# Project#1

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## Regression

This is a group project, and students should work in a group of size 3. Include all the R code, hypothesis testing, one or two lines of explanation for any output. The report should be organized, printed, and stapled. The due date of this project is **Wednesday** 02/19/2020.

```
Movies = read.csv("C3 2008Movies.csv")
```

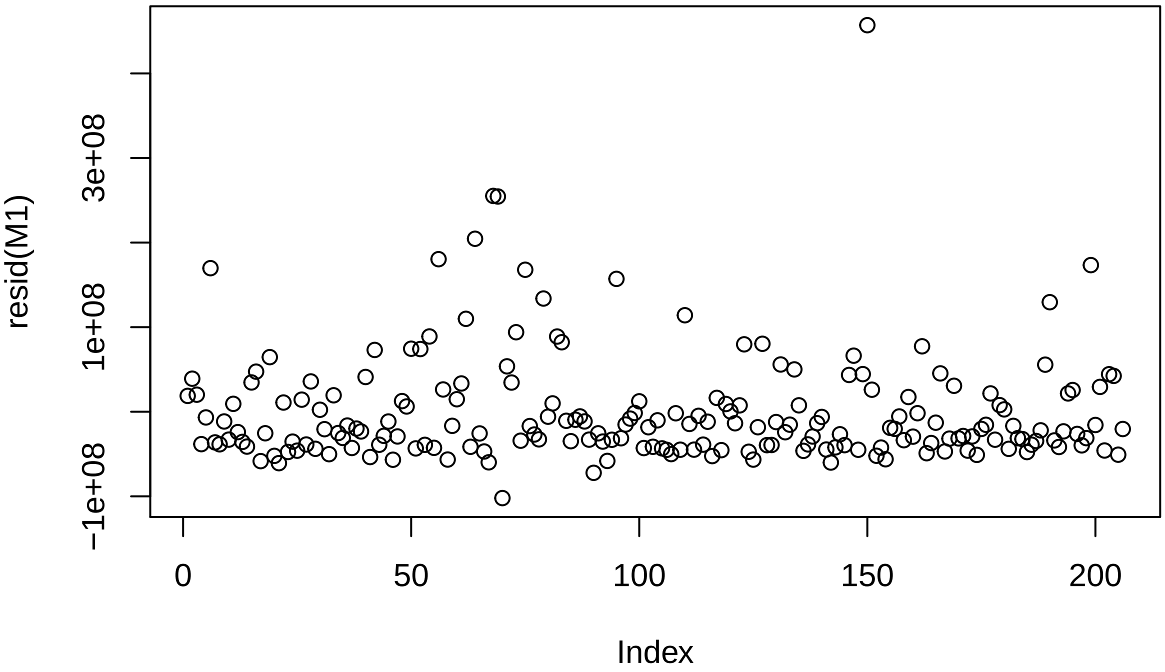
The 2008Movies file contains data on movies released in 2008.

1. Calculate a regression model to predict box office from run time. Interpret the $R^2$ value and test statistic for the slope in the context of this problem.

