flightData.aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## DAY\_TIME 27 1.912e+07 708127 404 <2e-16 \*\*\*  
## Residuals 1005476 1.763e+09 1753   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 43071 observations deleted due to missingness

# THE ‘BEST’ MODEL

In the last lecture class, the professor taught us a workflow for determoining the ‘best’ model. I have used the ‘backward elimination adjusted r squared’ method. Please use the lecture notes to understand what I did below:

#### STEP 1: FULL MODEL (day,time, airline, origin, destination)

arrDelayModel00 <- lm(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + DEP\_TIME\_OF\_DAY + AIRLINE + ORIGIN\_AIRPORT + DESTINATION\_AIRPORT , data = flightData)  
summary(arrDelayModel00)$adj.r.squared

## [1] 0.0348465

#### STEP 2: 4-Variable MODEL

From the results below it looks like removing any of the variables gives a lower adjusted r-square. So, **the full model is the best model**

arrDelayModel01 <- lm(ARRIVAL\_DELAY ~ DEP\_TIME\_OF\_DAY + AIRLINE + ORIGIN\_AIRPORT + DESTINATION\_AIRPORT , data = flightData)  
print("No DAY\_OF\_WEEK")

## [1] "No DAY\_OF\_WEEK"

summary(arrDelayModel01)$adj.r.squared

## [1] 0.03166952

rm(arrDelayModel01)  
arrDelayModel02 <- lm(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + AIRLINE + ORIGIN\_AIRPORT + DESTINATION\_AIRPORT , data = flightData)  
print("No DEP\_TIME\_OF\_DAY")

## [1] "No DEP\_TIME\_OF\_DAY"

summary(arrDelayModel02)$adj.r.squared

## [1] 0.02811578

rm(arrDelayModel02)  
arrDelayModel03 <- lm(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + DEP\_TIME\_OF\_DAY + ORIGIN\_AIRPORT + DESTINATION\_AIRPORT , data = flightData)  
print("No AIRLINE")

## [1] "No AIRLINE"

summary(arrDelayModel03)$adj.r.squared

## [1] 0.0291916

rm(arrDelayModel03)  
arrDelayModel04 <- lm(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + DEP\_TIME\_OF\_DAY + AIRLINE + DESTINATION\_AIRPORT , data = flightData)  
print("No ORIGIN\_AIRPORT")

## [1] "No ORIGIN\_AIRPORT"

summary(arrDelayModel04)$adj.r.squared

## [1] 0.02931644

rm(arrDelayModel04)  
arrDelayModel05 <- lm(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + DEP\_TIME\_OF\_DAY + AIRLINE + ORIGIN\_AIRPORT, data = flightData)  
print("No DESTINATION\_AIRPORT")

## [1] "No DESTINATION\_AIRPORT"

summary(arrDelayModel05)$adj.r.squared

## [1] 0.03056048

rm(arrDelayModel05)

# PREDICTION

#### Setting prediction Model for day, time, airline, origin & destination (the winning model above)

arrDelayModel <- arrDelayModel00  
summary(arrDelayModel)

