

Advanced Statistical Modelling: Linear Models

Joel Cantero Priego and Ricard Meyerhofer Parra

12/10/2019

Introduction

In this assignment, we are going to use the IMDB dataset. This IMDB dataset, contains information of 940 films released between 2000 and 2016. The data has been obtained from the IMDB's webpage. The following is a list where we can see all the variables of the dataset:

Variable name	Description	Values
movietitle	Director of the given title	String
gross	Gross in dollars	Integer
budget	Budget in dollars	Integer
duration	Film duration in minutes	Integer
titleyear	The release year of the title	Integer
directorfl	Director Facebook likes	Integer
actor1fl	Actor 1 Facebook likes	Integer
actor2fl	Actor 2 Facebook likes	Integer
actor3fl	Actor 3 Facebook likes	Integer
castfl	Cast Facebook likes	Integer
facenumber_in_poster	Number of faces that appears in the poster	Integer
genre	Genre film	Action/Comedy/Drama/Terror

As we can see we have that all our variables are numerical in exception genre. This dataset is complete which means that it has no missing values. However, this does not imply that there are no outliers.

As required in the assignment, we are going to create a categorical variable: **yearcat** which is the categorical substitution of titleyear with 3 levels: 2000-2005, 2006-2010 and 2011-2016. Therefore, we will have two categorical variables (genre and titleyear).

```
dataset$yearcat<-cut(dataset$titleyear,  
                      c(2000, 2005, 2010, 2016),  
                      include.lowest = TRUE,  
                      labels=c("2000-2005", "2006-2010", "2011-2016"))
```

Exploratory Data Analysis

In this section we are going to focus in explaining the most interesting conclusions of our data, perform an univariate and multivariate analysis of the variables in order to find outliers and see how each of these variables is related with the gross. We are also going to modify some variables in order to make the linear model perform better on them.

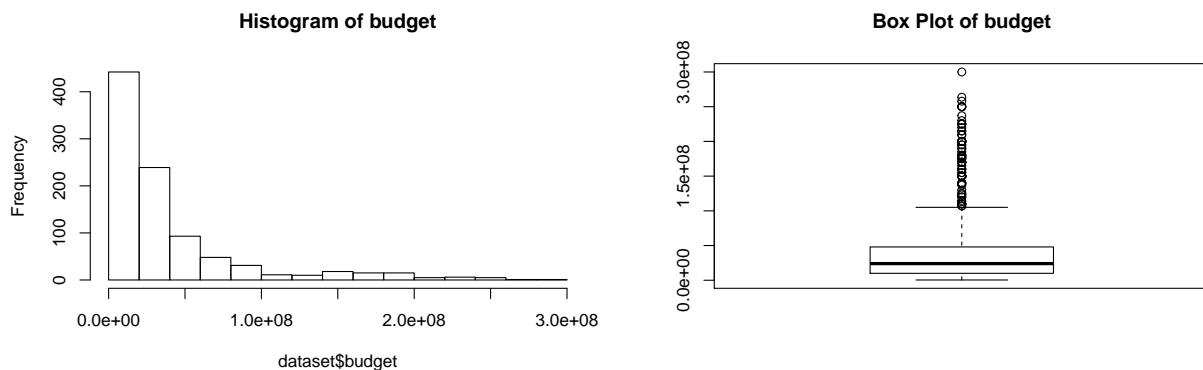
Movie title

We have performed a cloud of the most relevant words that appear in the movies. To do so, we have removed stopwords and punctuation. We could have also done a stemming process but is not so important for us to do so. We can see that the top words are words such as: man, love, movie, house, american, life, big, etc.



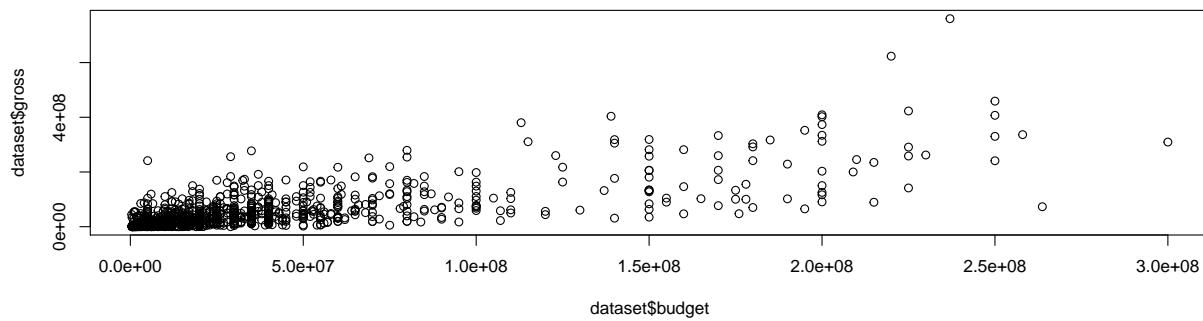
Budget

We can see that there is a very disperse amount of values regarding the budget that range from a minimum of 400 thousand dollars (*Napoleon Dynamite*) to 300 million dollars (*Pirates of the Caribbean: At World's End*). Despite how crazy these numbers can appear to be, we have revised them by looking at the budget of these two movies on the internet and are correct. Note that this does not imply that all the budgets we have are correct but it implies that we have to deal with such a range of different values in a same variable.



Relationship between budget and gross

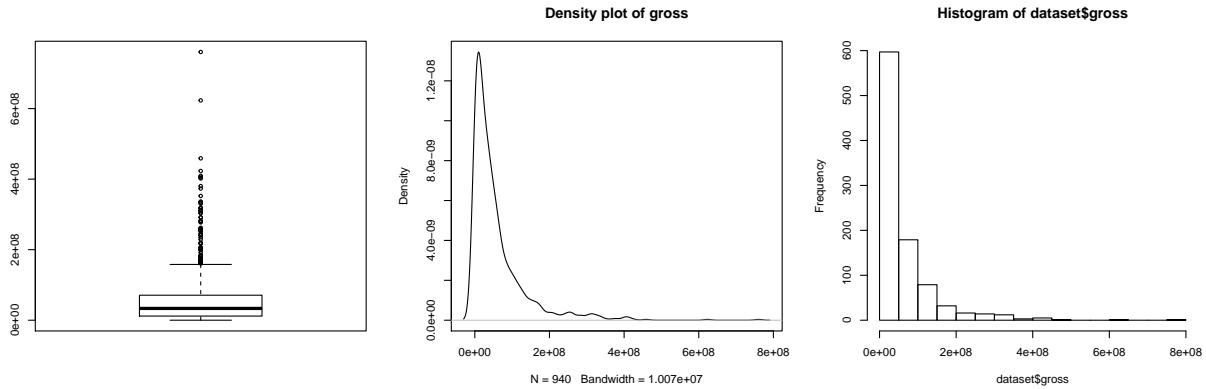
We can see that the revenue is correlated with the budget as we can see in the plot below.



Gross

If we take a look at the gross variable, we can see that in a similar fashion than with budget, we have a range of values that can go from 3330\$ with Mi America to Avatar with 760 millions of dollars.

```
par(mfrow=c(1,3))
boxplot(dataset$gross)
plot(density(dataset$gross), main="Density plot of gross")
hist(dataset$gross)
```

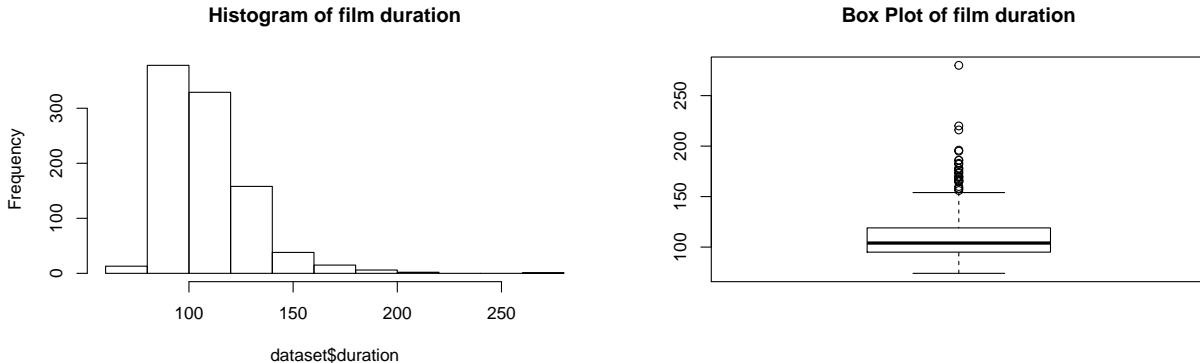


As we have just seen values from budget and gross are in a bigger scale than the rest of our data. This is a problem when performing a linear model since it adds complexity to the model. In order to avoid so, we are going to scale those variables. We decided to apply \log_{10} because it is easier to interpret later when showing (insert justification).

Now we can see that even it does not follow a normal distribution completely it starts to look like one and what is more important is that the range of values is smaller for both, budget and gross.

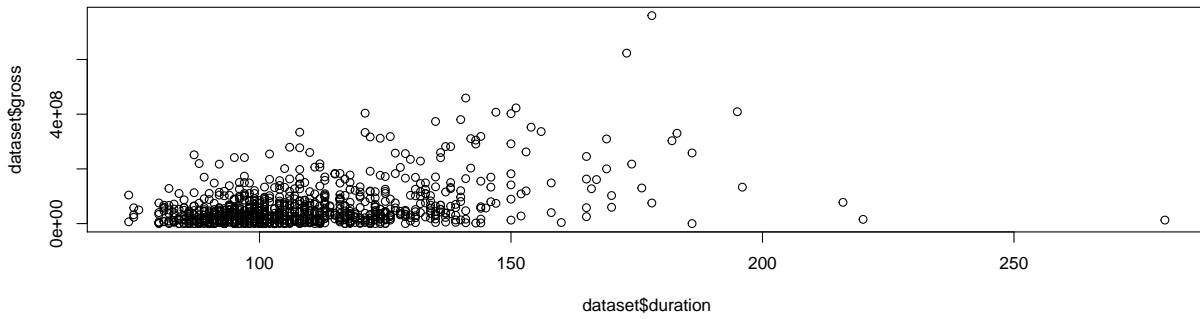
Duration

In duration film, we see that there is a certain tendency to normality centered around 100 minutes, we consider it as usual. There is a strange observation of 280 minutes for “Gods and General” film. After we check it, we can say that it is not an error but an extreme value.



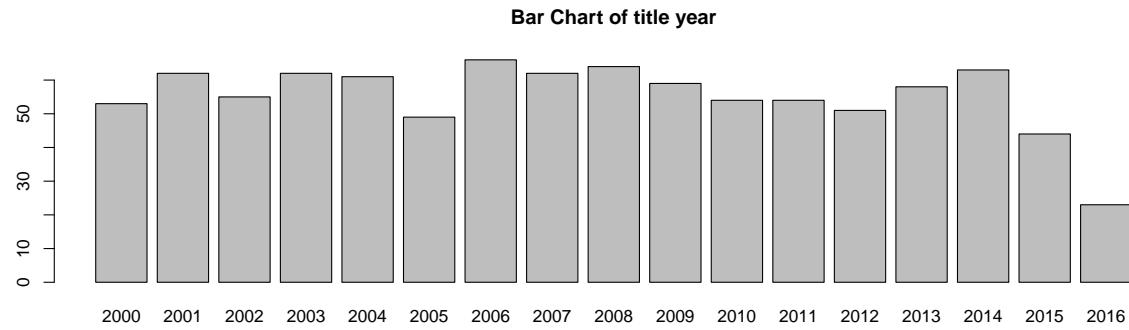
Relationship between duration and gross

We can see that there is not a clear correlation between the duration of a film and its revenue since we can see that transversally to the duration, we have the similar results in gross.