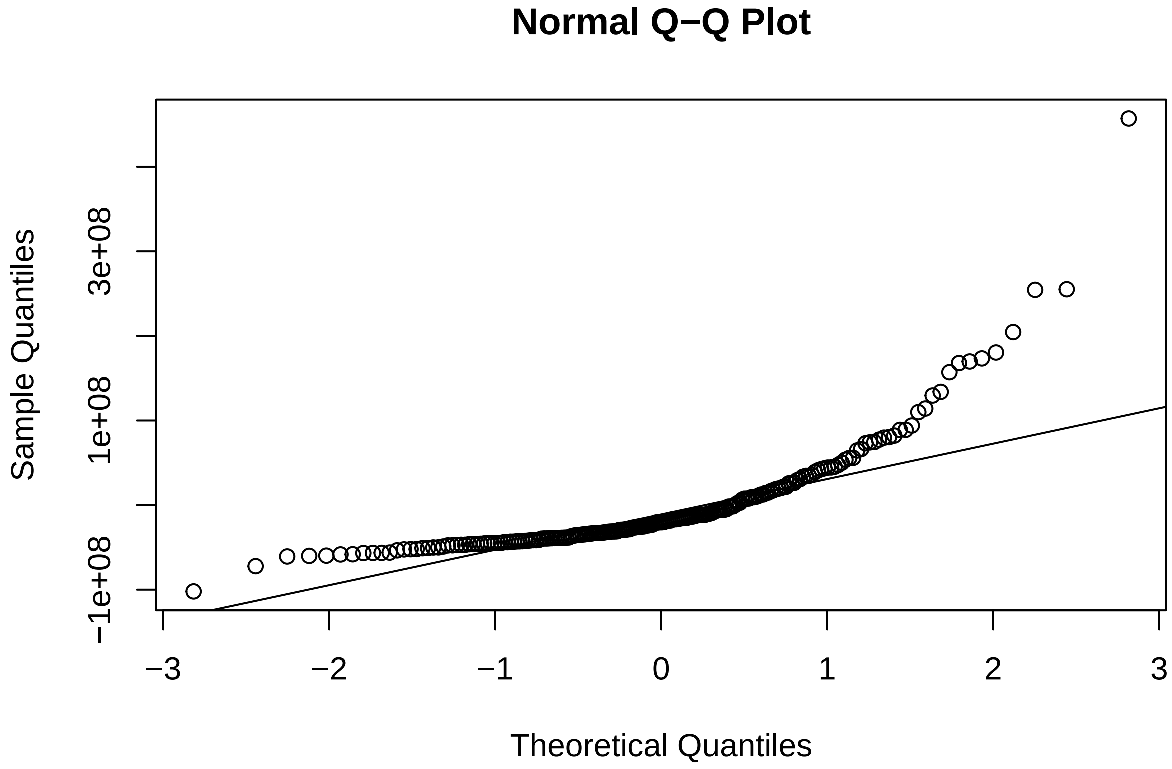
```
M1 = lm(BoxOfficeGross~RunTime, data=Movies)
summary(M1)
```

```
##
## Call:
## lm(formula = BoxOfficeGross ~ RunTime, data = Movies)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -102059739  -39266026  -20290622   17164421  457025023
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3506911   24316122   0.144    0.885
## RunTime       478843     226856   2.111    0.036 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 65930000 on 204 degrees of freedom
##   (3 observations deleted due to missingness)
## Multiple R-squared:  0.02137,    Adjusted R-squared:  0.01658
## F-statistic: 4.455 on 1 and 204 DF,  p-value: 0.03601
```

```
plot(resid(M1))
```



```
qqnorm(resid(M1))
qqline(resid(M1))
```