##   
## Call:  
## lm(formula = ARRIVAL\_DELAY ~ DAY\_OF\_WEEK + DEP\_TIME\_OF\_DAY +   
## AIRLINE + ORIGIN\_AIRPORT + DESTINATION\_AIRPORT, data = flightData)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -91.07 -19.34 -8.73 5.38 1968.54   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 6.236887 3.066803 2.034 0.041984 \*   
## DAY\_OF\_WEEK.L -0.839439 0.110103 -7.624 2.46e-14 \*\*\*  
## DAY\_OF\_WEEK.Q 4.803135 0.107609 44.635 < 2e-16 \*\*\*  
## DAY\_OF\_WEEK.C 0.299787 0.110156 2.721 0.006499 \*\*   
## DAY\_OF\_WEEK^4 2.707768 0.111729 24.235 < 2e-16 \*\*\*  
## DAY\_OF\_WEEK^5 2.611585 0.110317 23.673 < 2e-16 \*\*\*  
## DAY\_OF\_WEEK^6 -1.577275 0.107267 -14.704 < 2e-16 \*\*\*  
## DEP\_TIME\_OF\_DAY.L -1.489815 0.224410 -6.639 3.16e-11 \*\*\*  
## DEP\_TIME\_OF\_DAY.Q -8.566606 0.177427 -48.282 < 2e-16 \*\*\*  
## DEP\_TIME\_OF\_DAY.C -1.708332 0.108123 -15.800 < 2e-16 \*\*\*  
## AIRLINEAS -2.934488 0.404841 -7.248 4.22e-13 \*\*\*  
## AIRLINEB6 5.185965 0.316334 16.394 < 2e-16 \*\*\*  
## AIRLINEDL -1.195727 0.255650 -4.677 2.91e-06 \*\*\*  
## AIRLINEEV 4.118997 0.276798 14.881 < 2e-16 \*\*\*  
## AIRLINEF9 16.560617 0.423873 39.070 < 2e-16 \*\*\*  
## AIRLINEHA -0.473223 0.802065 -0.590 0.555187   
## AIRLINEMQ 11.051249 0.275692 40.085 < 2e-16 \*\*\*  
## AIRLINENK 9.369165 0.376472 24.887 < 2e-16 \*\*\*  
## AIRLINEOO 6.693698 0.272959 24.523 < 2e-16 \*\*\*  
## AIRLINEUA 0.153772 0.256298 0.600 0.548522   
## AIRLINEUS 0.084981 0.314780 0.270 0.787183   
## AIRLINEVX -1.730950 0.476759 -3.631 0.000283 \*\*\*  
## AIRLINEWN -0.376567 0.252451 -1.492 0.135793   
## ORIGIN\_AIRPORTABI -10.437398 2.886280 -3.616 0.000299 \*\*\*  
## ORIGIN\_AIRPORTABQ -2.870134 2.269042 -1.265 0.205904   
## ORIGIN\_AIRPORTABR 10.542159 4.188228 2.517 0.011833 \*   
## ORIGIN\_AIRPORTABY -2.589946 3.780622 -0.685 0.493307   
## ORIGIN\_AIRPORTACT -10.016651 3.281747 -3.052 0.002272 \*\*   
## ORIGIN\_AIRPORTACV 0.056910 3.216092 0.018 0.985882   
## ORIGIN\_AIRPORTACY -12.069203 2.665388 -4.528 5.95e-06 \*\*\*  
## ORIGIN\_AIRPORTADK -1.430863 9.780724 -0.146 0.883689   
## ORIGIN\_AIRPORTADQ -8.993138 5.765013 -1.560 0.118772   
## ORIGIN\_AIRPORTAEX -4.693925 2.737456 -1.715 0.086400 .   
## ORIGIN\_AIRPORTAGS 1.290601 2.917135 0.442 0.658185   
## ORIGIN\_AIRPORTALB -5.614644 2.449580 -2.292 0.021901 \*   
## ORIGIN\_AIRPORTALO -4.348204 4.483329 -0.970 0.332116   
## ORIGIN\_AIRPORTAMA -4.514774 2.504749 -1.802 0.071469 .   
## ORIGIN\_AIRPORTANC -8.092259 2.380516 -3.399 0.000675 \*\*\*  
## ORIGIN\_AIRPORTAPN -3.040144 4.563617 -0.666 0.505303   
## ORIGIN\_AIRPORTASE -1.061685 2.438301 -0.435 0.663258   
## ORIGIN\_AIRPORTATL -6.541663 2.166176 -3.020 0.002529 \*\*   
## ORIGIN\_AIRPORTATW -5.110885 2.830946 -1.805 0.071018 .   
## ORIGIN\_AIRPORTAUS -4.374150 2.208301 -1.981 0.047617 \*   
## ORIGIN\_AIRPORTAVL -2.598177 2.905869 -0.894 0.371261   
## ORIGIN\_AIRPORTAVP -4.618623 3.478449 -1.328 0.184250   
## ORIGIN\_AIRPORTAZO -5.860086 3.038253 -1.929 0.053760 .   
## ORIGIN\_AIRPORTBDL -3.448395 2.266516 -1.521 0.128147   
## ORIGIN\_AIRPORTBET 1.210133 3.899197 0.310 0.756292   
## ORIGIN\_AIRPORTBFL -6.618257 2.850203 -2.322 0.020231 \*   
## ORIGIN\_AIRPORTBGM 6.093348 7.220953 0.844 0.398758   
## ORIGIN\_AIRPORTBGR 9.797455 9.494751 1.032 0.302128   
## ORIGIN\_AIRPORTBHM -3.807365 2.304502 -1.652 0.098506 .   
## ORIGIN\_AIRPORTBIL -11.183497 2.841561 -3.936 8.30e-05 \*\*\*  
## ORIGIN\_AIRPORTBIS -2.901205 2.695335 -1.076 0.281758   
## ORIGIN\_AIRPORTBJI -17.144730 4.165511 -4.116 3.86e-05 \*\*\*  
## ORIGIN\_AIRPORTBLI -0.854899 3.622738 -0.236 0.813447   
## ORIGIN\_AIRPORTBMI 1.258319 2.814654 0.447 0.654832   
## ORIGIN\_AIRPORTBNA -4.988327 2.200051 -2.267 0.023368 \*   
## ORIGIN\_AIRPORTBOI -3.816310 2.345639 -1.627 0.103742   
## ORIGIN\_AIRPORTBOS 1.960319 2.177895 0.900 0.368068   
## ORIGIN\_AIRPORTBPT 7.212812 3.786371 1.905 0.056788 .   
## ORIGIN\_AIRPORTBQK -6.615853 3.737877 -1.770 0.076736 .   
## ORIGIN\_AIRPORTBQN 6.172869 3.512350 1.757 0.078837 .   
## ORIGIN\_AIRPORTBRD -9.572032 4.432441 -2.160 0.030809 \*   
## ORIGIN\_AIRPORTBRO -5.189025 2.928877 -1.772 0.076448 .   
## ORIGIN\_AIRPORTBRW 0.964308 4.062563 0.237 0.812374   
## ORIGIN\_AIRPORTBTM -21.881572 4.220817 -5.184 2.17e-07 \*\*\*  
## ORIGIN\_AIRPORTBTR -0.001297 2.416020 -0.001 0.999572   
## ORIGIN\_AIRPORTBTV -2.765974 2.885907 -0.958 0.337840   
## ORIGIN\_AIRPORTBUF -3.605652 2.288987 -1.575 0.115207   
## ORIGIN\_AIRPORTBUR -4.154412 2.266166 -1.833 0.066768 .   
## ORIGIN\_AIRPORTBWI -0.129605 2.183662 -0.059 0.952672   
## ORIGIN\_AIRPORTBZN -5.700311 2.728729 -2.089 0.036708 \*   
## ORIGIN\_AIRPORTCAE -0.714030 2.476921 -0.288 0.773138   
## ORIGIN\_AIRPORTCAK -8.946907 2.456647 -3.642 0.000271 \*\*\*  
## ORIGIN\_AIRPORTCDC -9.534997 4.416468 -2.159 0.030853 \*   
## ORIGIN\_AIRPORTCDV -10.974444 4.824694 -2.275 0.022928 \*   
## ORIGIN\_AIRPORTCEC -1.085399 4.343918 -0.250 0.802691   
## ORIGIN\_AIRPORTCHA -8.934547 2.646307 -3.376 0.000735 \*\*\*  
## ORIGIN\_AIRPORTCHO 1.249685 2.988449 0.418 0.675822   
## ORIGIN\_AIRPORTCHS -6.989783 2.353711 -2.970 0.002981 \*\*   
## ORIGIN\_AIRPORTCID 2.849398 2.421652 1.177 0.239342   
## ORIGIN\_AIRPORTCIU -5.952379 4.312403 -1.380 0.167497   
## ORIGIN\_AIRPORTCLD -8.048242 2.927777 -2.749 0.005979 \*\*   
## ORIGIN\_AIRPORTCLE -4.780857 2.211479 -2.162 0.030631 \*   
## ORIGIN\_AIRPORTCLL -6.217319 3.007653 -2.067 0.038719 \*   
## ORIGIN\_AIRPORTCLT -4.996238 2.182351 -2.289 0.022057 \*   
## ORIGIN\_AIRPORTCMH -3.064667 2.240528 -1.368 0.171365   
## ORIGIN\_AIRPORTCMI 3.586549 2.986178 1.201 0.229732   
## ORIGIN\_AIRPORTCMX -11.809546 4.423536 -2.670 0.007592 \*\*   
## ORIGIN\_AIRPORTCNY -32.387057 4.401901 -7.358 1.88e-13 \*\*\*  
## ORIGIN\_AIRPORTCOD -8.884442 4.225672 -2.102 0.035510 \*   
## ORIGIN\_AIRPORTCOS -0.741698 2.443050 -0.304 0.761437   
## ORIGIN\_AIRPORTCOU -1.119206 3.401871 -0.329 0.742158   
## ORIGIN\_AIRPORTCPR -14.986875 3.061153 -4.896 9.79e-07 \*\*\*  
## ORIGIN\_AIRPORTCRP -4.819829 2.475669 -1.947 0.051549 .   
## ORIGIN\_AIRPORTCRW 5.532500 3.001733 1.843 0.065314 .   