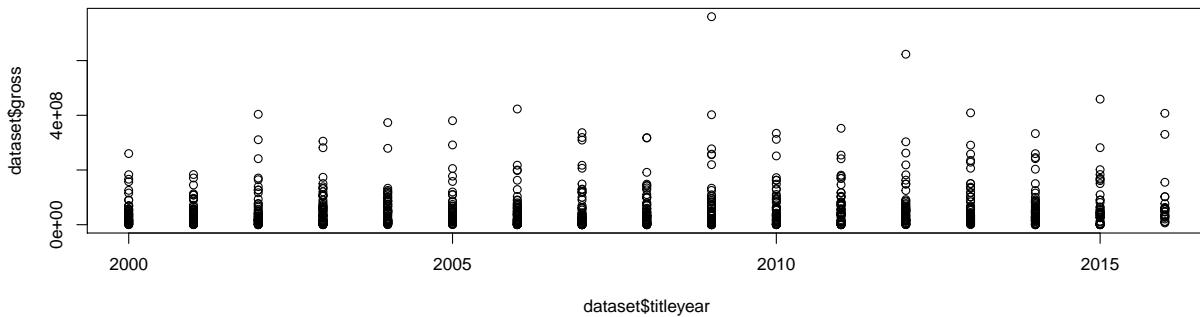
Title Year

No problems for year, there is a certain expected balanced in years proportion even that we can see a decay in the number of films for 2016.



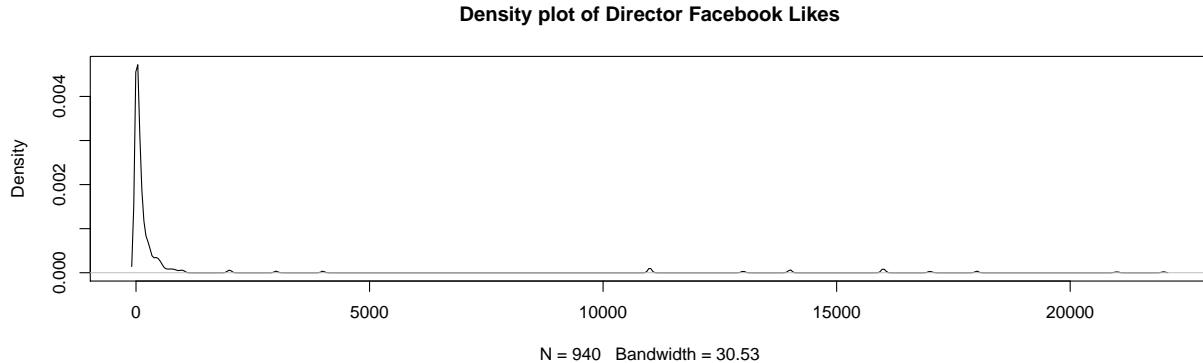
Relationship between years and gross

We can see that there is not a strong correlation between the year of release and the gross obtained from those years. Even that there are some years better than others.



Directorfl, Actor1fl, Actor2fl, Actor3fl, Castfl

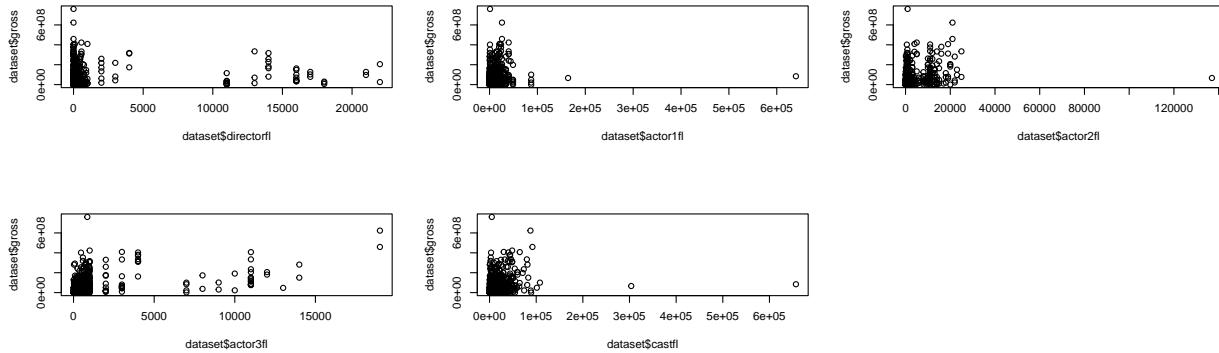
In Director Facebook likes, we see that there is a value which appears in the majority of the cases: In this case, is the 0 value. Apart from this zero value, we see that small number of likes are more common than medium or higher number of likes.



We can see that the other variables Actor1fl, Actor2fl, Actor3fl, Castfl follow a similar fashion.

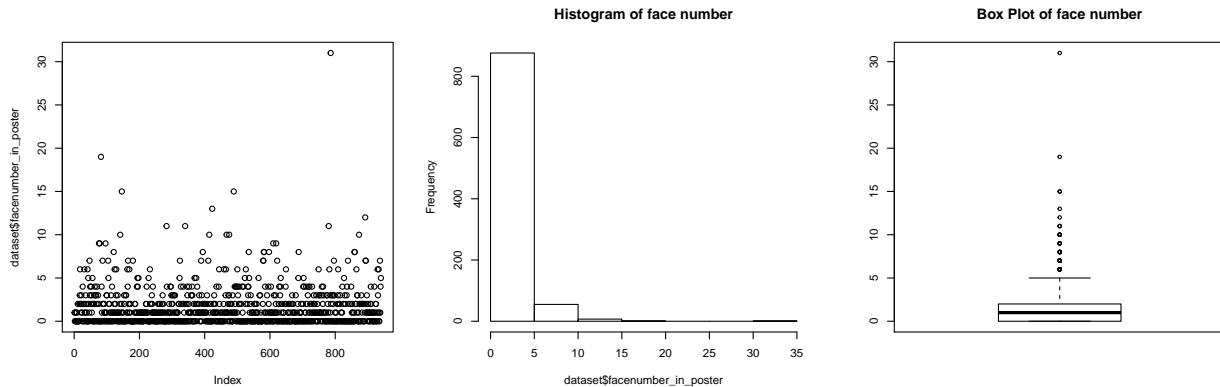
Relationship of Directorfl, Actor1fl, Actor2fl, Actor3fl, Castfl with gross

We can see a trend where the more likes Directors, Acts or Cast are they tend to have more revenue.

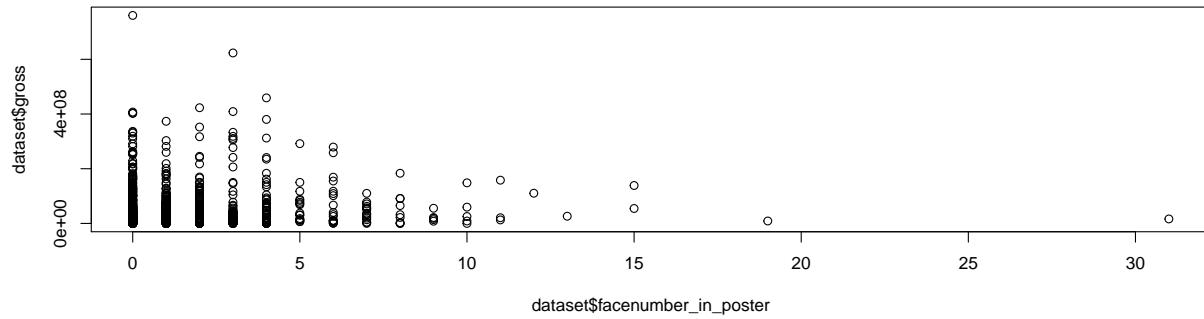


Facenumber in poster

In face number in film poster, the mean is about 1,6 faces and we can observe an extrem value of 31 in “The Master”. We can say once again that it is not an error but an extreme value.

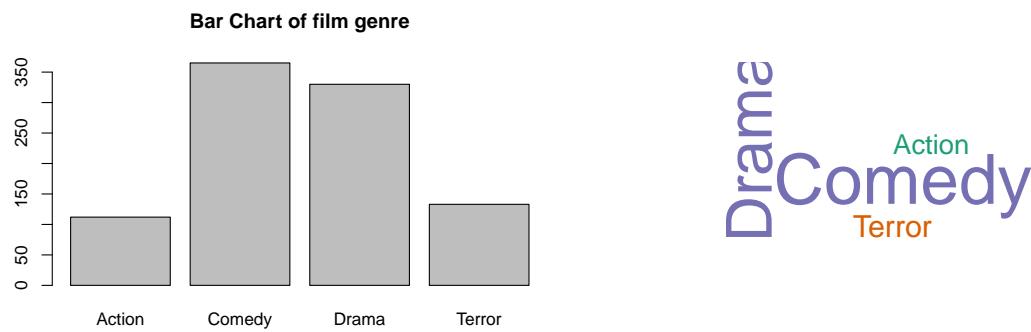


Relationship of Facenumber with Gross



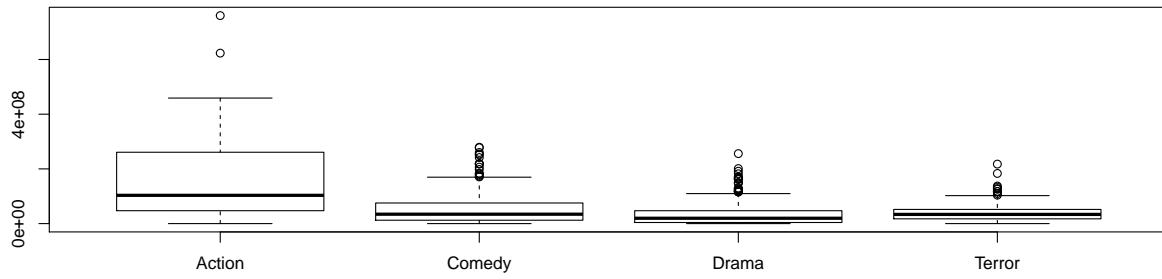
Genre

In genre film we can observe that there are more comedy and drama films than action and terror films.



Relationship of Genre with Gross

We can see that action films from the dataset tend to have a slightly more income than drama, terror and comedy films. We also can see that there are more outliers in the comedy genre.

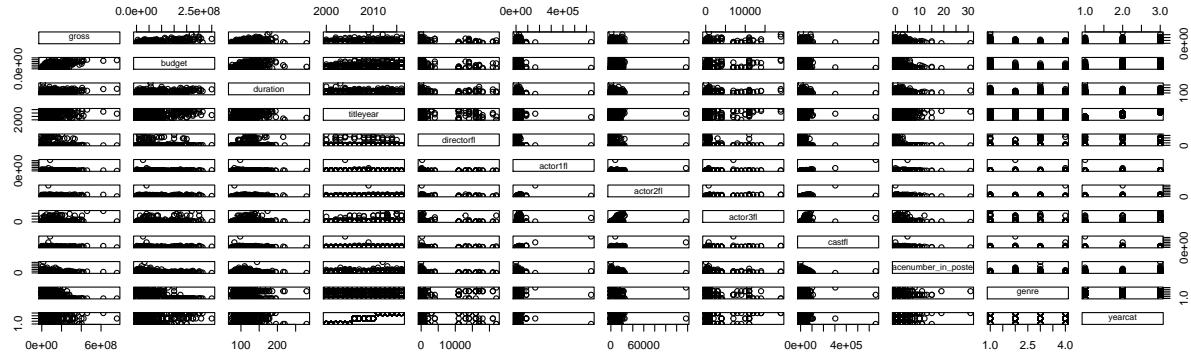


Correlation matrix

In this section we can see the correlation between the variables. It is a bit of what we have seen but in this case is not only focused with the gross but all the variables. Furthermore, by doing the correlation of the variables, we have a numeric value that says us how correlated two variables are which we did not quantify when doing the exploratory analysis.

