#INTRODUCTION/SUMMARY
#This project is to complete the Movielens capstone assignment for EDX Datascience Program.
#I tried to run a variety of algorithms but none would work with my computer. I opted for a very simple approach that I found: Penalized Least Squares Regression. I applied this to a number of variables, but got the best RMSE with rating/userId. This method assumes that fewer ratings per user produces more volatility.

#METHODS
#First I download the dataset, then explore it. Then change the timestamp to date/time(using Lubridate) in order to run additional explorations. Finally, I ran the Penalized Least Squares Regression on the ratings/userId variables.

#Download edx dataset

```
dl <- tempfile()
download.file("http://files.grouplens.org/datasets/movielens/ml-10m.zip", dl)

ratings <- read.table(text = gsub("::", "\t", readLines(unzip(dl, "ml-10M100K/ratings.dat"))),
                      col.names = c("userId", "movieId", "rating", "timestamp"))

movies <- str_split_fixed(readLines(unzip(dl, "ml-10M100K/movies.dat")), "\\::", 3)
colnames(movies) <- c("movieId", "title", "genres")
movies <- as.data.frame(movies) %>% mutate(movieId = as.numeric(levels(movieId))[movieId],
                                           title = as.character(title),
                                           genres = as.character(genres))

movielens <- left_join(ratings, movies, by = "movieId")

# Validation set will be 10% of MovieLens data

set.seed(1) # if using R 3.6.0: set.seed(1, sample.kind = "Rounding")
test_index <- createDataPartition(y = movielens$rating, times = 1, p = 0.1, list = FALSE)
edx <- movielens[-test_index,]
temp <- movielens[test_index,]

# Make sure userId and movieId in validation set are also in edx set

validation <- temp %>%
  semi_join(edx, by = "movieId") %>%
  semi_join(edx, by = "userId")

#Add rows removed from validation set back into edx set

removed <- anti_join(temp, validation)
edx <- rbind(edx, removed)
```

```
rm(dl, ratings, movies, test_index, temp, movielens, removed)

#Explore data


#Convert timestamp to datetime

edx <- edx %>% mutate(timestamp = as.POSIXct(timestamp, origin = "1970-01-01",
                                              tz = "GMT"))
edx$timestamp <- format(edx$timestamp, "%H")

#colnames(edx)

names(edx)[names(edx) == "timestamp"] <- "hour_rated"

releaseyear <- stringi::stri_extract(edx$title, regex = "(\\d{4})", comments = TRUE) %>%
  as.numeric()

edx <- edx %>% mutate(release_year = releaseyear)

validation <- validation %>% mutate(timestamp = as.POSIXct(validation$timestamp,
                                                           origin = "1970-01-01", tz = "GMT"))
validation$timestamp <- format(validation$timestamp, "%H")

colnames(validation)
names(validation)[names(validation) == "timestamp"] <- "hour_rated"

releaseyear2 <- stringi::stri_extract(validation$title, regex = "(\\d{4})",
                                      comments = TRUE) %>% as.numeric()

validation <- validation %>% mutate(release_year = releaseyear2)
#This next section is an excellent idea; not mine. I tried lms on this; knn, etc. I tried this method
#with the time of day (thinking those ratings made while one might be drunk would be higher). I
tried
#every variable. This one works). But it's not my idea.
RMSE <- function(true_ratings, predicted_ratings){
  sqrt(mean((true_ratings - predicted_ratings)^2))
}

lambdas <- seq(0, 5, 0.25)

rmses <- sapply(lambdas,function(l){

  #Calculate the mean of ratings from the edx training set
  mu <- mean(edx$rating)
```

```
  #Adjust mean by movie effect and penalize low number on ratings
  b_i <- edx %>%
    group_by(movieId) %>%
    summarize(b_i = sum(rating - mu)/(n()+l))

  #ajdust mean by user and movie effect and penalize low number of ratings
  b_u <- edx %>%
    left_join(b_i, by="movieId") %>%
    group_by(userId) %>%
    summarize(b_u = sum(rating - b_i - mu)/(n()+l))

  #predict ratings in the training set to derive optimal penalty value 'lambda'
  predicted_ratings <-
    edx %>%
    left_join(b_i, by = "movieId") %>%
    left_join(b_u, by = "userId") %>%
    mutate(pred = mu + b_i + b_u) %>%
    .$pred

  return(RMSE(predicted_ratings, edx$rating))
})

#RESULTS

lambda <- lambdas[which.min(rmses)]
paste('Optimal RMSE of',min(rmses),'is achieved with Lambda',lambda)

#Run the same program with best lambda
lambda <- 0.5

predict_a<- sapply(lambda,function(l){

#Find the mean from the training set
  mu <- mean(edx$rating)

#Find movie effect with best lambda
  b_i <- edx %>%
    group_by(movieId) %>%
    summarize(b_i = sum(rating - mu)/(n()+l))

#Find user effect with best lambda
  b_u <- edx %>%
    left_join(b_i, by="userId") %>%
    group_by(hour_rated) %>%
    summarize(b_u = sum(rating - b_i - mu)/(n()+l))
```

```
#Predict the ratings on the validation set
  predictedRating<-
    validation %>%
    left_join(b_i, by = "userId") %>%
    left_join(b_u, by = "hour_rated") %>%
    mutate(pred = mu + b_i + b_u) %>%
    .$pred #validation

  return(predictedRating)
#this is the end of "not mine"
})
```

#CONCLUSION:

The Penalized Least Squares Regression does indeed produce an acceptable RMSE. Overall, however, this is a lame machine learning exercise. It isn’t efficient to run various algorithms, and the assignment doesn’t ask to compare accuracy (which really is the point, isn’t it?).