2. Create indicator variables for the genre and MPAA rating. Use the best subsets regression to determine a appropriate regression model.

```
Genre1 = as.numeric(Movies$Genre)
MPAA = as.numeric(Movies$MPAA)

library("leaps")
Model_subset = regsubsets(BoxOfficeGross~Genre + MPAA, data=Movies)
summary(Model_subset)
```

```
## Subset selection object
## Call: regsubsets.formula(BoxOfficeGross ~ Genre + MPAA, data = Movies)
## 14 Variables  (and intercept)
##                          Forced in Forced out
## GenreAdventure               FALSE      FALSE
## GenreComedy                  FALSE      FALSE
## GenreConcert/Performance     FALSE      FALSE
## GenreDocumentary             FALSE      FALSE
## GenreDrama                   FALSE      FALSE
## GenreHorror                  FALSE      FALSE
## GenreMusical                 FALSE      FALSE
## GenreRomantic Comedy         FALSE      FALSE
## GenreThriller/Suspense       FALSE      FALSE
## GenreWestern                 FALSE      FALSE
## MPAANot Rated                FALSE      FALSE
## MPAAPG                       FALSE      FALSE
## MPAAPG-13                    FALSE      FALSE
## MPAAR                        FALSE      FALSE
## 1 subsets of each size up to 8
## Selection Algorithm: exhaustive
##          GenreAdventure GenreComedy GenreConcert/Performance GenreDocumentary
## 1  ( 1 ) "*"            " "         " "                      " "             
## 2  ( 1 ) "*"            " "         " "                      " "             
## 3  ( 1 ) "*"            " "         " "                      " "             
## 4  ( 1 ) "*"            " "         " "                      "*"             
## 5  ( 1 ) "*"            " "         " "                      "*"             
## 6  ( 1 ) " "            "*"         " "                      "*"             
## 7  ( 1 ) " "            "*"         "*"                      "*"             
## 8  ( 1 ) " "            "*"         "*"                      "*"             
##          GenreDrama GenreHorror GenreMusical GenreRomantic Comedy
## 1  ( 1 ) " "        " "         " "          " "                 
## 2  ( 1 ) " "        " "         " "          " "                 
## 3  ( 1 ) "*"        " "         " "          " "                 
## 4  ( 1 ) "*"        " "         " "          " "                 
## 5  ( 1 ) "*"        " "         "*"          " "                 
## 6  ( 1 ) "*"        " "         " "          "*"                 
## 7  ( 1 ) "*"        " "         " "          "*"                 
## 8  ( 1 ) "*"        "*"         " "          "*"                 
##          GenreThriller/Suspense GenreWestern MPAANot Rated MPAAPG MPAAPG-13
## 1  ( 1 ) " "                    " "          " "           " "    " "      
## 2  ( 1 ) " "                    " "          " "           " "    " "      
## 3  ( 1 ) " "                    " "          " "           " "    " "      
## 4  ( 1 ) " "                    " "          " "           " "    " "      
## 5  ( 1 ) " "                    " "          " "           " "    " "      
## 6  ( 1 ) "*"                    " "          " "           " "    " "      
## 7  ( 1 ) "*"                    " "          " "           " "    " "      
## 8  ( 1 ) "*"                    " "          " "           " "    " "
##          MPAAR
## 1  ( 1 ) " "
## 2  ( 1 ) "*"
## 3  ( 1 ) "*"
## 4  ( 1 ) "*"
## 5  ( 1 ) "*"
## 6  ( 1 ) "*"
## 7  ( 1 ) "*"
## 8  ( 1 ) "*"
```

```
# We want row 8
# GenreComedy + GenreConcert/Performance + GenreDocumentary + GenreDrama + GenreHorror + GenreRomantic

Comedy = as.numeric(Movies$Genre == "Comedy")
Concert = as.numeric(Movies$Genre == "Concert/Performance")
Documentary = as.numeric(Movies$Genre == "Documentary")
Drama = as.numeric(Movies$Genre == "Drama")
Horror = as.numeric(Movies$Genre == "Horror")
RomCom = as.numeric(Movies$Genre == "Romantic Comedy")
Thriller = as.numeric(Movies$Genre == "Thriller/Suspense")
MPAAR = as.numeric(Movies$MPAA == "R")

Model_full= lm(BoxOfficeGross~Comedy  + Documentary + Drama + Horror + RomCom + Thriller + MPAAR, data=
summary(Model_full)
```

```
##
## Call:
## lm(formula = BoxOfficeGross ~ Comedy + Documentary + Drama +
##     Horror + RomCom + Thriller + MPAAR, data = Movies)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -87403806 -34956378 -15322486  15599782 441377138
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  91938923    9290754   9.896  < 2e-16 ***
## Comedy      -32622258   12217608  -2.670 0.008213 **
## Documentary -63151227   23048950  -2.740 0.006708 **
## Drama       -50116653   13090337  -3.829 0.000173 ***
## Horror      -25167335   23297041  -1.080 0.281331
## RomCom      -40335879   22053247  -1.829 0.068901 .
## Thriller    -40776589   17191709  -2.372 0.018657 *
## MPAAR       -20904677    9660465  -2.164 0.031666 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 63550000 on 198 degrees of freedom
##   (3 observations deleted due to missingness)
## Multiple R-squared:  0.1174, Adjusted R-squared:  0.08621
## F-statistic: 3.763 on 7 and 198 DF,  p-value: 0.0007475
```

```
Model_best = lm(BoxOfficeGross~Comedy  + Documentary + Drama + Thriller + MPAAR, data=Movies)
summary(Model_best)
```

```
##
## Call:
## lm(formula = BoxOfficeGross ~ Comedy + Documentary + Drama +
##     Thriller + MPAAR, data = Movies)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -78418169 -37089654 -15088470  15318455 450362775
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  82953286    8108581  10.230  < 2e-16 ***
## Comedy      -23261221   11247471  -2.068 0.039914 *
## Documentary -53919296   22656062  -2.380 0.018257 *
## Drama       -40706552   12182281  -3.341 0.000994 ***
## Thriller    -31181374   16499744  -1.890 0.060230 .
## MPAAR       -22013000    9601360  -2.293 0.022906 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 63870000 on 200 degrees of freedom
##   (3 observations deleted due to missingness)
## Multiple R-squared:  0.09966,    Adjusted R-squared:  0.07715
## F-statistic: 4.428 on 5 and 200 DF,  p-value: 0.000758
```

```
# plot(predict(Model_best))
# plot(resid(Model_best))
```

```
a. Validate the model assumptions.

b. Look at residual plots and check for heteroskedasticity (unequal variance), multicollinearity, correl

c. submit your suggested least squares regression formula along with a limited number of appropriate gra
```

$BoxOfficeGross = 82953286 - 23261221(Comedy) - 53919296(Documentary) - 40706552(Drama) - 31181374(Thriller) + -2$

```
d. Test the overall model adequacy.
```

3. Conduct an extra sum of squares test to determine if one or more interaction terms (or quadratic terms) should be included in the model. You can choose any other terms to test.
4. Test whether average run time is the same for different Genre. Clearly show your hypothesis test.
5. Check equality of variance of run time for Genre type.