We can see that there is a positive correlation between gross and budget variable (0,729). On the other hand there is positive correlation between Cast Facebook Likes and Actor Facebook likes.

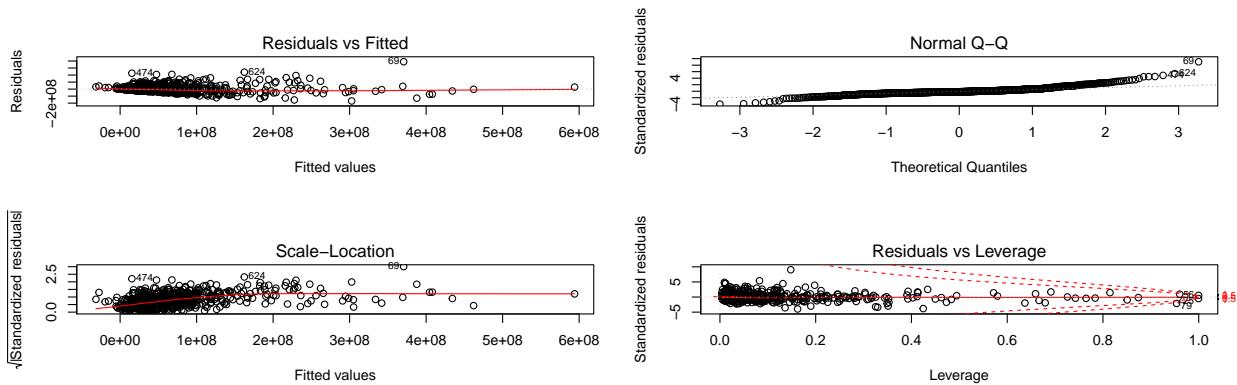
EXPLICAR MÉS



	gross	budget	duration	directorfl	actor1fl	actor2fl	actor3fl	castfl	facenumber_in_poster
gross	1.000000	0.7295407	0.4169113	0.1135821	0.1203821	0.2516909	0.3897209	0.2117592	0.0029669
budget	0.7295407	1.000000	0.4807725	0.1185898	0.1384697	0.2587875	0.3404662	0.2198807	-0.0065147
duration	0.4169113	0.4807725	1.000000	0.2152645	0.0649505	0.1288276	0.1809332	0.1070346	-0.0123550
directorfl	0.1135821	0.1185898	0.2152645	1.000000	0.0660325	0.0940824	0.0453623	0.0825869	-0.0843436
actor1fl	0.1203821	0.1384697	0.0649505	0.0660325	1.000000	0.3491797	0.2377791	0.9618000	0.0551944
actor2fl	0.2516909	0.2587875	0.1288276	0.0940824	0.3491797	1.000000	0.4591963	0.5725142	0.0258751
actor3fl	0.3897209	0.3404662	0.1809332	0.0453623	0.2377791	0.4591963	1.000000	0.4160769	0.0847390
castfl	0.2117592	0.2198807	0.1070346	0.0825869	0.9618000	0.5725142	0.4160769	1.000000	0.0650337
facenumber_in_poster	0.0029669	-0.0065147	-0.0123550	-0.0843436	0.0551944	0.0258751	0.0847390	0.0650337	1.000000

Fitting the complete model

```
op<-par(mfrow=c(2,2))
plot(completeModel)
```



Use the stepwise procedure, by using the BIC criterion, to select the significant variables

```
nullModel <- lm(gross ~ 1, dataset)

forwardModel <- step(nullModel,
                      scope = list(upper=completeModel),
                      direction="both", criterion = "BIC",
                      k=log(nrow(dataset)))

## Start: AIC=34148.06
## gross ~ 1
##
##                               Df  Sum of Sq      RSS     AIC
## + budget                   1 2.9716e+18 2.6117e+18 33441
## + genre                    3 1.4060e+18 4.1773e+18 33896
## + duration                 1 9.7047e+17 4.6129e+18 33975
## + actor3fl                 1 8.4801e+17 4.7353e+18 34000
## + actor2fl                 1 3.5369e+17 5.2296e+18 34093
## + castfl                   1 2.5037e+17 5.3330e+18 34112
## + actor1fl                 1 8.0913e+16 5.5024e+18 34141
## + directorfl                1 7.2030e+16 5.5113e+18 34143
## <none>                     5.5833e+18 34148
## + facenumber_in_poster     1 4.9147e+13 5.5833e+18 34155
##
## Step: AIC=33440.71
## gross ~ budget
##
##                               Df  Sum of Sq      RSS     AIC
## + actor3fl                   1 1.2616e+17 2.4856e+18 33401
## + duration                   1 3.1794e+16 2.5799e+18 33436
## + actor2fl                   1 2.3672e+16 2.5880e+18 33439
## <none>                      2.6117e+18 33441
## + castfl                     1 1.5469e+16 2.5962e+18 33442
## + directorfl                 1 4.1485e+15 2.6076e+18 33446
## + genre                      3 4.1774e+16 2.5699e+18 33446
## + actor1fl                   1 2.1342e+15 2.6096e+18 33447
## + facenumber_in_poster       1 3.3274e+14 2.6114e+18 33447
## - budget                     1 2.9716e+18 5.5833e+18 34148
```

```

##  

## Step: AIC=33401.02  

## gross ~ budget + actor3fl  

##  

## Df Sum of Sq RSS AIC  

## + duration 1 2.9212e+16 2.4563e+18 33397  

## + budget:actor3fl 1 2.6100e+16 2.4595e+18 33398  

## <none> 2.4856e+18 33401  

## + genre 3 4.0490e+16 2.4451e+18 33406  

## + directorfl 1 3.9079e+15 2.4816e+18 33406  

## + actor1fl 1 7.3386e+14 2.4848e+18 33408  

## + facenumber_in_poster 1 2.1523e+14 2.4853e+18 33408  

## + actor2fl 1 9.1531e+13 2.4855e+18 33408  

## + castfl 1 6.9824e+13 2.4855e+18 33408  

## - actor3fl 1 1.2616e+17 2.6117e+18 33441  

## - budget 1 2.2498e+18 4.7353e+18 34000  

##  

## Step: AIC=33396.75  

## gross ~ budget + actor3fl + duration  

##  

## Df Sum of Sq RSS AIC  

## + budget:duration 1 1.0735e+17 2.3490e+18 33362  

## + duration:actor3fl 1 7.5688e+16 2.3807e+18 33374  

## + genre 3 7.8760e+16 2.3776e+18 33387  

## + budget:actor3fl 1 3.0510e+16 2.4258e+18 33392  

## <none> 2.4563e+18 33397  

## - duration 1 2.9212e+16 2.4856e+18 33401  

## + directorfl 1 1.0235e+15 2.4553e+18 33403  

## + actor1fl 1 6.7684e+14 2.4557e+18 33403  

## + facenumber_in_poster 1 1.5710e+14 2.4562e+18 33404  

## + actor2fl 1 1.0390e+14 2.4562e+18 33404  

## + castfl 1 5.1951e+13 2.4563e+18 33404  

## - actor3fl 1 1.2358e+17 2.5799e+18 33436  

## - budget 1 1.5863e+18 4.0427e+18 33858  

##  

## Step: AIC=33361.59  

## gross ~ budget + actor3fl + duration + budget:duration  

##  

## Df Sum of Sq RSS AIC  

## + duration:actor3fl 1 3.3772e+16 2.3152e+18 33355  

## + genre 3 6.4370e+16 2.2846e+18 33356  

## <none> 2.3490e+18 33362  

## + budget:actor3fl 1 1.4844e+16 2.3341e+18 33362  

## + directorfl 1 2.4757e+15 2.3465e+18 33367  

## + actor2fl 1 5.3568e+14 2.3485e+18 33368  

## + actor1fl 1 3.7134e+14 2.3486e+18 33368  

## + facenumber_in_poster 1 2.1291e+14 2.3488e+18 33368  

## + castfl 1 1.3060e+12 2.3490e+18 33368  

## - budget:duration 1 1.0735e+17 2.4563e+18 33397  

## - actor3fl 1 1.3420e+17 2.4832e+18 33407  

##  

## Step: AIC=33354.82  

## gross ~ budget + actor3fl + duration + budget:duration + actor3fl:duration  

##

```

```

##                                     Df  Sum of Sq      RSS     AIC
## + genre                           3  7.1535e+16 2.2437e+18 33346
## <none>                            2.3152e+18 33355
## + directorfl                      1  3.2579e+15 2.3120e+18 33360
## + budget:actor3fl                 1  2.0119e+15 2.3132e+18 33361
## + actor2fl                         1  9.9298e+14 2.3142e+18 33361
## + castfl                           1  7.2908e+14 2.3145e+18 33361
## - actor3fl:duration                1  3.3772e+16 2.3490e+18 33362
## + actor1fl                          1  1.6057e+14 2.3151e+18 33362
## + facenumber_in_poster             1  3.6290e+13 2.3152e+18 33362
## - budget:duration                  1  6.5439e+16 2.3807e+18 33374
##
## Step:  AIC=33345.86
## gross ~ budget + actor3fl + duration + genre + budget:duration +
##       actor3fl:duration
##
##                                     Df  Sum of Sq      RSS     AIC
## + duration:genre                   3  7.0389e+16 2.1733e+18 33336
## + budget:genre                     3  5.9506e+16 2.1842e+18 33341
## <none>                            2.2437e+18 33346
## + directorfl                       1  4.1225e+15 2.2396e+18 33351
## + budget:actor3fl                 1  3.9625e+15 2.2397e+18 33351
## + facenumber_in_poster            1  2.3467e+15 2.2413e+18 33352
## + actor2fl                          1  1.5555e+15 2.2421e+18 33352
## + castfl                           1  7.9943e+14 2.2429e+18 33352
## + actor1fl                          1  1.9901e+14 2.2435e+18 33353
## - genre                            3  7.1535e+16 2.3152e+18 33355
## - actor3fl:duration                1  4.0937e+16 2.2846e+18 33356
## - budget:duration                  1  5.2623e+16 2.2963e+18 33361
## + actor3fl:genre                   3  1.2337e+16 2.2313e+18 33361
##
## Step:  AIC=33336.43
## gross ~ budget + actor3fl + duration + genre + budget:duration +
##       actor3fl:duration + duration:genre
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:duration                  1  2.5100e+14 2.1735e+18 33330
## <none>                            2.1733e+18 33336
## + directorfl                       1  1.2222e+16 2.1611e+18 33338
## + budget:actor3fl                 1  4.0158e+15 2.1693e+18 33342
## + facenumber_in_poster            1  3.3738e+15 2.1699e+18 33342
## + budget:genre                     3  3.4718e+16 2.1386e+18 33342
## + actor2fl                          1  1.2368e+15 2.1721e+18 33343
## + castfl                           1  7.5364e+14 2.1725e+18 33343
## + actor1fl                          1  2.0237e+14 2.1731e+18 33343
## - duration:genre                   3  7.0389e+16 2.2437e+18 33346
## - actor3fl:duration                1  3.7999e+16 2.2113e+18 33346
## + actor3fl:genre                   3  7.8868e+15 2.1654e+18 33354
##
## Step:  AIC=33329.7
## gross ~ budget + actor3fl + duration + genre + actor3fl:duration +
##       duration:genre
##
##                                     Df  Sum of Sq      RSS     AIC