## ORIGIN\_AIRPORTCSG -3.156621 3.618378 -0.872 0.382998   
## ORIGIN\_AIRPORTCVG -6.236302 2.258390 -2.761 0.005756 \*\*   
## ORIGIN\_AIRPORTCWA -7.422264 3.332654 -2.227 0.025939 \*   
## ORIGIN\_AIRPORTDAB -3.314861 3.244021 -1.022 0.306858   
## ORIGIN\_AIRPORTDAL -3.480243 2.194261 -1.586 0.112725   
## ORIGIN\_AIRPORTDAY -8.479095 2.377794 -3.566 0.000363 \*\*\*  
## ORIGIN\_AIRPORTDBQ -3.798858 3.956834 -0.960 0.337018   
## ORIGIN\_AIRPORTDCA -5.876103 2.182720 -2.692 0.007100 \*\*   
## ORIGIN\_AIRPORTDEN -0.572459 2.166539 -0.264 0.791605   
## ORIGIN\_AIRPORTDFW -0.935174 2.170168 -0.431 0.666525   
## ORIGIN\_AIRPORTDHN 2.272140 3.391200 0.670 0.502851   
## ORIGIN\_AIRPORTDIK -8.309595 3.452169 -2.407 0.016081 \*   
## ORIGIN\_AIRPORTDLH -7.203128 3.196074 -2.254 0.024213 \*   
## ORIGIN\_AIRPORTDRO 2.608316 3.014088 0.865 0.386833   
## ORIGIN\_AIRPORTDSM -1.566037 2.372371 -0.660 0.509180   
## ORIGIN\_AIRPORTDTW -2.961609 2.175254 -1.362 0.173356   
## ORIGIN\_AIRPORTDVL -0.066501 5.282811 -0.013 0.989956   
## ORIGIN\_AIRPORTEAU -5.506626 4.213243 -1.307 0.191220   
## ORIGIN\_AIRPORTECP -2.807747 2.794208 -1.005 0.314972   
## ORIGIN\_AIRPORTEGE 0.138392 2.719471 0.051 0.959414   
## ORIGIN\_AIRPORTEKO -9.572481 4.220822 -2.268 0.023334 \*   
## ORIGIN\_AIRPORTELM -5.094699 3.036606 -1.678 0.093394 .   
## ORIGIN\_AIRPORTELP -4.534998 2.320518 -1.954 0.050666 .   
## ORIGIN\_AIRPORTERI 2.953167 3.582306 0.824 0.409726   
## ORIGIN\_AIRPORTESC -4.379301 4.516633 -0.970 0.332249   
## ORIGIN\_AIRPORTEUG -9.376765 2.675714 -3.504 0.000458 \*\*\*  
## ORIGIN\_AIRPORTEVV -1.095355 2.692080 -0.407 0.684096   
## ORIGIN\_AIRPORTEWN -5.560800 4.360343 -1.275 0.202199   
## ORIGIN\_AIRPORTEWR -1.788258 2.174709 -0.822 0.410908   
## ORIGIN\_AIRPORTEYW -13.199789 2.831424 -4.662 3.13e-06 \*\*\*  
## ORIGIN\_AIRPORTFAI -0.598940 3.148419 -0.190 0.849125   
## ORIGIN\_AIRPORTFAR -6.282728 2.519994 -2.493 0.012662 \*   
## ORIGIN\_AIRPORTFAT 0.458038 2.415263 0.190 0.849589   
## ORIGIN\_AIRPORTFAY -0.101804 3.111614 -0.033 0.973900   
## ORIGIN\_AIRPORTFCA -17.588105 3.264790 -5.387 7.16e-08 \*\*\*  
## ORIGIN\_AIRPORTFLG -7.090336 3.255315 -2.178 0.029400 \*   
## ORIGIN\_AIRPORTFLL -7.387217 2.181185 -3.387 0.000707 \*\*\*  
## ORIGIN\_AIRPORTFNT -12.825116 2.587664 -4.956 7.19e-07 \*\*\*  
## ORIGIN\_AIRPORTFSD -3.190543 2.453949 -1.300 0.193544   
## ORIGIN\_AIRPORTFSM -4.520863 2.963355 -1.526 0.127112   
## ORIGIN\_AIRPORTFWA -3.522477 2.623271 -1.343 0.179343   
## ORIGIN\_AIRPORTGCC -17.470334 3.521038 -4.962 6.99e-07 \*\*\*  
## ORIGIN\_AIRPORTGCK -5.755004 4.313864 -1.334 0.182181   
## ORIGIN\_AIRPORTGEG -5.678021 2.363931 -2.402 0.016309 \*   
## ORIGIN\_AIRPORTGFK -8.621939 4.639329 -1.858 0.063106 .   
## ORIGIN\_AIRPORTGGG -1.688334 4.496859 -0.375 0.707328   
## ORIGIN\_AIRPORTGJT -12.129630 2.764606 -4.387 1.15e-05 \*\*\*  
## ORIGIN\_AIRPORTGNV -1.308233 2.828304 -0.463 0.643687   
## ORIGIN\_AIRPORTGPT -11.261364 2.642613 -4.261 2.03e-05 \*\*\*  
## ORIGIN\_AIRPORTGRB -7.993757 2.578245 -3.100 0.001932 \*\*   
## ORIGIN\_AIRPORTGRI -5.075525 4.353962 -1.166 0.243726   
## ORIGIN\_AIRPORTGRK -6.556031 2.610950 -2.511 0.012040 \*   
## ORIGIN\_AIRPORTGRR -6.005368 2.326708 -2.581 0.009850 \*\*   
## ORIGIN\_AIRPORTGSO -4.749182 2.416260 -1.966 0.049356 \*   
## ORIGIN\_AIRPORTGSP -4.250955 2.470609 -1.721 0.085322 .   
## ORIGIN\_AIRPORTGTF -10.634676 3.177856 -3.346 0.000818 \*\*\*  
## ORIGIN\_AIRPORTGTR 0.492998 3.772878 0.131 0.896037   
## ORIGIN\_AIRPORTGUC -0.572625 3.754019 -0.153 0.878764   
## ORIGIN\_AIRPORTGUM -17.280664 5.469174 -3.160 0.001580 \*\*   
## ORIGIN\_AIRPORTHDN -0.542769 3.083371 -0.176 0.860270   
## ORIGIN\_AIRPORTHIB -11.106659 4.100619 -2.709 0.006758 \*\*   
## ORIGIN\_AIRPORTHLN -18.649682 3.415630 -5.460 4.76e-08 \*\*\*  
## ORIGIN\_AIRPORTHNL -8.039111 2.262543 -3.553 0.000381 \*\*\*  
## ORIGIN\_AIRPORTHOB -6.792070 4.580029 -1.483 0.138081   
## ORIGIN\_AIRPORTHOU -4.475097 2.197977 -2.036 0.041750 \*   
## ORIGIN\_AIRPORTHPN 3.567087 2.410405 1.480 0.138908   
## ORIGIN\_AIRPORTHRL -8.584511 2.728324 -3.146 0.001653 \*\*   
## ORIGIN\_AIRPORTHSV -7.611282 2.560496 -2.973 0.002953 \*\*   
## ORIGIN\_AIRPORTHYS -6.121159 4.455761 -1.374 0.169516   
## ORIGIN\_AIRPORTIAD 0.677560 2.206288 0.307 0.758764   
## ORIGIN\_AIRPORTIAG 0.434306 5.418723 0.080 0.936119   
## ORIGIN\_AIRPORTIAH -6.631170 2.167769 -3.059 0.002221 \*\*   
## ORIGIN\_AIRPORTICT -0.935382 2.412695 -0.388 0.698244   
## ORIGIN\_AIRPORTIDA -13.330691 3.006633 -4.434 9.26e-06 \*\*\*  
## ORIGIN\_AIRPORTILG 4.500393 6.193138 0.727 0.467426   
## ORIGIN\_AIRPORTILM -3.480234 3.164974 -1.100 0.271503   
## ORIGIN\_AIRPORTIMT -5.437983 4.596544 -1.183 0.236786   
## ORIGIN\_AIRPORTIND -5.198867 2.239114 -2.322 0.020242 \*   
## ORIGIN\_AIRPORTINL 3.152558 4.807939 0.656 0.512018   
## ORIGIN\_AIRPORTISN -6.176264 2.794893 -2.210 0.027117 \*   
## ORIGIN\_AIRPORTISP -0.721421 2.628062 -0.275 0.783695   
## ORIGIN\_AIRPORTITH -16.929009 20.788814 -0.814 0.415455   
## ORIGIN\_AIRPORTITO -12.630267 2.565259 -4.924 8.50e-07 \*\*\*  
## ORIGIN\_AIRPORTJAC -3.381586 2.624456 -1.288 0.197576   
## ORIGIN\_AIRPORTJAN -4.154721 2.437604 -1.704 0.088301 .   
## ORIGIN\_AIRPORTJAX -3.458752 2.272671 -1.522 0.128037   
## ORIGIN\_AIRPORTJFK 2.684152 2.180683 1.231 0.218369   
## ORIGIN\_AIRPORTJLN -4.950903 4.353962 -1.137 0.255495   
## ORIGIN\_AIRPORTJMS 13.753561 6.132660 2.243 0.024918 \*   
## ORIGIN\_AIRPORTJNU 1.023957 2.958520 0.346 0.729264   
## ORIGIN\_AIRPORTKOA -12.171913 2.370640 -5.134 2.83e-07 \*\*\*  
## ORIGIN\_AIRPORTKTN -4.137992 3.209372 -1.289 0.197278   
## ORIGIN\_AIRPORTLAN 0.745957 2.982368 0.250 0.802493   
## ORIGIN\_AIRPORTLAR -13.263416 4.341965 -3.055 0.002253 \*\*   
## ORIGIN\_AIRPORTLAS -2.606879 2.171492 -1.201 0.229945   
## ORIGIN\_AIRPORTLAW -4.650087 3.444139 -1.350 0.176970   
## ORIGIN\_AIRPORTLAX -3.979127 2.166654 -1.837 0.066279 .   
## ORIGIN\_AIRPORTLBB -1.350771 2.540913 -0.532 0.594997   
## ORIGIN\_AIRPORTLBE -5.946828 3.605563 -1.649 0.099077 .   
## ORIGIN\_AIRPORTLCH -9.081700 3.078007 -2.951 0.003173 \*\*   
## ORIGIN\_AIRPORTLEX -4.960456 2.503991 -1.981 0.047589 \*   
## ORIGIN\_AIRPORTLFT -1.872646 2.504836 -0.748 0.454694   
## ORIGIN\_AIRPORTLGA 2.905056 2.174405 1.336 0.181542   
## ORIGIN\_AIRPORTLGB -9.123532 2.395303 -3.809 0.000140 \*\*\*  
## ORIGIN\_AIRPORTLIH -14.370278 2.383505 -6.029 1.65e-09 \*\*\*  
## ORIGIN\_AIRPORTLIT -3.140379 2.352153 -1.335 0.181841   
## ORIGIN\_AIRPORTLNK -12.143948 2.908816 -4.175 2.98e-05 \*\*\*  
## ORIGIN\_AIRPORTLRD -12.750649 2.950787 -4.321 1.55e-05 \*\*\*  
## ORIGIN\_AIRPORTLSE -8.941612 3.362084 -2.660 0.007825 \*\*   
## ORIGIN\_AIRPORTLWS -17.987401 4.406018 -4.082 4.46e-05 \*\*\*  
## ORIGIN\_AIRPORTMAF -3.348083 2.379253 -1.407 0.159369   
## ORIGIN\_AIRPORTMBS -10.110064 3.097227 -3.264 0.001098 \*\*   
## ORIGIN\_AIRPORTMCI -6.665278 2.209619 -3.016 0.002557 \*\*   
## ORIGIN\_AIRPORTMCO -4.090476 2.173677 -1.882 0.059860 .   