```

```

## <none>                                2.1735e+18 33330
## + directorfl          1 1.1828e+16 2.1617e+18 33331
## + budget:actor3fl      1 3.9917e+15 2.1696e+18 33335
## + facenumber_in_poster  1 3.4141e+15 2.1701e+18 33335
## + budget:genre          3 3.3482e+16 2.1401e+18 33336
## + actor2fl              1 1.2685e+15 2.1723e+18 33336
## + castfl                1 7.3296e+14 2.1728e+18 33336
## + budget:duration        1 2.5100e+14 2.1733e+18 33336
## + actor1fl              1 1.8852e+14 2.1734e+18 33336
## - actor3fl:duration      1 3.8284e+16 2.2118e+18 33339
## + actor3fl:genre          3 7.9487e+15 2.1656e+18 33347
## - duration:genre          3 1.2276e+17 2.2963e+18 33361
## - budget                  1 4.8707e+17 2.6606e+18 33513

backwardModel <- step(completeModel,
                      scope = list(lower=nullModel),
                      direction="both",
                      criterion = "BIC",
                      k=log(nrow(dataset)))

## Start: AIC=33572.72
## gross ~ (budget + duration + directorfl + actor1fl + actor2fl +
##           actor3fl + castfl + facenumber_in_poster + genre)^2
##
##                                     Df  Sum of Sq    RSS   AIC
## - actor2fl:genre            3 9.1283e+14 1.9144e+18 33553
## - actor3fl:genre            3 1.8347e+15 1.9153e+18 33553
## - castfl:genre              3 2.6169e+15 1.9161e+18 33553
## - actor1fl:genre            3 2.7820e+15 1.9162e+18 33554
## - facenumber_in_poster:genre 3 2.8061e+15 1.9163e+18 33554
## - directorfl:genre          3 1.1693e+16 1.9251e+18 33558
## - duration:genre             3 2.1032e+16 1.9345e+18 33562
## - castfl:facenumber_in_poster 1 2.6126e+12 1.9135e+18 33566
## - budget:actor2fl           1 2.3118e+13 1.9135e+18 33566
## - actor1fl:facenumber_in_poster 1 2.8884e+13 1.9135e+18 33566
## - actor2fl:facenumber_in_poster 1 5.3356e+13 1.9135e+18 33566
## - budget:directorfl         1 7.4715e+13 1.9135e+18 33566
## - actor3fl:facenumber_in_poster 1 9.4680e+13 1.9135e+18 33566
## - duration:facenumber_in_poster 1 1.7692e+14 1.9136e+18 33566
## - duration:directorfl        1 1.7999e+14 1.9136e+18 33566
## - actor2fl:actor3fl          1 3.3733e+14 1.9138e+18 33566
## - directorfl:facenumber_in_poster 1 3.6402e+14 1.9138e+18 33566
## - duration:actor3fl          1 6.6116e+14 1.9141e+18 33566
## - actor1fl:castfl            1 1.0307e+15 1.9145e+18 33566
## - budget:castfl              1 1.2490e+15 1.9147e+18 33566
## - budget:facenumber_in_poster 1 1.3647e+15 1.9148e+18 33567
## - budget:actor1fl            1 2.0602e+15 1.9155e+18 33567
## - actor2fl:castfl            1 4.0454e+15 1.9175e+18 33568
## - actor1fl:actor3fl          1 4.2113e+15 1.9177e+18 33568
## - actor1fl:actor2fl          1 4.5102e+15 1.9180e+18 33568
## - actor3fl:castfl            1 4.5146e+15 1.9180e+18 33568
## - budget:duration            1 4.9359e+15 1.9184e+18 33568
## - budget:actor3fl            1 5.7839e+15 1.9192e+18 33569
## - duration:castfl            1 7.7167e+15 1.9212e+18 33570
## - duration:actor1fl          1 7.7597e+15 1.9212e+18 33570

```

```

## - directorfl:actor3fl          1 8.5754e+15 1.9220e+18 33570
## - duration:actor2fl           1 1.3033e+16 1.9265e+18 33572
## <none>                         1 1.9134e+18 33573
## - directorfl:castfl          1 1.6271e+16 1.9297e+18 33574
## - directorfl:actor1fl         1 1.7240e+16 1.9307e+18 33574
## - directorfl:actor2fl         1 2.0372e+16 1.9338e+18 33576
## - budget:genre                 3 5.1956e+16 1.9654e+18 33577
##
## Step: AIC=33552.63
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##        budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##        budget:castfl + budget:facenumber_in_poster + budget:genre +
##        duration:directorfl + duration:actor1fl + duration:actor2fl +
##        duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##        duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##        directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##        directorfl:genre + actor1fl:actor2fl + actor1fl:actor3fl +
##        actor1fl:castfl + actor1fl:facenumber_in_poster + actor1fl:genre +
##        actor2fl:actor3fl + actor2fl:castfl + actor2fl:facenumber_in_poster +
##        actor3fl:castfl + actor3fl:facenumber_in_poster + actor3fl:genre +
##        castfl:facenumber_in_poster + castfl:genre + facenumber_in_poster:genre
##
##                                         Df  Sum of Sq      RSS     AIC
## - facenumber_in_poster:genre      3 2.5225e+15 1.9169e+18 33533
## - actor3fl:genre                 3 5.2678e+15 1.9196e+18 33535
## - directorfl:genre               3 1.1959e+16 1.9263e+18 33538
## - actor1fl:genre                 3 1.5041e+16 1.9294e+18 33539
## - castfl:genre                   3 1.5601e+16 1.9300e+18 33540
## - duration:genre                 3 2.1479e+16 1.9358e+18 33543
## - castfl:facenumber_in_poster    1 1.4376e+13 1.9144e+18 33546
## - actor2fl:facenumber_in_poster  1 2.5838e+13 1.9144e+18 33546
## - actor3fl:facenumber_in_poster  1 5.6425e+13 1.9144e+18 33546
## - actor1fl:facenumber_in_poster  1 5.7173e+13 1.9144e+18 33546
## - budget:directorfl             1 7.8623e+13 1.9144e+18 33546
## - duration:directorfl           1 2.0171e+14 1.9146e+18 33546
## - duration:facenumber_in_poster 1 2.1323e+14 1.9146e+18 33546
## - actor2fl:actor3fl             1 2.2834e+14 1.9146e+18 33546
## - directorfl:facenumber_in_poster 1 3.3570e+14 1.9147e+18 33546
## - duration:actor3fl             1 7.9477e+14 1.9152e+18 33546
## - budget:actor2fl               1 9.6683e+14 1.9153e+18 33546
## - actor1fl:castfl               1 1.2269e+15 1.9156e+18 33546
## - budget:facenumber_in_poster   1 1.2282e+15 1.9156e+18 33546
## - actor2fl:castfl               1 3.5777e+15 1.9179e+18 33548
## - actor1fl:actor3fl             1 4.2352e+15 1.9186e+18 33548
## - actor1fl:actor2fl             1 4.2690e+15 1.9186e+18 33548
## - actor3fl:castfl               1 4.5297e+15 1.9189e+18 33548
## - budget:duration               1 4.7204e+15 1.9191e+18 33548
## - budget:castfl                 1 7.5423e+15 1.9219e+18 33549
## - directorfl:actor3fl           1 8.4292e+15 1.9228e+18 33550
## - budget:actor1fl               1 1.0313e+16 1.9247e+18 33551
## - duration:actor1fl             1 1.0409e+16 1.9248e+18 33551
## - duration:castfl               1 1.0556e+16 1.9249e+18 33551
## - budget:actor3fl               1 1.3633e+16 1.9280e+18 33552

```

```

## <none>                                1.9144e+18 33553
## - directorfl:castfl                  1 1.5787e+16 1.9301e+18 33554
## - directorfl:actor1fl                1 1.6718e+16 1.9311e+18 33554
## - duration:actor2fl                 1 1.8091e+16 1.9325e+18 33555
## - directorfl:actor2fl                1 1.9776e+16 1.9341e+18 33555
## - budget:genre                        3 5.1693e+16 1.9661e+18 33557
##
## Step: AIC=33533.33
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##        budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##        budget:castfl + budget:facenumber_in_poster + budget:genre +
##        duration:directorfl + duration:actor1fl + duration:actor2fl +
##        duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##        duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##        directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##        directorfl:genre + actor1fl:actor2fl + actor1fl:actor3fl +
##        actor1fl:castfl + actor1fl:facenumber_in_poster + actor1fl:genre +
##        actor2fl:actor3fl + actor2fl:castfl + actor2fl:facenumber_in_poster +
##        actor3fl:castfl + actor3fl:facenumber_in_poster + actor3fl:genre +
##        castfl:facenumber_in_poster + castfl:genre
##
##                                         Df  Sum of Sq      RSS   AIC
## - actor3fl:genre                      3 5.2959e+15 1.9222e+18 33515
## - directorfl:genre                     3 1.2861e+16 1.9297e+18 33519
## - actor1fl:genre                      3 1.4655e+16 1.9315e+18 33520
## - castfl:genre                        3 1.5206e+16 1.9321e+18 33520
## - duration:genre                      3 2.2094e+16 1.9390e+18 33524
## - actor3fl:facenumber_in_poster       1 8.3195e+11 1.9169e+18 33526
## - actor2fl:facenumber_in_poster       1 4.1486e+13 1.9169e+18 33527
## - budget:directorfl                  1 7.1802e+13 1.9170e+18 33527
## - duration:directorfl                1 1.8869e+14 1.9171e+18 33527
## - castfl:facenumber_in_poster        1 2.0205e+14 1.9171e+18 33527
## - actor1fl:facenumber_in_poster      1 2.8995e+14 1.9172e+18 33527
## - directorfl:facenumber_in_poster    1 3.1899e+14 1.9172e+18 33527
## - actor2fl:actor3fl                 1 3.8683e+14 1.9173e+18 33527
## - duration:actor3fl                 1 8.9667e+14 1.9178e+18 33527
## - budget:actor2fl                  1 1.1551e+15 1.9180e+18 33527
## - actor1fl:castfl                  1 1.3347e+15 1.9182e+18 33527
## - budget:facenumber_in_poster       1 1.6643e+15 1.9185e+18 33527
## - duration:facenumber_in_poster     1 2.0700e+15 1.9190e+18 33528
## - actor2fl:castfl                  1 3.6326e+15 1.9205e+18 33528
## - actor1fl:actor2fl                1 4.2518e+15 1.9211e+18 33529
## - budget:duration                  1 4.4022e+15 1.9213e+18 33529
## - actor1fl:actor3fl                1 5.0331e+15 1.9219e+18 33529
## - actor3fl:castfl                  1 5.4715e+15 1.9224e+18 33529
## - budget:castfl                   1 7.8095e+15 1.9247e+18 33530
## - directorfl:actor3fl              1 8.3596e+15 1.9252e+18 33531
## - budget:actor1fl                  1 1.0568e+16 1.9275e+18 33532
## - duration:actor1fl                1 1.1119e+16 1.9280e+18 33532
## - duration:castfl                  1 1.1343e+16 1.9282e+18 33532
## - budget:actor3fl                  1 1.3736e+16 1.9306e+18 33533
## <none>
## - directorfl:castfl                1 1.5615e+16 1.9325e+18 33534

```

```

## - directorfl:actor1fl          1 1.6546e+16 1.9334e+18 33535
## - duration:actor2fl           1 1.9130e+16 1.9360e+18 33536
## - directorfl:actor2fl          1 1.9590e+16 1.9365e+18 33536
## - budget:genre                  3 5.0453e+16 1.9673e+18 33537
##
## Step: AIC=33515.39
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##        budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##        budget:castfl + budget:facenumber_in_poster + budget:genre +
##        duration:directorfl + duration:actor1fl + duration:actor2fl +
##        duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##        duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##        directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##        directorfl:genre + actor1fl:actor2fl + actor1fl:actor3fl +
##        actor1fl:castfl + actor1fl:facenumber_in_poster + actor1fl:genre +
##        actor2fl:actor3fl + actor2fl:castfl + actor2fl:facenumber_in_poster +
##        actor3fl:castfl + actor3fl:facenumber_in_poster + castfl:facenumber_in_poster +
##        castfl:genre
##
##                                     Df  Sum of Sq      RSS     AIC
## - directorfl:genre            3 1.2402e+16 1.9346e+18 33501
## - actor1fl:genre             3 1.9231e+16 1.9414e+18 33504
## - duration:genre              3 2.1675e+16 1.9439e+18 33505
## - castfl:genre                3 2.4545e+16 1.9467e+18 33507
## - actor2fl:facenumber_in_poster 1 1.0320e+13 1.9222e+18 33509
## - castfl:facenumber_in_poster  1 7.7038e+13 1.9223e+18 33509
## - actor3fl:facenumber_in_poster 1 1.0621e+14 1.9223e+18 33509
## - budget:directorfl          1 1.1237e+14 1.9223e+18 33509
## - actor1fl:facenumber_in_poster 1 1.2951e+14 1.9223e+18 33509
## - directorfl:facenumber_in_poster 1 2.2705e+14 1.9224e+18 33509
## - duration:directorfl         1 3.1065e+14 1.9225e+18 33509
## - actor1fl:castfl             1 3.5538e+14 1.9225e+18 33509
## - budget:actor2fl            1 6.1140e+14 1.9228e+18 33509
## - actor2fl:actor3fl          1 1.1036e+15 1.9233e+18 33509
## - budget:facenumber_in_poster 1 1.5555e+15 1.9237e+18 33509
## - duration:facenumber_in_poster 1 2.1167e+15 1.9243e+18 33510
## - duration:actor3fl           1 3.2928e+15 1.9255e+18 33510
## - budget:castfl               1 3.9426e+15 1.9261e+18 33510
## - actor1fl:actor3fl          1 4.1544e+15 1.9263e+18 33511
## - budget:duration             1 4.6478e+15 1.9268e+18 33511
## - actor2fl:castfl             1 4.8792e+15 1.9271e+18 33511
## - actor1fl:actor2fl           1 5.2743e+15 1.9275e+18 33511
## - budget:actor1fl             1 6.2865e+15 1.9285e+18 33512
## - actor3fl:castfl             1 6.2875e+15 1.9285e+18 33512
## - directorfl:actor3fl          1 7.3948e+15 1.9296e+18 33512
## - budget:actor3fl             1 1.1143e+16 1.9333e+18 33514
## <none>                           1.9222e+18 33515
## - directorfl:castfl            1 1.4082e+16 1.9363e+18 33515
## - directorfl:actor1fl          1 1.4990e+16 1.9372e+18 33516
## - duration:actor1fl            1 1.5052e+16 1.9372e+18 33516
## - duration:castfl              1 1.5297e+16 1.9375e+18 33516
## - directorfl:actor2fl          1 1.8022e+16 1.9402e+18 33517
## - budget:genre                  3 4.9070e+16 1.9712e+18 33519

```

```

## - duration:actor2fl          1 2.0582e+16 1.9428e+18 33519
##
## Step: AIC=33500.9
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##        budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##        budget:castfl + budget:facenumber_in_poster + budget:genre +
##        duration:directorfl + duration:actor1fl + duration:actor2fl +
##        duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##        duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##        directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##        actor1fl:actor2fl + actor1fl:actor3fl + actor1fl:castfl +
##        actor1fl:facenumber_in_poster + actor1fl:genre + actor2fl:actor3fl +
##        actor2fl:castfl + actor2fl:facenumber_in_poster + actor3fl:castfl +
##        actor3fl:facenumber_in_poster + castfl:facenumber_in_poster +
##        castfl:genre
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor1fl:genre            3 1.9107e+16 1.9537e+18 33490
## - castfl:genre              3 2.4830e+16 1.9594e+18 33492
## - duration:genre            3 2.4844e+16 1.9594e+18 33492
## - actor2fl:facenumber_in_poster 1 5.9150e+12 1.9346e+18 33494
## - castfl:facenumber_in_poster 1 6.6484e+13 1.9346e+18 33494
## - actor1fl:facenumber_in_poster 1 1.1584e+14 1.9347e+18 33494
## - actor3fl:facenumber_in_poster 1 1.3720e+14 1.9347e+18 33494
## - directorfl:facenumber_in_poster 1 2.8107e+14 1.9349e+18 33494
## - actor1fl:castfl            1 3.0210e+14 1.9349e+18 33494
## - budget:actor2fl           1 4.1648e+14 1.9350e+18 33494
## - duration:directorfl       1 9.8919e+14 1.9356e+18 33495
## - actor2fl:actor3fl         1 1.2585e+15 1.9358e+18 33495
## - budget:facenumber_in_poster 1 1.5146e+15 1.9361e+18 33495
## - duration:facenumber_in_poster 1 2.3901e+15 1.9370e+18 33495
## - duration:actor3fl          1 3.1898e+15 1.9378e+18 33496
## - budget:duration           1 3.2914e+15 1.9379e+18 33496
## - budget:castfl             1 3.8417e+15 1.9384e+18 33496
## - actor1fl:actor3fl          1 4.0108e+15 1.9386e+18 33496
## - directorfl:actor3fl        1 4.9873e+15 1.9396e+18 33496
## - actor2fl:castfl            1 5.8301e+15 1.9404e+18 33497
## - budget:actor1fl            1 6.2279e+15 1.9408e+18 33497
## - actor1fl:actor2fl          1 6.2305e+15 1.9408e+18 33497
## - actor3fl:castfl            1 6.3594e+15 1.9409e+18 33497
## - budget:directorfl          1 8.1643e+15 1.9427e+18 33498
## - budget:actor3fl            1 1.0903e+16 1.9455e+18 33499
## - directorfl:castfl          1 1.1222e+16 1.9458e+18 33499
## - directorfl:actor1fl        1 1.2076e+16 1.9467e+18 33500
## <none>                         1.9346e+18 33501
## - duration:actor1fl          1 1.5362e+16 1.9499e+18 33501
## - directorfl:actor2fl        1 1.5496e+16 1.9501e+18 33502
## - duration:castfl            1 1.5585e+16 1.9502e+18 33502
## - budget:genre               3 4.9785e+16 1.9844e+18 33504
## - duration:actor2fl          1 2.1360e+16 1.9559e+18 33504
##
## Step: AIC=33489.6
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +

```

```

## actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
## budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
## budget:castfl + budget:facenumber_in_poster + budget:genre +
## duration:directorfl + duration:actor1fl + duration:actor2fl +
## duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
## duration:genre + directorfl:actor1fl + directorfl:actor2fl +
## directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
## actor1fl:actor2fl + actor1fl:actor3fl + actor1fl:castfl +
## actor1fl:facenumber_in_poster + actor2fl:actor3fl + actor2fl:castfl +
## actor2fl:facenumber_in_poster + actor3fl:castfl + actor3fl:facenumber_in_poster +
## castfl:facenumber_in_poster + castfl:genre
##
##                                     Df  Sum of Sq      RSS     AIC
## - castfl:genre                  3 1.1411e+16 1.9651e+18 33475
## - duration:genre                3 2.7358e+16 1.9810e+18 33482
## - actor3fl:facenumber_in_poster 1 1.3348e+12 1.9537e+18 33483
## - castfl:facenumber_in_poster   1 1.9533e+14 1.9539e+18 33483
## - actor1fl:facenumber_in_poster 1 2.0696e+14 1.9539e+18 33483
## - actor2fl:facenumber_in_poster 1 2.1755e+14 1.9539e+18 33483
## - directorfl:facenumber_in_poster 1 5.8352e+14 1.9543e+18 33483
## - actor1fl:castfl              1 6.3616e+14 1.9543e+18 33483
## - budget:actor2fl              1 1.3456e+15 1.9550e+18 33483
## - duration:directorfl          1 1.7922e+15 1.9555e+18 33484
## - duration:actor3fl            1 2.1746e+15 1.9559e+18 33484
## - budget:facenumber_in_poster  1 2.3402e+15 1.9560e+18 33484
## - budget:duration              1 2.3404e+15 1.9560e+18 33484
## - duration:facenumber_in_poster 1 2.8066e+15 1.9565e+18 33484
## - directorfl:actor3fl          1 3.3252e+15 1.9570e+18 33484
## - actor2fl:actor3fl            1 3.7458e+15 1.9574e+18 33485
## - actor2fl:castfl              1 5.5229e+15 1.9592e+18 33485
## - actor1fl:actor2fl            1 5.8071e+15 1.9595e+18 33486
## - budget:castfl                1 6.9236e+15 1.9606e+18 33486
## - directorfl:castfl            1 8.2025e+15 1.9619e+18 33487
## - actor1fl:actor3fl            1 8.9971e+15 1.9627e+18 33487
## - directorfl:actor1fl          1 9.0964e+15 1.9628e+18 33487
## - actor3fl:castfl              1 9.7562e+15 1.9634e+18 33487
## - budget:directorfl            1 1.0010e+16 1.9637e+18 33488
## - budget:actor1fl              1 1.1116e+16 1.9648e+18 33488
## - directorfl:actor2fl          1 1.1429e+16 1.9651e+18 33488
## - budget:actor3fl              1 1.1928e+16 1.9656e+18 33488
## <none>                         1.9537e+18 33490
## - duration:castfl              1 1.4839e+16 1.9685e+18 33490
## - duration:actor1fl            1 1.5625e+16 1.9693e+18 33490
## - duration:actor2fl            1 1.6443e+16 1.9701e+18 33491
## - budget:genre                 3 4.6694e+16 2.0004e+18 33491
##
## Step:  AIC=33474.53
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##       actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##       budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##       budget:castfl + budget:facenumber_in_poster + budget:genre +
##       duration:directorfl + duration:actor1fl + duration:actor2fl +
##       duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##       duration:genre + directorfl:actor1fl + directorfl:actor2fl +

```

```

##      directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##      actor1fl:actor2fl + actor1fl:actor3fl + actor1fl:castfl +
##      actor1fl:facenumber_in_poster + actor2fl:actor3fl + actor2fl:castfl +
##      actor2fl:facenumber_in_poster + actor3fl:castfl + actor3fl:facenumber_in_poster +
##      castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor3fl:facenumber_in_poster   1 3.8383e+13 1.9651e+18 33468
## - actor1fl:facenumber_in_poster   1 3.1660e+14 1.9654e+18 33468
## - castfl:facenumber_in_poster    1 3.6309e+14 1.9655e+18 33468
## - actor1fl:castfl               1 4.2482e+14 1.9655e+18 33468
## - actor2fl:facenumber_in_poster   1 4.8217e+14 1.9656e+18 33468
## - budget:duration                1 6.6756e+14 1.9658e+18 33468
## - directorfl:facenumber_in_poster 1 8.1744e+14 1.9659e+18 33468
## - budget:actor2fl                1 8.6779e+14 1.9660e+18 33468
## - duration:actor3fl              1 2.1571e+15 1.9673e+18 33469
## - duration:directorfl             1 2.5714e+15 1.9677e+18 33469
## - duration:facenumber_in_poster   1 2.6371e+15 1.9677e+18 33469
## - actor1fl:actor2fl               1 2.6413e+15 1.9677e+18 33469
## - actor2fl:castfl                1 2.6465e+15 1.9677e+18 33469
## - directorfl:actor3fl             1 3.1189e+15 1.9682e+18 33469
## - budget:facenumber_in_poster    1 3.2144e+15 1.9683e+18 33469
## - duration:genre                  3 3.4730e+16 1.9998e+18 33470
## - actor2fl:actor3fl               1 6.6421e+15 1.9717e+18 33471
## - budget:castfl                  1 7.3139e+15 1.9724e+18 33471
## - directorfl:castfl               1 7.3151e+15 1.9724e+18 33471
## - directorfl:actor1fl              1 8.0421e+15 1.9731e+18 33472
## - budget:actor3fl                 1 9.9832e+15 1.9751e+18 33472
## - directorfl:actor2fl              1 1.0109e+16 1.9752e+18 33473
## - budget:genre                   3 3.9611e+16 2.0047e+18 33473
## - budget:actor1fl                 1 1.0884e+16 1.9760e+18 33473
## - budget:directorfl                1 1.1910e+16 1.9770e+18 33473
## - actor1fl:actor3fl               1 1.3026e+16 1.9781e+18 33474
## - actor3fl:castfl                 1 1.4359e+16 1.9795e+18 33475
## <none>                           1.9651e+18 33475
## - duration:actor1fl               1 1.5063e+16 1.9802e+18 33475
## - duration:castfl                 1 1.5310e+16 1.9804e+18 33475
## - duration:actor2fl               1 1.7384e+16 1.9825e+18 33476
##
## Step:  AIC=33467.71
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##       actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##       budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##       budget:castfl + budget:facenumber_in_poster + budget:genre +
##       duration:directorfl + duration:actor1fl + duration:actor2fl +
##       duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##       duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##       directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##       actor1fl:actor2fl + actor1fl:actor3fl + actor1fl:castfl +
##       actor1fl:facenumber_in_poster + actor2fl:actor3fl + actor2fl:castfl +
##       actor2fl:facenumber_in_poster + actor3fl:castfl + castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor1fl:castfl                1 4.4485e+14 1.9656e+18 33461