## ORIGIN\_AIRPORTMDT -1.233408 2.674703 -0.461 0.644700   
## ORIGIN\_AIRPORTMDW -3.827324 2.184664 -1.752 0.079790 .   
## ORIGIN\_AIRPORTMEI 14.705102 5.531379 2.658 0.007849 \*\*   
## ORIGIN\_AIRPORTMEM -2.632637 2.300660 -1.144 0.252501   
## ORIGIN\_AIRPORTMFE -5.779816 2.612456 -2.212 0.026939 \*   
## ORIGIN\_AIRPORTMFR -4.761779 2.901086 -1.641 0.100719   
## ORIGIN\_AIRPORTMGM -3.307419 2.731260 -1.211 0.225915   
## ORIGIN\_AIRPORTMHK -11.117529 3.229040 -3.443 0.000575 \*\*\*  
## ORIGIN\_AIRPORTMHT -6.318666 2.535529 -2.492 0.012701 \*   
## ORIGIN\_AIRPORTMIA -5.289050 2.187152 -2.418 0.015596 \*   
## ORIGIN\_AIRPORTMKE -5.866146 2.223955 -2.638 0.008347 \*\*   
## ORIGIN\_AIRPORTMKG -11.283894 4.395054 -2.567 0.010246 \*   
## ORIGIN\_AIRPORTMLB -6.333932 3.350369 -1.891 0.058689 .   
## ORIGIN\_AIRPORTMLI -1.271253 2.573238 -0.494 0.621286   
## ORIGIN\_AIRPORTMLU -2.323963 2.821763 -0.824 0.410175   
## ORIGIN\_AIRPORTMMH -13.467810 4.938212 -2.727 0.006386 \*\*   
## ORIGIN\_AIRPORTMOB -3.100714 2.530002 -1.226 0.220358   
## ORIGIN\_AIRPORTMOT -8.009023 3.134527 -2.555 0.010616 \*   
## ORIGIN\_AIRPORTMQT -7.467349 5.935849 -1.258 0.208389   
## ORIGIN\_AIRPORTMRY -6.866598 2.692910 -2.550 0.010776 \*   
## ORIGIN\_AIRPORTMSN -7.742366 2.365241 -3.273 0.001063 \*\*   
## ORIGIN\_AIRPORTMSO -14.957326 3.254521 -4.596 4.31e-06 \*\*\*  
## ORIGIN\_AIRPORTMSP -7.563884 2.177683 -3.473 0.000514 \*\*\*  
## ORIGIN\_AIRPORTMSY -6.667423 2.206269 -3.022 0.002511 \*\*   
## ORIGIN\_AIRPORTMTJ -6.264950 3.050940 -2.053 0.040029 \*   
## ORIGIN\_AIRPORTMYR -5.039428 2.703702 -1.864 0.062336 .   
## ORIGIN\_AIRPORTOAJ -2.461133 3.454700 -0.712 0.476216   
## ORIGIN\_AIRPORTOAK -1.100757 2.209596 -0.498 0.618363   
## ORIGIN\_AIRPORTOGG -11.057511 2.286208 -4.837 1.32e-06 \*\*\*  
## ORIGIN\_AIRPORTOKC -4.847777 2.284130 -2.122 0.033807 \*   
## ORIGIN\_AIRPORTOMA -3.813976 2.270842 -1.680 0.093047 .   
## ORIGIN\_AIRPORTOME 2.081577 4.391136 0.474 0.635471   
## ORIGIN\_AIRPORTONT -2.655919 2.272004 -1.169 0.242414   
## ORIGIN\_AIRPORTORD 3.485568 2.163820 1.611 0.107215   
## ORIGIN\_AIRPORTORF -0.342629 2.365774 -0.145 0.884847   
## ORIGIN\_AIRPORTORH -12.370340 4.442104 -2.785 0.005356 \*\*   
## ORIGIN\_AIRPORTOTH 2.847901 7.227909 0.394 0.693570   
## ORIGIN\_AIRPORTOTZ 4.800368 4.662605 1.030 0.303223   
## ORIGIN\_AIRPORTPAH -12.509440 4.394723 -2.846 0.004421 \*\*   
## ORIGIN\_AIRPORTPBG 6.469334 5.555318 1.165 0.244210   
## ORIGIN\_AIRPORTPBI -1.634848 2.231676 -0.733 0.463824   
## ORIGIN\_AIRPORTPDX -6.980203 2.208093 -3.161 0.001571 \*\*   
## ORIGIN\_AIRPORTPHF 3.517017 3.317393 1.060 0.289065   
## ORIGIN\_AIRPORTPHL -0.667405 2.190736 -0.305 0.760634   
## ORIGIN\_AIRPORTPHX -2.870404 2.170811 -1.322 0.186078   
## ORIGIN\_AIRPORTPIA -1.516144 2.625725 -0.577 0.563656   
## ORIGIN\_AIRPORTPIB -5.434945 4.920578 -1.105 0.269362   
## ORIGIN\_AIRPORTPIH 2.959836 4.232618 0.699 0.484370   
## ORIGIN\_AIRPORTPIT -6.375268 2.238516 -2.848 0.004400 \*\*   
## ORIGIN\_AIRPORTPLN 5.893495 4.514714 1.305 0.191758   
## ORIGIN\_AIRPORTPNS -7.374145 2.431506 -3.033 0.002423 \*\*   
## ORIGIN\_AIRPORTPPG -6.130840 9.304666 -0.659 0.509960   
## ORIGIN\_AIRPORTPSC -14.510787 3.010962 -4.819 1.44e-06 \*\*\*  
## ORIGIN\_AIRPORTPSE -6.593112 4.068268 -1.621 0.105100   
## ORIGIN\_AIRPORTPSG -8.599139 4.971961 -1.730 0.083715 .   
## ORIGIN\_AIRPORTPSP -2.325710 2.310314 -1.007 0.314096   
## ORIGIN\_AIRPORTPUB -1.157530 4.486216 -0.258 0.796392   
## ORIGIN\_AIRPORTPVD -4.500113 2.348423 -1.916 0.055336 .   
## ORIGIN\_AIRPORTPWM -5.567344 2.817728 -1.976 0.048175 \*   
## ORIGIN\_AIRPORTRAP -9.379892 2.872615 -3.265 0.001094 \*\*   
## ORIGIN\_AIRPORTRDD -17.575461 3.721104 -4.723 2.32e-06 \*\*\*  
## ORIGIN\_AIRPORTRDM -9.514274 3.067471 -3.102 0.001924 \*\*   
## ORIGIN\_AIRPORTRDU -4.486677 2.222366 -2.019 0.043501 \*   
## ORIGIN\_AIRPORTRHI -11.073027 3.907744 -2.834 0.004603 \*\*   
## ORIGIN\_AIRPORTRIC -1.501426 2.296260 -0.654 0.513204   
## ORIGIN\_AIRPORTRKS -10.658268 3.741028 -2.849 0.004385 \*\*   
## ORIGIN\_AIRPORTRNO -4.018478 2.316385 -1.735 0.082776 .   
## ORIGIN\_AIRPORTROA -1.337300 3.166339 -0.422 0.672770   
## ORIGIN\_AIRPORTROC -2.705460 2.438849 -1.109 0.267293   
## ORIGIN\_AIRPORTROW 5.593120 3.827601 1.461 0.143944   
## ORIGIN\_AIRPORTRST -3.837898 3.015928 -1.273 0.203181   
## ORIGIN\_AIRPORTRSW -4.223258 2.209748 -1.911 0.055980 .   
## ORIGIN\_AIRPORTSAF -2.539321 3.373848 -0.753 0.451661   
## ORIGIN\_AIRPORTSAN -5.123498 2.185508 -2.344 0.019063 \*   
## ORIGIN\_AIRPORTSAT -5.534969 2.224722 -2.488 0.012849 \*   
## ORIGIN\_AIRPORTSAV -4.028342 2.437201 -1.653 0.098361 .   
## ORIGIN\_AIRPORTSBA -6.841684 2.479143 -2.760 0.005786 \*\*   
## ORIGIN\_AIRPORTSBN 3.164923 2.561321 1.236 0.216585   
## ORIGIN\_AIRPORTSBP -8.928804 2.565875 -3.480 0.000502 \*\*\*  
## ORIGIN\_AIRPORTSCC -8.666850 5.602433 -1.547 0.121868   
## ORIGIN\_AIRPORTSCE 6.824488 4.137868 1.649 0.099091 .   
## ORIGIN\_AIRPORTSDF -6.542884 2.341663 -2.794 0.005204 \*\*   
## ORIGIN\_AIRPORTSEA -4.675874 2.183397 -2.142 0.032229 \*   
## ORIGIN\_AIRPORTSFO -0.670162 2.171262 -0.309 0.757587   
## ORIGIN\_AIRPORTSGF 0.129073 2.452818 0.053 0.958033   
## ORIGIN\_AIRPORTSGU -10.574466 3.142542 -3.365 0.000766 \*\*\*  
## ORIGIN\_AIRPORTSHV 0.982169 2.482323 0.396 0.692352   
## ORIGIN\_AIRPORTSIT -2.477599 3.990570 -0.621 0.534690   
## ORIGIN\_AIRPORTSJC -2.583134 2.212087 -1.168 0.242914   
## ORIGIN\_AIRPORTSJT -10.943034 3.253403 -3.364 0.000769 \*\*\*  
## ORIGIN\_AIRPORTSJU -3.718725 2.236904 -1.662 0.096424 .   
## ORIGIN\_AIRPORTSLC -10.300599 2.180223 -4.725 2.31e-06 \*\*\*  
## ORIGIN\_AIRPORTSMF -1.389312 2.213502 -0.628 0.530231   
## ORIGIN\_AIRPORTSMX 8.076133 4.191640 1.927 0.054014 .   
## ORIGIN\_AIRPORTSNA -5.447459 2.212430 -2.462 0.013809 \*   
## ORIGIN\_AIRPORTSPI -7.439512 3.306086 -2.250 0.024433 \*   
## ORIGIN\_AIRPORTSPS -2.456306 3.551193 -0.692 0.489135   
## ORIGIN\_AIRPORTSRQ -1.877154 2.630289 -0.714 0.475432   
## ORIGIN\_AIRPORTSTC -2.324681 5.187149 -0.448 0.654037   
## ORIGIN\_AIRPORTSTL -6.023760 2.199446 -2.739 0.006167 \*\*   
## ORIGIN\_AIRPORTSTT -4.712705 2.522482 -1.868 0.061723 .   
## ORIGIN\_AIRPORTSTX -2.534809 3.649779 -0.695 0.487362   
## ORIGIN\_AIRPORTSUN -11.545317 3.653206 -3.160 0.001576 \*\*   
## ORIGIN\_AIRPORTSUX 2.167191 4.437884 0.488 0.625310   
## ORIGIN\_AIRPORTSWF -1.166803 4.125202 -0.283 0.777294   
## ORIGIN\_AIRPORTSYR -3.399818 2.529695 -1.344 0.178960   
## ORIGIN\_AIRPORTTLH -6.958903 2.653634 -2.622 0.008731 \*\*   
## ORIGIN\_AIRPORTTOL -14.751353 3.896910 -3.785 0.000153 \*\*\*  
## ORIGIN\_AIRPORTTPA -5.033513 2.185022 -2.304 0.021243 \*   
## ORIGIN\_AIRPORTTRI -5.333919 3.070169 -1.737 0.082328 .   
## ORIGIN\_AIRPORTTTN 15.062401 2.910649 5.175 2.28e-07 \*\*\*  
## ORIGIN\_AIRPORTTUL -6.730359 2.287950 -2.942 0.003265 \*\*   
## ORIGIN\_AIRPORTTUS -7.827009 2.274898 -3.441 0.000580 \*\*\*  
## ORIGIN\_AIRPORTTVC -5.422562 2.934816 -1.848 0.064651 .   
## ORIGIN\_AIRPORTTWF -17.164153 4.269162 -4.020 5.81e-05 \*\*\*  
## ORIGIN\_AIRPORTTXK -15.260321 3.866306 -3.947 7.91e-05 \*\*\*  
## ORIGIN\_AIRPORTTYR -4.429900 3.009729 -1.472 0.141059   
## ORIGIN\_AIRPORTTYS 0.268440 2.448363 0.110 0.912694   
## ORIGIN\_AIRPORTUST -38.743016 7.929345 -4.886 1.03e-06 \*\*\*  
## ORIGIN\_AIRPORTVEL -10.741492 4.460373 -2.408 0.016031 \*   
## ORIGIN\_AIRPORTVLD -1.485413 3.718705 -0.399 0.689566   
## ORIGIN\_AIRPORTVPS -2.654034 2.592050 -1.024 0.305876   
## ORIGIN\_AIRPORTWRG -5.763002 5.069914 -1.137 0.255661   
## ORIGIN\_AIRPORTXNA 1.276360 2.380228 0.536 0.591797   
## ORIGIN\_AIRPORTYAK -22.388844 4.945623 -4.527 5.98e-06 \*\*\*  
## ORIGIN\_AIRPORTYUM -6.816728 3.051792 -2.234 0.025504 \*   
## DESTINATION\_AIRPORTABI -5.858382 2.892915 -2.025 0.042859 \*   
## DESTINATION\_AIRPORTABQ 0.854868 2.274497 0.376 0.707029   
## DESTINATION\_AIRPORTABR -14.618653 4.235144 -3.452 0.000557 \*\*\*  
## DESTINATION\_AIRPORTABY 1.888143 3.790328 0.498 0.618380   
## DESTINATION\_AIRPORTACT 0.364583 3.272465 0.111 0.911292   
## DESTINATION\_AIRPORTACV -4.181648 3.228542 -1.295 0.195247   
## DESTINATION\_AIRPORTACY -0.777715 2.671974 -0.291 0.771003   
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## DESTINATION\_AIRPORTADQ 2.538000 5.769702 0.440 0.660021   
## DESTINATION\_AIRPORTAEX -2.656156 2.741629 -0.969 0.332633   
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## DESTINATION\_AIRPORTAMA -0.180616 2.509347 -0.072 0.942620   
## DESTINATION\_AIRPORTANC -4.415959 2.379874 -1.856 0.063519 .   
## DESTINATION\_AIRPORTAPN 6.213514 4.550152 1.366 0.172077   
## DESTINATION\_AIRPORTASE 5.421810 2.444363 2.218 0.026549 \*   
## DESTINATION\_AIRPORTATL -0.041754 2.171989 -0.019 0.984663   
## DESTINATION\_AIRPORTATW -0.014437 2.838636 -0.005 0.995942   
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## DESTINATION\_AIRPORTAVL 3.608159 2.909789 1.240 0.214973   
## DESTINATION\_AIRPORTAVP 1.640693 3.486858 0.471 0.637972   
## DESTINATION\_AIRPORTAZO -2.443897 3.042339 -0.803 0.421804   
## DESTINATION\_AIRPORTBDL 3.624047 2.272154 1.595 0.110716   
## DESTINATION\_AIRPORTBET 5.755154 3.899241 1.476 0.139953   
## DESTINATION\_AIRPORTBFL -3.092522 2.859053 -1.082 0.279404   
## DESTINATION\_AIRPORTBGM 7.758045 7.222813 1.074 0.282777   
## DESTINATION\_AIRPORTBGR -1.857040 9.278398 -0.200 0.841366   
## DESTINATION\_AIRPORTBHM 1.756108 2.309680 0.760 0.447060   
## DESTINATION\_AIRPORTBIL 1.632999 2.844640 0.574 0.565926   
## DESTINATION\_AIRPORTBIS 4.463366 2.697617 1.655 0.098014 .   
## DESTINATION\_AIRPORTBJI -10.559030 4.166120 -2.534 0.011261 \*   
## DESTINATION\_AIRPORTBLI -9.189081 3.643280 -2.522 0.011662 \*   
## DESTINATION\_AIRPORTBMI 4.496823 2.817850 1.596 0.110526   
## DESTINATION\_AIRPORTBNA 0.466651 2.205673 0.212 0.832444   
## DESTINATION\_AIRPORTBOI 1.081071 2.351931 0.460 0.645766   
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## DESTINATION\_AIRPORTBPT 7.759843 3.796819 2.044 0.040976 \*   
## DESTINATION\_AIRPORTBQK -0.727647 3.734206 -0.195 0.845503   
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## DESTINATION\_AIRPORTBRW 13.418976 5.577481 2.406 0.016132 \*   
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## DESTINATION\_AIRPORTBZN 1.724113 2.734158 0.631 0.528314   
## DESTINATION\_AIRPORTCAE 2.681570 2.482829 1.080 0.280122   
## DESTINATION\_AIRPORTCAK 0.243925 2.462508 0.099 0.921094   
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## DESTINATION\_AIRPORTCEC -10.076435 4.320352 -2.332 0.019684 \*   
## DESTINATION\_AIRPORTCHA 0.983395 2.646254 0.372 0.710177   
## DESTINATION\_AIRPORTCHO 11.111924 2.985327 3.722 0.000198 \*\*\*  
## DESTINATION\_AIRPORTCHS 1.449974 2.357732 0.615 0.538564   
## DESTINATION\_AIRPORTCID 6.075403 2.426158 2.504 0.012276 \*   
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## DESTINATION\_AIRPORTCLE 0.508999 2.217274 0.230 0.818433   
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## DESTINATION\_AIRPORTCMX -4.808249 4.456152 -1.079 0.280582   
## DESTINATION\_AIRPORTCNY -15.193482 4.404837 -3.449 0.000562 \*\*\*  
## DESTINATION\_AIRPORTCOD -1.901796 4.265372 -0.446 0.655692   
## DESTINATION\_AIRPORTCOS 5.460102 2.450483 2.228 0.025869 \*   
## DESTINATION\_AIRPORTCOU 6.825408 3.413731 1.999 0.045566 \*   
## DESTINATION\_AIRPORTCPR -6.053990 3.069339 -1.972 0.048563 \*   
## DESTINATION\_AIRPORTCRP 3.088165 2.480067 1.245 0.213061   
## DESTINATION\_AIRPORTCRW 8.371343 3.011497 2.780 0.005439 \*\*   
## DESTINATION\_AIRPORTCSG 7.555155 3.621604 2.086 0.036967 \*   
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## DESTINATION\_AIRPORTDEN 2.233093 2.172239 1.028 0.303943   
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## DESTINATION\_AIRPORTDIK -3.112125 3.454935 -0.901 0.367707   
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## DESTINATION\_AIRPORTDTW 1.722267 2.181086 0.790 0.429740   
## DESTINATION\_AIRPORTDVL -14.269884 7.524173 -1.897 0.057889 .   
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## DESTINATION\_AIRPORTEGE 10.463179 2.725171 3.839 0.000123 \*\*\*  
## DESTINATION\_AIRPORTEKO -4.354416 4.235586 -1.028 0.303924   
## DESTINATION\_AIRPORTELM 7.738667 3.036868 2.548 0.010827 \*   
## DESTINATION\_AIRPORTELP 1.929246 2.325669 0.830 0.406797   
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## DESTINATION\_AIRPORTESC 0.393686 4.566607 0.086 0.931300   
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## DESTINATION\_AIRPORTEVV 1.522669 2.697420 0.564 0.572420   