```

```

## - budget:duration          1 6.6702e+14 1.9658e+18 33461
## - directorfl:facenumber_in_poster 1 7.9553e+14 1.9659e+18 33461
## - actor2fl:facenumber_in_poster 1 7.9920e+14 1.9659e+18 33461
## - actor1fl:facenumber_in_poster 1 8.8368e+14 1.9660e+18 33461
## - budget:actor2fl           1 9.1930e+14 1.9661e+18 33461
## - castfl:facenumber_in_poster 1 1.1030e+15 1.9662e+18 33461
## - duration:actor3fl         1 2.1223e+15 1.9673e+18 33462
## - duration:directorfl        1 2.5429e+15 1.9677e+18 33462
## - actor1fl:actor2fl          1 2.6654e+15 1.9678e+18 33462
## - actor2fl:castfl            1 2.6726e+15 1.9678e+18 33462
## - duration:facenumber_in_poster 1 2.9672e+15 1.9681e+18 33462
## - directorfl:actor3fl        1 3.2124e+15 1.9683e+18 33462
## - budget:facenumber_in_poster 1 3.2925e+15 1.9684e+18 33462
## - duration:genre              3 3.4837e+16 2.0000e+18 33464
## - actor2fl:actor3fl          1 6.6971e+15 1.9718e+18 33464
## - directorfl:castfl          1 7.4994e+15 1.9726e+18 33464
## - budget:castfl              1 7.5230e+15 1.9727e+18 33464
## - directorfl:actor1fl        1 8.2478e+15 1.9734e+18 33465
## - budget:actor3fl            1 1.0280e+16 1.9754e+18 33466
## - directorfl:actor2fl        1 1.0361e+16 1.9755e+18 33466
## - budget:genre                3 3.9595e+16 2.0047e+18 33466
## - budget:actor1fl            1 1.1134e+16 1.9763e+18 33466
## - budget:directorfl          1 1.1885e+16 1.9770e+18 33467
## - actor1fl:actor3fl          1 1.2999e+16 1.9781e+18 33467
## - actor3fl:castfl            1 1.4321e+16 1.9795e+18 33468
## <none>                      1.9651e+18 33468
## - duration:actor1fl          1 1.5205e+16 1.9803e+18 33468
## - duration:castfl            1 1.5493e+16 1.9806e+18 33468
## - duration:actor2fl          1 1.7596e+16 1.9827e+18 33469
##
## Step: AIC=33461.07
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##       actor3fl + castfl + facenumber_in_poster + genre + budget:duration +
##       budget:directorfl + budget:actor1fl + budget:actor2fl + budget:actor3fl +
##       budget:castfl + budget:facenumber_in_poster + budget:genre +
##       duration:directorfl + duration:actor1fl + duration:actor2fl +
##       duration:actor3fl + duration:castfl + duration:facenumber_in_poster +
##       duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##       directorfl:actor3fl + directorfl:castfl + directorfl:facenumber_in_poster +
##       actor1fl:actor2fl + actor1fl:actor3fl + actor1fl:facenumber_in_poster +
##       actor2fl:actor3fl + actor2fl:castfl + actor2fl:facenumber_in_poster +
##       actor3fl:castfl + castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:duration          1 6.0125e+14 1.9662e+18 33455
## - actor2fl:facenumber_in_poster 1 6.9601e+14 1.9663e+18 33455
## - directorfl:facenumber_in_poster 1 7.4467e+14 1.9663e+18 33455
## - actor1fl:facenumber_in_poster 1 9.9304e+14 1.9666e+18 33455
## - budget:actor2fl           1 9.9994e+14 1.9666e+18 33455
## - castfl:facenumber_in_poster 1 1.0950e+15 1.9667e+18 33455
## - duration:actor3fl         1 2.0283e+15 1.9676e+18 33455
## - duration:directorfl        1 2.4145e+15 1.9680e+18 33455
## - actor1fl:actor2fl          1 2.6635e+15 1.9682e+18 33455
## - actor2fl:castfl            1 2.7340e+15 1.9683e+18 33456

```

```

## - duration:facenumber_in_poster      1 3.1039e+15 1.9687e+18 33456
## - directorfl:actor3fl              1 3.3504e+15 1.9689e+18 33456
## - budget:facenumber_in_poster      1 3.3638e+15 1.9689e+18 33456
## - duration:genre                   3 3.5706e+16 2.0013e+18 33457
## - budget:castfl                  1 7.3085e+15 1.9729e+18 33458
## - directorfl:castfl              1 7.6134e+15 1.9732e+18 33458
## - directorfl:actor1fl             1 8.3628e+15 1.9739e+18 33458
## - actor2fl:actor3fl              1 9.6127e+15 1.9752e+18 33459
## - budget:actor3fl                1 9.8401e+15 1.9754e+18 33459
## - directorfl:actor2fl             1 1.0503e+16 1.9761e+18 33459
## - budget:actor1fl                1 1.0714e+16 1.9763e+18 33459
## - budget:genre                   3 4.1671e+16 2.0073e+18 33460
## - actor1fl:actor3fl              1 1.2935e+16 1.9785e+18 33460
## <none>                           1 1.9656e+18 33461
## - duration:actor1fl              1 1.5214e+16 1.9808e+18 33461
## - duration:castfl                1 1.5343e+16 1.9809e+18 33462
## - actor3fl:castfl               1 1.5466e+16 1.9810e+18 33462
## - duration:actor2fl              1 1.7315e+16 1.9829e+18 33462
##
## Step: AIC=33454.51
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##        budget:actor1fl + budget:actor2fl + budget:actor3fl + budget:castfl +
##        budget:facenumber_in_poster + budget:genre + duration:directorfl +
##        duration:actor1fl + duration:actor2fl + duration:actor3fl +
##        duration:castfl + duration:facenumber_in_poster + duration:genre +
##        directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##        directorfl:castfl + directorfl:facenumber_in_poster + actor1fl:actor2fl +
##        actor1fl:actor3fl + actor1fl:facenumber_in_poster + actor2fl:actor3fl +
##        actor2fl:castfl + actor2fl:facenumber_in_poster + actor3fl:castfl +
##        castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - directorfl:facenumber_in_poster 1  6.2811e+14 1.9668e+18 33448
## - actor2fl:facenumber_in_poster   1  8.4326e+14 1.9670e+18 33448
## - actor1fl:facenumber_in_poster   1  1.1081e+15 1.9673e+18 33448
## - castfl:facenumber_in_poster    1  1.2599e+15 1.9674e+18 33448
## - budget:actor2fl                1  1.3004e+15 1.9675e+18 33448
## - duration:directorfl            1  2.0366e+15 1.9682e+18 33449
## - duration:actor3fl              1  2.1670e+15 1.9684e+18 33449
## - actor1fl:actor2fl              1  2.7263e+15 1.9689e+18 33449
## - actor2fl:castfl                1  2.7958e+15 1.9690e+18 33449
## - duration:facenumber_in_poster  1  3.1082e+15 1.9693e+18 33449
## - budget:facenumber_in_poster    1  3.2237e+15 1.9694e+18 33449
## - directorfl:actor3fl            1  3.5728e+15 1.9698e+18 33449
## - directorfl:castfl              1  7.9762e+15 1.9742e+18 33451
## - budget:castfl                 1  8.1892e+15 1.9744e+18 33452
## - directorfl:actor1fl            1  8.7101e+15 1.9749e+18 33452
## - actor2fl:actor3fl              1  1.0097e+16 1.9763e+18 33452
## - budget:actor3fl                1  1.0551e+16 1.9767e+18 33453
## - directorfl:actor2fl            1  1.0940e+16 1.9771e+18 33453
## - budget:directorfl              1  1.1415e+16 1.9776e+18 33453
## - budget:actor1fl                1  1.1702e+16 1.9779e+18 33453

```

```

## - budget:genre          3 4.2339e+16 2.0085e+18 33454
## - actor1fl:actor3fl     1 1.3702e+16 1.9799e+18 33454
## <none>                  1.9662e+18 33455
## - duration:actor1fl     1 1.5883e+16 1.9821e+18 33455
## - duration:castfl       1 1.6175e+16 1.9824e+18 33455
## - actor3fl:castfl       1 1.6464e+16 1.9826e+18 33456
## - duration:actor2fl     1 1.8294e+16 1.9845e+18 33456
## - duration:genre         3 8.7852e+16 2.0540e+18 33475
##
## Step: AIC=33447.97
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##        budget:actor1fl + budget:actor2fl + budget:actor3fl + budget:castfl +
##        budget:facenumber_in_poster + budget:genre + duration:directorfl +
##        duration:actor1fl + duration:actor2fl + duration:actor3fl +
##        duration:castfl + duration:facenumber_in_poster + duration:genre +
##        directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##        directorfl:castfl + actor1fl:actor2fl + actor1fl:actor3fl +
##        actor1fl:facenumber_in_poster + actor2fl:actor3fl + actor2fl:castfl +
##        actor2fl:facenumber_in_poster + actor3fl:castfl + castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS   AIC
## - actor2fl:facenumber_in_poster  1 8.4772e+14 1.9677e+18 33442
## - actor1fl:facenumber_in_poster  1 1.0882e+15 1.9679e+18 33442
## - castfl:facenumber_in_poster   1 1.2398e+15 1.9681e+18 33442
## - budget:actor2fl              1 1.2672e+15 1.9681e+18 33442
## - duration:actor3fl            1 1.8970e+15 1.9687e+18 33442
## - duration:directorfl          1 2.2443e+15 1.9691e+18 33442
## - actor1fl:actor2fl            1 2.7273e+15 1.9695e+18 33442
## - actor2fl:castfl              1 2.8213e+15 1.9696e+18 33442
## - budget:facenumber_in_poster   1 3.0051e+15 1.9698e+18 33443
## - duration:facenumber_in_poster 1 3.1981e+15 1.9700e+18 33443
## - directorfl:actor3fl          1 4.5765e+15 1.9714e+18 33443
## - budget:castfl                1 8.1395e+15 1.9750e+18 33445
## - directorfl:castfl            1 9.2375e+15 1.9760e+18 33446
## - actor2fl:actor3fl            1 9.6816e+15 1.9765e+18 33446
## - directorfl:actor1fl          1 1.0383e+16 1.9772e+18 33446
## - budget:actor3fl              1 1.0583e+16 1.9774e+18 33446
## - budget:directorfl             1 1.0795e+16 1.9776e+18 33446
## - budget:actor1fl              1 1.1614e+16 1.9784e+18 33447
## - directorfl:actor2fl          1 1.2045e+16 1.9789e+18 33447
## - actor1fl:actor3fl            1 1.3206e+16 1.9800e+18 33447
## - budget:genre                 3 4.2546e+16 2.0094e+18 33448
## <none>                         1.9668e+18 33448
## - duration:actor1fl            1 1.5369e+16 1.9822e+18 33448
## - duration:castfl              1 1.5659e+16 1.9825e+18 33449
## - actor3fl:castfl              1 1.5934e+16 1.9827e+18 33449
## - duration:actor2fl            1 1.7953e+16 1.9848e+18 33450
## - duration:genre                3 8.9615e+16 2.0564e+18 33469
##
## Step: AIC=33441.53
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##        budget:actor1fl + budget:actor2fl + budget:actor3fl + budget:castfl +