## DESTINATION\_AIRPORTEWN -2.911328 4.375261 -0.665 0.505791   
## DESTINATION\_AIRPORTEWR 3.698405 2.180421 1.696 0.089850 .   
## DESTINATION\_AIRPORTEYW -3.327624 2.834605 -1.174 0.240424   
## DESTINATION\_AIRPORTFAI -5.970395 3.216965 -1.856 0.063467 .   
## DESTINATION\_AIRPORTFAR 1.899828 2.523887 0.753 0.451607   
## DESTINATION\_AIRPORTFAT -1.940910 2.421505 -0.802 0.422825   
## DESTINATION\_AIRPORTFAY 0.907152 3.117814 0.291 0.771084   
## DESTINATION\_AIRPORTFCA -3.511124 3.274929 -1.072 0.283665   
## DESTINATION\_AIRPORTFLG -4.123459 3.256021 -1.266 0.205366   
## DESTINATION\_AIRPORTFLL -0.869009 2.186830 -0.397 0.691085   
## DESTINATION\_AIRPORTFNT 0.534496 2.593901 0.206 0.836745   
## DESTINATION\_AIRPORTFSD 3.744544 2.455305 1.525 0.127239   
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## DESTINATION\_AIRPORTFWA -0.633427 2.625632 -0.241 0.809363   
## DESTINATION\_AIRPORTGCC -9.508537 3.523022 -2.699 0.006956 \*\*   
## DESTINATION\_AIRPORTGCK -6.471251 4.343280 -1.490 0.136239   
## DESTINATION\_AIRPORTGEG -0.872380 2.370032 -0.368 0.712808   
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## DESTINATION\_AIRPORTGGG -0.990906 4.484178 -0.221 0.825109   
## DESTINATION\_AIRPORTGJT -4.313138 2.768072 -1.558 0.119192   
## DESTINATION\_AIRPORTGNV 1.007682 2.833670 0.356 0.722133   
## DESTINATION\_AIRPORTGPT -0.350557 2.645334 -0.133 0.894574   
## DESTINATION\_AIRPORTGRB 0.550316 2.586109 0.213 0.831486   
## DESTINATION\_AIRPORTGRI -6.026695 4.384445 -1.375 0.169267   
## DESTINATION\_AIRPORTGRK 0.580193 2.616148 0.222 0.824490   
## DESTINATION\_AIRPORTGRR 3.022921 2.331720 1.296 0.194826   
## DESTINATION\_AIRPORTGSO 1.730235 2.421018 0.715 0.474812   
## DESTINATION\_AIRPORTGSP 1.080781 2.475005 0.437 0.662345   
## DESTINATION\_AIRPORTGTF -3.798489 3.189815 -1.191 0.233725   
## DESTINATION\_AIRPORTGTR 0.185740 3.775909 0.049 0.960767   
## DESTINATION\_AIRPORTGUC 1.450630 3.778437 0.384 0.701035   
## DESTINATION\_AIRPORTGUM 14.164579 5.505004 2.573 0.010081 \*   
## DESTINATION\_AIRPORTHDN 3.259889 3.092125 1.054 0.291766   
## DESTINATION\_AIRPORTHIB -4.253187 4.100459 -1.037 0.299621   
## DESTINATION\_AIRPORTHLN -8.507006 3.419173 -2.488 0.012845 \*   
## DESTINATION\_AIRPORTHNL 11.092262 2.267767 4.891 1.00e-06 \*\*\*  
## DESTINATION\_AIRPORTHOB 0.943121 4.617147 0.204 0.838146   
## DESTINATION\_AIRPORTHOU -0.490083 2.203634 -0.222 0.824005   
## DESTINATION\_AIRPORTHPN 5.331010 2.415803 2.207 0.027334 \*   
## DESTINATION\_AIRPORTHRL -0.778337 2.733707 -0.285 0.775860   
## DESTINATION\_AIRPORTHSV -0.302799 2.564346 -0.118 0.906004   
## DESTINATION\_AIRPORTHYS -9.150495 4.443554 -2.059 0.039468 \*   
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## DESTINATION\_AIRPORTIAG 2.493187 5.413906 0.461 0.645146   
## DESTINATION\_AIRPORTIAH 0.251357 2.173620 0.116 0.907938   
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## DESTINATION\_AIRPORTIDA 1.600985 3.014357 0.531 0.595336   
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## DESTINATION\_AIRPORTITH 0.899265 20.789525 0.043 0.965498   
## DESTINATION\_AIRPORTITO 5.281793 2.568930 2.056 0.039780 \*   
## DESTINATION\_AIRPORTJAC 7.230292 2.633705 2.745 0.006046 \*\*   
## DESTINATION\_AIRPORTJAN 0.945496 2.442407 0.387 0.698670   
## DESTINATION\_AIRPORTJAX 2.065958 2.278247 0.907 0.364503   
## DESTINATION\_AIRPORTJFK 7.783361 2.186458 3.560 0.000371 \*\*\*  
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## DESTINATION\_AIRPORTKOA 4.015433 2.374827 1.691 0.090869 .   
## DESTINATION\_AIRPORTKTN 3.165945 3.202436 0.989 0.322857   
## DESTINATION\_AIRPORTLAN 1.136377 2.997586 0.379 0.704616   
## DESTINATION\_AIRPORTLAR -9.192851 4.372063 -2.103 0.035498 \*   
## DESTINATION\_AIRPORTLAS -0.708535 2.177174 -0.325 0.744850   
## DESTINATION\_AIRPORTLAW 1.634154 3.452173 0.473 0.635950   
## DESTINATION\_AIRPORTLAX -0.717702 2.172344 -0.330 0.741112   
## DESTINATION\_AIRPORTLBB 1.589561 2.545752 0.624 0.532367   
## DESTINATION\_AIRPORTLBE 2.462217 3.603632 0.683 0.494443   
## DESTINATION\_AIRPORTLCH -3.343545 3.079779 -1.086 0.277637   
## DESTINATION\_AIRPORTLEX 0.800559 2.511687 0.319 0.749928   
## DESTINATION\_AIRPORTLFT 0.415786 2.507531 0.166 0.868303   
## DESTINATION\_AIRPORTLGA 11.523549 2.180255 5.285 1.25e-07 \*\*\*  
## DESTINATION\_AIRPORTLGB -6.618457 2.401648 -2.756 0.005855 \*\*   
## DESTINATION\_AIRPORTLIH 3.085141 2.387659 1.292 0.196316   
## DESTINATION\_AIRPORTLIT 3.215690 2.356563 1.365 0.172389   
## DESTINATION\_AIRPORTLNK -2.048899 2.917504 -0.702 0.482506   
## DESTINATION\_AIRPORTLRD -3.512224 2.954892 -1.189 0.234592   
## DESTINATION\_AIRPORTLSE 2.567435 3.358143 0.765 0.444546   
## DESTINATION\_AIRPORTLWS -13.756963 4.419026 -3.113 0.001851 \*\*   
## DESTINATION\_AIRPORTMAF 2.075171 2.383580 0.871 0.383967   
## DESTINATION\_AIRPORTMBS -2.403594 3.096934 -0.776 0.437678   
## DESTINATION\_AIRPORTMCI 0.657816 2.215161 0.297 0.766497   
## DESTINATION\_AIRPORTMCO 1.497920 2.179379 0.687 0.491884   
## DESTINATION\_AIRPORTMDT 0.986711 2.674483 0.369 0.712176   
## DESTINATION\_AIRPORTMDW 0.617254 2.190412 0.282 0.778099   
## DESTINATION\_AIRPORTMEI 3.481259 4.130606 0.843 0.399343   
## DESTINATION\_AIRPORTMEM 1.057928 2.305572 0.459 0.646337   
## DESTINATION\_AIRPORTMFE 1.059031 2.620749 0.404 0.686143   
## DESTINATION\_AIRPORTMFR -4.860530 2.910458 -1.670 0.094915 .   
## DESTINATION\_AIRPORTMGM 2.866648 2.732888 1.049 0.294204   
## DESTINATION\_AIRPORTMHK 5.643495 3.232385 1.746 0.080825 .   
## DESTINATION\_AIRPORTMHT 2.750583 2.541386 1.082 0.279112   
## DESTINATION\_AIRPORTMIA 1.959148 2.192697 0.893 0.371596   
## DESTINATION\_AIRPORTMKE 0.487916 2.229478 0.219 0.826769   
## DESTINATION\_AIRPORTMKG -1.200026 4.412073 -0.272 0.785632   
## DESTINATION\_AIRPORTMLB -0.266671 3.353969 -0.080 0.936628   
## DESTINATION\_AIRPORTMLI 0.273797 2.578850 0.106 0.915447   
## DESTINATION\_AIRPORTMLU 1.429768 2.823719 0.506 0.612617   
## DESTINATION\_AIRPORTMMH -8.980703 4.940831 -1.818 0.069118 .   
## DESTINATION\_AIRPORTMOB 1.184401 2.536152 0.467 0.640495   
## DESTINATION\_AIRPORTMOT 2.805568 3.153480 0.890 0.373641   
## DESTINATION\_AIRPORTMQT 10.187804 5.892781 1.729 0.083834 .   
## DESTINATION\_AIRPORTMRY -7.162577 2.701020 -2.652 0.008006 \*\*   
## DESTINATION\_AIRPORTMSN -0.680218 2.369410 -0.287 0.774049   
## DESTINATION\_AIRPORTMSO -6.843326 3.263859 -2.097 0.036021 \*   
## DESTINATION\_AIRPORTMSP 0.655852 2.183451 0.300 0.763892   
## DESTINATION\_AIRPORTMSY 0.215644 2.211978 0.097 0.922338   
## DESTINATION\_AIRPORTMTJ 5.733365 3.044805 1.883 0.059701 .   