```

```

##      budget:facenumber_in_poster + budget:genre + duration:directorfl +
##      duration:actor1fl + duration:actor2fl + duration:actor3fl +
##      duration:castfl + duration:facenumber_in_poster + duration:genre +
##      directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##      directorfl:castfl + actor1fl:actor2fl + actor1fl:actor3fl +
##      actor1fl:facenumber_in_poster + actor2fl:actor3fl + actor2fl:castfl +
##      actor3fl:castfl + castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor1fl:facenumber_in_poster  1  2.4834e+14 1.9679e+18 33435
## - castfl:facenumber_in_poster   1  4.3994e+14 1.9681e+18 33435
## - budget:actor2fl              1  9.2003e+14 1.9686e+18 33435
## - duration:actor3fl             1  1.8620e+15 1.9695e+18 33436
## - duration:directorfl            1  2.2292e+15 1.9699e+18 33436
## - actor1fl:actor2fl              1  2.2930e+15 1.9700e+18 33436
## - actor2fl:castfl                1  2.3313e+15 1.9700e+18 33436
## - budget:facenumber_in_poster   1  3.0268e+15 1.9707e+18 33436
## - duration:facenumber_in_poster  1  3.6603e+15 1.9713e+18 33436
## - directorfl:actor3fl             1  5.0726e+15 1.9727e+18 33437
## - budget:castfl                  1  7.4069e+15 1.9751e+18 33438
## - actor2fl:actor3fl                1  8.9474e+15 1.9766e+18 33439
## - budget:actor3fl                  1  1.0097e+16 1.9778e+18 33439
## - directorfl:castfl                 1  1.0445e+16 1.9781e+18 33440
## - budget:directorfl                 1  1.0781e+16 1.9784e+18 33440
## - budget:actor1fl                  1  1.0824e+16 1.9785e+18 33440
## - directorfl:actor1fl                 1  1.1670e+16 1.9793e+18 33440
## - actor1fl:actor3fl                  1  1.2398e+16 1.9801e+18 33441
## - budget:genre                      3  4.2711e+16 2.0104e+18 33441
## - directorfl:actor2fl                 1  1.3800e+16 1.9815e+18 33441
## <none>                                1.9677e+18 33442
## - duration:actor1fl                 1  1.4928e+16 1.9826e+18 33442
## - duration:castfl                   1  1.5208e+16 1.9829e+18 33442
## - actor3fl:castfl                   1  1.5513e+16 1.9832e+18 33442
## - duration:actor2fl                 1  1.7368e+16 1.9850e+18 33443
## - duration:genre                     3  8.9807e+16 2.0575e+18 33463
##
## Step:  AIC=33434.8
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##       actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##       budget:actor1fl + budget:actor2fl + budget:actor3fl + budget:castfl +
##       budget:facenumber_in_poster + budget:genre + duration:directorfl +
##       duration:actor1fl + duration:actor2fl + duration:actor3fl +
##       duration:castfl + duration:facenumber_in_poster + duration:genre +
##       directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##       directorfl:castfl + actor1fl:actor2fl + actor1fl:actor3fl +
##       actor2fl:actor3fl + actor2fl:castfl + actor3fl:castfl + castfl:facenumber_in_poster
##
##                                     Df  Sum of Sq      RSS     AIC
## - castfl:facenumber_in_poster    1  2.8625e+14 1.9682e+18 33428
## - budget:actor2fl                1  7.8882e+14 1.9687e+18 33428
## - duration:actor3fl               1  2.0675e+15 1.9700e+18 33429
## - duration:directorfl              1  2.2453e+15 1.9702e+18 33429
## - actor1fl:actor2fl                 1  2.3670e+15 1.9703e+18 33429
## - actor2fl:castfl                  1  2.4273e+15 1.9703e+18 33429

```

```

## - budget:facenumber_in_poster    1 2.9747e+15 1.9709e+18 33429
## - duration:facenumber_in_poster 1 3.5515e+15 1.9715e+18 33430
## - directorfl:actor3fl          1 5.0366e+15 1.9729e+18 33430
## - budget:castfl                1 7.1610e+15 1.9751e+18 33431
## - actor2fl:actor3fl            1 8.7140e+15 1.9766e+18 33432
## - budget:actor3fl              1 9.8768e+15 1.9778e+18 33433
## - directorfl:castfl            1 1.0492e+16 1.9784e+18 33433
## - budget:actor1fl              1 1.0630e+16 1.9785e+18 33433
## - budget:directorfl             1 1.0821e+16 1.9787e+18 33433
## - directorfl:actor1fl          1 1.1746e+16 1.9797e+18 33434
## - actor1fl:actor3fl            1 1.2749e+16 1.9807e+18 33434
## - budget:genre                  3 4.2624e+16 2.0105e+18 33434
## - directorfl:actor2fl          1 1.3814e+16 1.9817e+18 33435
## <none>                           1.9679e+18 33435
## - duration:actor1fl            1 1.5373e+16 1.9833e+18 33435
## - actor3fl:castfl              1 1.5569e+16 1.9835e+18 33435
## - duration:castfl              1 1.5720e+16 1.9836e+18 33435
## - duration:actor2fl            1 1.8064e+16 1.9860e+18 33437
## - duration:genre                3 8.9692e+16 2.0576e+18 33456
##
## Step: AIC=33428.09
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##        budget:actor1fl + budget:actor2fl + budget:actor3fl + budget:castfl +
##        budget:facenumber_in_poster + budget:genre + duration:directorfl +
##        duration:actor1fl + duration:actor2fl + duration:actor3fl +
##        duration:castfl + duration:facenumber_in_poster + duration:genre +
##        directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##        directorfl:castfl + actor1fl:actor2fl + actor1fl:actor3fl +
##        actor2fl:actor3fl + actor2fl:castfl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS   AIC
## - budget:actor2fl               1  6.9073e+14 1.9689e+18 33422
## - duration:directorfl           1  2.1558e+15 1.9703e+18 33422
## - duration:actor3fl             1  2.1669e+15 1.9704e+18 33422
## - actor1fl:actor2fl             1  2.4092e+15 1.9706e+18 33422
## - actor2fl:castfl               1  2.5024e+15 1.9707e+18 33422
## - budget:facenumber_in_poster   1  4.3170e+15 1.9725e+18 33423
## - duration:facenumber_in_poster 1  4.4537e+15 1.9726e+18 33423
## - directorfl:actor3fl           1  4.9465e+15 1.9731e+18 33424
## - budget:castfl                 1  6.9576e+15 1.9752e+18 33425
## - actor2fl:actor3fl             1  8.4593e+15 1.9767e+18 33425
## - budget:actor3fl               1  1.0023e+16 1.9782e+18 33426
## - directorfl:castfl             1  1.0401e+16 1.9786e+18 33426
## - budget:actor1fl               1  1.0437e+16 1.9786e+18 33426
## - budget:directorfl              1  1.0926e+16 1.9791e+18 33426
## - directorfl:actor1fl           1  1.1626e+16 1.9798e+18 33427
## - actor1fl:actor3fl             1  1.2570e+16 1.9808e+18 33427
## - budget:genre                   3  4.2367e+16 2.0106e+18 33428
## - directorfl:actor2fl           1  1.3701e+16 1.9819e+18 33428
## <none>                           1.9682e+18 33428
## - actor3fl:castfl               1  1.5295e+16 1.9835e+18 33429
## - duration:actor1fl             1  1.5739e+16 1.9839e+18 33429
## - duration:castfl               1  1.6050e+16 1.9842e+18 33429

```

```

## - duration:actor2fl          1 1.8458e+16 1.9867e+18 33430
## - duration:genre              3 8.9742e+16 2.0579e+18 33449
##
## Step: AIC=33421.58
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##         budget:actor1fl + budget:actor3fl + budget:castfl + budget:facenumber_in_poster +
##         budget:genre + duration:directorfl + duration:actor1fl +
##         duration:actor2fl + duration:actor3fl + duration:castfl +
##         duration:facenumber_in_poster + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##         actor1fl:actor2fl + actor1fl:actor3fl + actor2fl:actor3fl +
##         actor2fl:castfl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - duration:directorfl          1 2.0459e+15 1.9709e+18 33416
## - actor1fl:actor2fl            1 2.1910e+15 1.9711e+18 33416
## - actor2fl:castfl              1 2.3103e+15 1.9712e+18 33416
## - duration:actor3fl            1 2.6253e+15 1.9715e+18 33416
## - budget:facenumber_in_poster  1 4.0141e+15 1.9729e+18 33417
## - duration:facenumber_in_poster 1 4.5549e+15 1.9734e+18 33417
## - directorfl:actor3fl          1 4.9128e+15 1.9738e+18 33417
## - actor2fl:actor3fl            1 8.9827e+15 1.9779e+18 33419
## - directorfl:castfl            1 1.0311e+16 1.9792e+18 33420
## - budget:directorfl            1 1.0642e+16 1.9795e+18 33420
## - budget:actor3fl              1 1.1405e+16 1.9803e+18 33420
## - directorfl:actor1fl          1 1.1502e+16 1.9804e+18 33420
## - budget:genre                  3 4.2193e+16 2.0111e+18 33421
## - directorfl:actor2fl          1 1.3600e+16 1.9825e+18 33421
## - actor1fl:actor3fl            1 1.3888e+16 1.9828e+18 33421
## <none>                         1.9689e+18 33422
## - actor3fl:castfl              1 1.8593e+16 1.9875e+18 33424
## - duration:actor1fl            1 1.8692e+16 1.9876e+18 33424
## - duration:castfl              1 1.9260e+16 1.9881e+18 33424
## - budget:castfl                1 2.2616e+16 1.9915e+18 33425
## - duration:actor2fl            1 2.3422e+16 1.9923e+18 33426
## - budget:actor1fl              1 3.1041e+16 1.9999e+18 33429
## - duration:genre                3 9.0084e+16 2.0590e+18 33443
##
## Step: AIC=33415.71
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##         budget:actor1fl + budget:actor3fl + budget:castfl + budget:facenumber_in_poster +
##         budget:genre + duration:actor1fl + duration:actor2fl + duration:actor3fl +
##         duration:castfl + duration:facenumber_in_poster + duration:genre +
##         directorfl:actor1fl + directorfl:actor2fl + directorfl:actor3fl +
##         directorfl:castfl + actor1fl:actor2fl + actor1fl:actor3fl +
##         actor2fl:actor3fl + actor2fl:castfl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - duration:actor3fl            1 1.7872e+15 1.9727e+18 33410
## - actor1fl:actor2fl            1 2.1030e+15 1.9730e+18 33410
## - actor2fl:castfl              1 2.2916e+15 1.9732e+18 33410
## - budget:facenumber_in_poster  1 3.9012e+15 1.9748e+18 33411