## DESTINATION\_AIRPORTMYR 2.150769 2.707698 0.794 0.427011   
## DESTINATION\_AIRPORTOAJ 1.370913 3.449114 0.397 0.691022   
## DESTINATION\_AIRPORTOAK -0.869394 2.215232 -0.392 0.694717   
## DESTINATION\_AIRPORTOGG 5.515827 2.290921 2.408 0.016054 \*   
## DESTINATION\_AIRPORTOKC 2.987613 2.289033 1.305 0.191830   
## DESTINATION\_AIRPORTOMA 1.848789 2.275641 0.812 0.416548   
## DESTINATION\_AIRPORTOME 4.281137 4.694395 0.912 0.361786   
## DESTINATION\_AIRPORTONT -0.155322 2.277289 -0.068 0.945623   
## DESTINATION\_AIRPORTORD 7.686444 2.169578 3.543 0.000396 \*\*\*  
## DESTINATION\_AIRPORTORF 1.004161 2.372288 0.423 0.672085   
## DESTINATION\_AIRPORTORH 2.677305 4.401743 0.608 0.543030   
## DESTINATION\_AIRPORTOTH 13.795733 7.229585 1.908 0.056361 .   
## DESTINATION\_AIRPORTOTZ 7.871081 4.360335 1.805 0.071051 .   
## DESTINATION\_AIRPORTPAH -10.621850 4.397647 -2.415 0.015720 \*   
## DESTINATION\_AIRPORTPBG 3.658769 5.513599 0.664 0.506953   
## DESTINATION\_AIRPORTPBI 1.875235 2.236934 0.838 0.401859   
## DESTINATION\_AIRPORTPDX -1.243558 2.213788 -0.562 0.574298   
## DESTINATION\_AIRPORTPHF 1.460746 3.303255 0.442 0.658334   
## DESTINATION\_AIRPORTPHL 3.754272 2.196346 1.709 0.087391 .   
## DESTINATION\_AIRPORTPHX 0.108965 2.176581 0.050 0.960073   
## DESTINATION\_AIRPORTPIA -0.651462 2.627379 -0.248 0.804172   
## DESTINATION\_AIRPORTPIB -21.876957 6.807321 -3.214 0.001310 \*\*   
## DESTINATION\_AIRPORTPIH -2.756437 4.247641 -0.649 0.516381   
## DESTINATION\_AIRPORTPIT 1.912283 2.243488 0.852 0.394009   
## DESTINATION\_AIRPORTPLN 5.350177 4.501902 1.188 0.234666   
## DESTINATION\_AIRPORTPNS 0.724910 2.437516 0.297 0.766164   
## DESTINATION\_AIRPORTPPG -1.849955 9.305449 -0.199 0.842417   
## DESTINATION\_AIRPORTPSC 1.449553 3.010847 0.481 0.630201   
## DESTINATION\_AIRPORTPSE -12.229488 4.139982 -2.954 0.003137 \*\*   
## DESTINATION\_AIRPORTPSG 8.963244 5.000077 1.793 0.073034 .   
## DESTINATION\_AIRPORTPSP -1.580592 2.315041 -0.683 0.494766   
## DESTINATION\_AIRPORTPUB -3.377137 4.458616 -0.757 0.448786   
## DESTINATION\_AIRPORTPVD 2.559721 2.354511 1.087 0.276968   
## DESTINATION\_AIRPORTPWM 0.744285 2.815169 0.264 0.791484   
## DESTINATION\_AIRPORTRAP -3.772855 2.874175 -1.313 0.189293   
## DESTINATION\_AIRPORTRDD -6.294118 3.716210 -1.694 0.090324 .   
## DESTINATION\_AIRPORTRDM -4.347422 3.077787 -1.413 0.157799   
## DESTINATION\_AIRPORTRDU 0.634177 2.227660 0.285 0.775887   
## DESTINATION\_AIRPORTRHI -5.832108 3.888691 -1.500 0.133677   
## DESTINATION\_AIRPORTRIC 1.485587 2.301734 0.645 0.518655   
## DESTINATION\_AIRPORTRKS -14.013693 3.767410 -3.720 0.000199 \*\*\*  
## DESTINATION\_AIRPORTRNO -1.211222 2.322037 -0.522 0.601935   
## DESTINATION\_AIRPORTROA 1.649618 3.172796 0.520 0.603115   
## DESTINATION\_AIRPORTROC 1.682042 2.443546 0.688 0.491225   
## DESTINATION\_AIRPORTROW -1.105407 3.845767 -0.287 0.773780   
## DESTINATION\_AIRPORTRST 5.453421 3.020041 1.806 0.070959 .   
## DESTINATION\_AIRPORTRSW 0.007091 2.215331 0.003 0.997446   
## DESTINATION\_AIRPORTSAF 1.990852 3.385572 0.588 0.556506   
## DESTINATION\_AIRPORTSAN -1.836550 2.191134 -0.838 0.401934   
## DESTINATION\_AIRPORTSAT 3.414624 2.230090 1.531 0.125730   
## DESTINATION\_AIRPORTSAV 2.569448 2.440968 1.053 0.292509   
## DESTINATION\_AIRPORTSBA -4.057114 2.482348 -1.634 0.102178   
## DESTINATION\_AIRPORTSBN 5.258909 2.568309 2.048 0.040598 \*   
## DESTINATION\_AIRPORTSBP -8.230586 2.569791 -3.203 0.001361 \*\*   
## DESTINATION\_AIRPORTSCC 2.301397 4.046179 0.569 0.569504   
## DESTINATION\_AIRPORTSCE 1.504868 4.174680 0.360 0.718492   
## DESTINATION\_AIRPORTSDF 2.178553 2.347139 0.928 0.353318   
## DESTINATION\_AIRPORTSEA -1.165759 2.189041 -0.533 0.594350   
## DESTINATION\_AIRPORTSFO 2.347994 2.176992 1.079 0.280789   
## DESTINATION\_AIRPORTSGF 4.101272 2.459583 1.667 0.095422 .   
## DESTINATION\_AIRPORTSGU -0.744387 3.144030 -0.237 0.812841   
## DESTINATION\_AIRPORTSHV 1.043560 2.486425 0.420 0.674702   
## DESTINATION\_AIRPORTSIT -2.762569 4.017323 -0.688 0.491664   
## DESTINATION\_AIRPORTSJC -1.630541 2.217732 -0.735 0.462200   
## DESTINATION\_AIRPORTSJT -2.077351 3.250940 -0.639 0.522823   
## DESTINATION\_AIRPORTSJU 3.999139 2.242558 1.783 0.074539 .   
## DESTINATION\_AIRPORTSLC -3.890806 2.185919 -1.780 0.075086 .   
## DESTINATION\_AIRPORTSMF 0.400526 2.219207 0.180 0.856774   
## DESTINATION\_AIRPORTSMX -12.121345 4.194631 -2.890 0.003856 \*\*   
## DESTINATION\_AIRPORTSNA -4.527787 2.218162 -2.041 0.041228 \*   
## DESTINATION\_AIRPORTSPI -3.789391 3.313305 -1.144 0.252753   
## DESTINATION\_AIRPORTSPS -5.753293 3.559781 -1.616 0.106053   
## DESTINATION\_AIRPORTSRQ 0.119624 2.631085 0.045 0.963736   
## DESTINATION\_AIRPORTSTC 6.537337 5.189702 1.260 0.207787   
## DESTINATION\_AIRPORTSTL 0.269744 2.204949 0.122 0.902633   
## DESTINATION\_AIRPORTSTT 2.963849 2.516374 1.178 0.238866   
## DESTINATION\_AIRPORTSTX 2.258453 3.653456 0.618 0.536464   
## DESTINATION\_AIRPORTSUN -2.365623 3.680874 -0.643 0.520432   
## DESTINATION\_AIRPORTSUX 5.621451 4.440736 1.266 0.205555   
## DESTINATION\_AIRPORTSWF 3.407030 4.117639 0.827 0.407997   
## DESTINATION\_AIRPORTSYR 3.571998 2.531111 1.411 0.158175   
## DESTINATION\_AIRPORTTLH 0.417417 2.659282 0.157 0.875272   
## DESTINATION\_AIRPORTTOL 2.059219 3.875640 0.531 0.595195   
## DESTINATION\_AIRPORTTPA 0.391339 2.190697 0.179 0.858223   
## DESTINATION\_AIRPORTTRI -1.936512 3.063073 -0.632 0.527248   
## DESTINATION\_AIRPORTTTN 25.328398 2.923183 8.665 < 2e-16 \*\*\*  
## DESTINATION\_AIRPORTTUL 0.377475 2.293298 0.165 0.869259   
## DESTINATION\_AIRPORTTUS -0.499382 2.280582 -0.219 0.826673   
## DESTINATION\_AIRPORTTVC 1.087333 2.940763 0.370 0.711572   
## DESTINATION\_AIRPORTTWF -3.848787 4.284598 -0.898 0.369034   
## DESTINATION\_AIRPORTTXK -9.011086 3.853495 -2.338 0.019366 \*   
## DESTINATION\_AIRPORTTYR 1.438955 3.007732 0.478 0.632352   
## DESTINATION\_AIRPORTTYS 4.039318 2.452486 1.647 0.099552 .   
## DESTINATION\_AIRPORTUST -27.888681 7.928425 -3.518 0.000436 \*\*\*  
## DESTINATION\_AIRPORTVEL -17.918869 4.509096 -3.974 7.07e-05 \*\*\*  
## DESTINATION\_AIRPORTVLD -0.756066 3.734189 -0.202 0.839548   
## DESTINATION\_AIRPORTVPS -0.117476 2.603624 -0.045 0.964012   
## DESTINATION\_AIRPORTWRG 7.827983 5.027001 1.557 0.119426   
## DESTINATION\_AIRPORTXNA 3.567511 2.384930 1.496 0.134691   
## DESTINATION\_AIRPORTYAK -1.495619 4.919727 -0.304 0.761125   
## DESTINATION\_AIRPORTYUM -6.538165 3.051835 -2.142 0.032164 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 41.35 on 1004853 degrees of freedom  
## (43071 observations deleted due to missingness)  
## Multiple R-squared: 0.03547, Adjusted R-squared: 0.03485   
## F-statistic: 56.85 on 650 and 1004853 DF, p-value: < 2.2e-16

#### Predicting for a specific query to demonstrate prediction power

Predicting ARRIVAL\_DELAY for a flight departing from Oakland, on a friday afternoon for Baltimore via Spirit Airlines

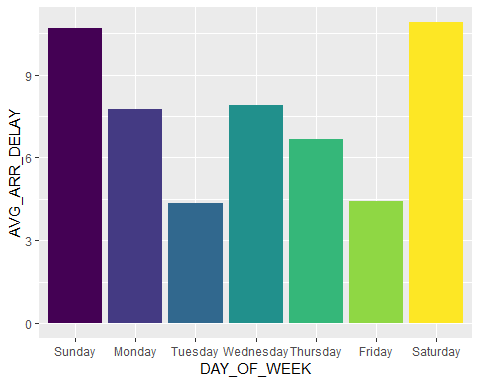
predict(arrDelayModel, data.frame(DAY\_OF\_WEEK = "Friday", DEP\_TIME\_OF\_DAY = "Afternoon", AIRLINE = "NK", ORIGIN\_AIRPORT = "OAK", DESTINATION\_AIRPORT = "BWI"))

## 1   
## 15.71989

# APPENDIX (All extra bits of analysis that were superceded by the above code)

Plot of arrival delay vs Day of the week

groupByDay <- group\_by(select(flightData, DAY\_OF\_WEEK, ARRIVAL\_DELAY),DAY\_OF\_WEEK)  
groupByDay <- groupByDay[complete.cases(groupByDay),]  
delayByDay <- summarise(groupByDay, AVG\_ARR\_DELAY = mean(ARRIVAL\_DELAY))  
ggplot(data = delayByDay, aes(x = DAY\_OF\_WEEK, y = AVG\_ARR\_DELAY, fill = DAY\_OF\_WEEK)) + geom\_bar(stat = "identity") + guides(fill = FALSE)



#### Hypothesis Test

H0 : Mean arrival delay on Sat <= 0 H1 : Mean arival delay > 0

Putting saturday arrival delays in a vector and then running the above hypothesis tests

arrdelaySat <- filter(flightData, DAY\_OF\_WEEK == "Saturday")$ARRIVAL\_DELAY  
summary(arrdelaySat)

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## -72.00 -12.00 -2.00 10.91 16.00 1593.00 7786

test\_res <- t.test(arrdelaySat, mu = 0, alternative = "greater")  
test\_res

##   
## One Sample t-test  
##   
## data: arrdelaySat  
## t = 85.686, df = 140890, p-value < 2.2e-16  
## alternative hypothesis: true mean is greater than 0  
## 95 percent confidence interval:  
## 10.7038 Inf  
## sample estimates:  
## mean of x   
## 10.9133

#### Anova on day of the week

res.aov <- aov(ARRIVAL\_DELAY ~ DAY\_OF\_WEEK, data = flightData)  
summary(res.aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## DAY\_OF\_WEEK 6 5.858e+06 976251 552.8 <2e-16 \*\*\*  
## Residuals 1005497 1.776e+09 1766   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 43071 observations deleted due to missingness