```

```

## - duration:facenumber_in_poster 1 4.7500e+15 1.9757e+18 33411
## - actor2fl:actor3fl             1 8.5700e+15 1.9795e+18 33413
## - budget:directorfl             1 8.6763e+15 1.9796e+18 33413
## - directorfl:actor3fl           1 1.0212e+16 1.9811e+18 33414
## - budget:genre                  3 4.2266e+16 2.0132e+18 33415
## - budget:actor3fl               1 1.3159e+16 1.9841e+18 33415
## - actor1fl:actor3fl              1 1.3271e+16 1.9842e+18 33415
## <none>                           1.9709e+18 33416
## - directorfl:castfl              1 1.6748e+16 1.9877e+18 33417
## - duration:actor1fl              1 1.7309e+16 1.9882e+18 33417
## - directorfl:actor1fl            1 1.7382e+16 1.9883e+18 33417
## - actor3fl:castfl                1 1.7732e+16 1.9887e+18 33417
## - duration:castfl                1 1.7749e+16 1.9887e+18 33417
## - directorfl:actor2fl             1 2.0566e+16 1.9915e+18 33419
## - duration:actor2fl              1 2.2589e+16 1.9935e+18 33420
## - budget:castfl                 1 2.4915e+16 1.9958e+18 33421
## - budget:actor1fl                1 3.2910e+16 2.0038e+18 33424
## - duration:genre                 3 9.2491e+16 2.0634e+18 33438
##
## Step: AIC=33409.71
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##        actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##        budget:actor1fl + budget:actor3fl + budget:castfl + budget:facenumber_in_poster +
##        budget:genre + duration:actor1fl + duration:actor2fl + duration:castfl +
##        duration:facenumber_in_poster + duration:genre + directorfl:actor1fl +
##        directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##        actor1fl:actor2fl + actor1fl:actor3fl + actor2fl:actor3fl +
##        actor2fl:castfl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor1fl:actor2fl             1  2.2100e+15 1.9749e+18 33404
## - actor2fl:castfl               1  2.4519e+15 1.9752e+18 33404
## - budget:facenumber_in_poster   1  3.6251e+15 1.9763e+18 33405
## - duration:facenumber_in_poster 1  4.5592e+15 1.9773e+18 33405
## - actor2fl:actor3fl              1  7.5763e+15 1.9803e+18 33406
## - budget:directorfl              1  8.5034e+15 1.9812e+18 33407
## - directorfl:actor3fl            1  9.0679e+15 1.9818e+18 33407
## - actor1fl:actor3fl              1  1.1838e+16 1.9846e+18 33408
## - budget:genre                   3  4.3383e+16 2.0161e+18 33410
## <none>                           1.9727e+18 33410
## - budget:actor3fl                1  1.5290e+16 1.9880e+18 33410
## - directorfl:castfl              1  1.5465e+16 1.9882e+18 33410
## - actor3fl:castfl                1  1.6096e+16 1.9888e+18 33411
## - directorfl:actor1fl             1  1.6122e+16 1.9888e+18 33411
## - directorfl:actor2fl             1  1.9489e+16 1.9922e+18 33412
## - duration:actor2fl              1  2.9073e+16 2.0018e+18 33417
## - budget:castfl                  1  3.0377e+16 2.0031e+18 33417
## - duration:actor1fl              1  3.5665e+16 2.0084e+18 33420
## - budget:actor1fl                1  3.8372e+16 2.0111e+18 33421
## - duration:castfl                1  3.9501e+16 2.0122e+18 33422
## - duration:genre                 3  9.7133e+16 2.0699e+18 33434
##
## Step: AIC=33403.92
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +

```

```

##      actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##      budget:actor1fl + budget:actor3fl + budget:castfl + budget:facenumber_in_poster +
##      budget:genre + duration:actor1fl + duration:actor2fl + duration:castfl +
##      duration:facenumber_in_poster + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##      actor1fl:actor3fl + actor2fl:actor3fl + actor2fl:castfl +
##      actor3fl:castfl
##
##                                     Df  Sum of Sq    RSS   AIC
## - actor2fl:castfl           1 1.3139e+15 1.9762e+18 33398
## - budget:facenumber_in_poster 1 3.6078e+15 1.9785e+18 33399
## - duration:facenumber_in_poster 1 4.6304e+15 1.9796e+18 33399
## - actor2fl:actor3fl          1 5.8251e+15 1.9808e+18 33400
## - budget:directorfl          1 8.1637e+15 1.9831e+18 33401
## - directorfl:actor3fl        1 9.4294e+15 1.9844e+18 33402
## <none>                         1.9749e+18 33404
## - budget:genre                3 4.4000e+16 2.0189e+18 33404
## - budget:actor3fl             1 1.4866e+16 1.9898e+18 33404
## - directorfl:castfl           1 1.5795e+16 1.9907e+18 33405
## - directorfl:actor1fl         1 1.6520e+16 1.9914e+18 33405
## - actor3fl:castfl             1 1.7549e+16 1.9925e+18 33405
## - actor1fl:actor3fl           1 1.8714e+16 1.9936e+18 33406
## - directorfl:actor2fl         1 1.9674e+16 1.9946e+18 33406
## - duration:actor2fl           1 2.7804e+16 2.0027e+18 33410
## - budget:castfl               1 2.9011e+16 2.0039e+18 33411
## - duration:actor1fl           1 3.4378e+16 2.0093e+18 33413
## - budget:actor1fl              1 3.6299e+16 2.0112e+18 33414
## - duration:castfl              1 3.8090e+16 2.0130e+18 33415
## - duration:genre                3 9.7861e+16 2.0728e+18 33429
##
## Step:  AIC=33397.7
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##      budget:actor1fl + budget:actor3fl + budget:castfl + budget:facenumber_in_poster +
##      budget:genre + duration:actor1fl + duration:actor2fl + duration:castfl +
##      duration:facenumber_in_poster + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##      actor1fl:actor3fl + actor2fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq    RSS   AIC
## - budget:facenumber_in_poster  1 3.6408e+15 1.9799e+18 33393
## - duration:facenumber_in_poster 1 4.8526e+15 1.9811e+18 33393
## - actor2fl:actor3fl            1 5.4322e+15 1.9817e+18 33393
## - budget:directorfl            1 7.8909e+15 1.9841e+18 33395
## - directorfl:actor3fl          1 1.2436e+16 1.9887e+18 33397
## - budget:actor3fl              1 1.3676e+16 1.9899e+18 33397
## <none>                         1.9762e+18 33398
## - budget:genre                 3 4.5592e+16 2.0218e+18 33399
## - actor3fl:castfl              1 1.7236e+16 1.9935e+18 33399
## - actor1fl:actor3fl             1 1.8157e+16 1.9944e+18 33399
## - directorfl:castfl             1 1.9465e+16 1.9957e+18 33400
## - directorfl:actor1fl           1 2.0117e+16 1.9964e+18 33400
## - directorfl:actor2fl           1 2.2908e+16 1.9992e+18 33402
## - budget:castfl                 1 2.7711e+16 2.0040e+18 33404

```

```

## - duration:actor1fl      1 3.4711e+16 2.0110e+18 33407
## - budget:actor1fl       1 3.5051e+16 2.0113e+18 33407
## - duration:actor2fl      1 3.5201e+16 2.0114e+18 33407
## - duration:castfl        1 3.9281e+16 2.0155e+18 33409
## - duration:genre          3 9.7387e+16 2.0736e+18 33422
##
## Step: AIC=33392.58
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##         budget:actor1fl + budget:actor3fl + budget:castfl + budget:genre +
##         duration:actor1fl + duration:actor2fl + duration:castfl +
##         duration:facenumber_in_poster + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##         actor1fl:actor3fl + actor2fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq    RSS   AIC
## - duration:facenumber_in_poster  1 2.8387e+15 1.9827e+18 33387
## - actor2fl:actor3fl            1 4.5918e+15 1.9845e+18 33388
## - budget:directorfl           1 7.7839e+15 1.9877e+18 33389
## - directorfl:actor3fl         1 1.1862e+16 1.9917e+18 33391
## - budget:actor3fl             1 1.3471e+16 1.9934e+18 33392
## <none>                         1.9799e+18 33393
## - actor3fl:castfl            1 1.5197e+16 1.9951e+18 33393
## - actor1fl:actor3fl          1 1.6012e+16 1.9959e+18 33393
## - budget:genre                3 4.7273e+16 2.0272e+18 33394
## - directorfl:castfl          1 1.8893e+16 1.9988e+18 33395
## - directorfl:actor1fl         1 1.9393e+16 1.9993e+18 33395
## - directorfl:actor2fl         1 2.2382e+16 2.0023e+18 33396
## - budget:castfl              1 2.7675e+16 2.0076e+18 33399
## - duration:actor1fl          1 3.2672e+16 2.0126e+18 33401
## - duration:actor2fl          1 3.3648e+16 2.0135e+18 33402
## - budget:actor1fl            1 3.4860e+16 2.0147e+18 33402
## - duration:castfl            1 3.7319e+16 2.0172e+18 33403
## - duration:genre              3 1.0017e+17 2.0801e+18 33418
##
## Step: AIC=33387.08
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + facenumber_in_poster + genre + budget:directorfl +
##         budget:actor1fl + budget:actor3fl + budget:castfl + budget:genre +
##         duration:actor1fl + duration:actor2fl + duration:castfl +
##         duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##         directorfl:actor3fl + directorfl:castfl + actor1fl:actor3fl +
##         actor2fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq    RSS   AIC
## - facenumber_in_poster        1 1.0891e+15 1.9838e+18 33381
## - actor2fl:actor3fl          1 4.6537e+15 1.9874e+18 33382
## - budget:directorfl          1 7.5578e+15 1.9903e+18 33384
## - directorfl:actor3fl        1 1.2336e+16 1.9951e+18 33386
## - budget:actor3fl            1 1.3275e+16 1.9960e+18 33387
## <none>                         1.9827e+18 33387
## - actor3fl:castfl            1 1.5894e+16 1.9986e+18 33388
## - actor1fl:actor3fl          1 1.6502e+16 1.9992e+18 33388
## - budget:genre                3 4.5881e+16 2.0286e+18 33388

```

```

## - directorfl:castfl      1 1.9432e+16 2.0022e+18 33389
## - directorfl:actor1fl    1 2.0032e+16 2.0028e+18 33390
## - directorfl:actor2fl    1 2.2712e+16 2.0054e+18 33391
## - budget:castfl          1 2.7827e+16 2.0105e+18 33393
## - duration:actor1fl     1 3.2437e+16 2.0152e+18 33395
## - duration:actor2fl     1 3.3017e+16 2.0157e+18 33396
## - budget:actor1fl        1 3.5103e+16 2.0178e+18 33397
## - duration:castfl        1 3.6684e+16 2.0194e+18 33397
## - duration:genre          3 9.8281e+16 2.0810e+18 33412
##
## Step: AIC=33380.75
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + genre + budget:directorfl + budget:actor1fl +
##         budget:actor3fl + budget:castfl + budget:genre + duration:actor1fl +
##         duration:actor2fl + duration:castfl + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##         actor1fl:actor3fl + actor2fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS      AIC
## - actor2fl:actor3fl      1 4.6824e+15 1.9885e+18 33376
## - budget:directorfl       1 7.3683e+15 1.9912e+18 33377
## - directorfl:actor3fl    1 1.2660e+16 1.9965e+18 33380
## - budget:actor3fl        1 1.3208e+16 1.9970e+18 33380
## <none>                      1.9838e+18 33381
## - actor3fl:castfl        1 1.6218e+16 2.0000e+18 33382
## - actor1fl:actor3fl      1 1.6891e+16 2.0007e+18 33382
## - budget:genre            3 4.7095e+16 2.0309e+18 33382
## - directorfl:castfl      1 1.9740e+16 2.0035e+18 33383
## - directorfl:actor1fl    1 2.0348e+16 2.0042e+18 33383
## - directorfl:actor2fl    1 2.3001e+16 2.0068e+18 33385
## - budget:castfl          1 2.8166e+16 2.0120e+18 33387
## - duration:actor1fl     1 3.2921e+16 2.0167e+18 33389
## - duration:actor2fl     1 3.3933e+16 2.0177e+18 33390
## - budget:actor1fl        1 3.5689e+16 2.0195e+18 33391
## - duration:castfl        1 3.7551e+16 2.0214e+18 33392
## - duration:genre          3 9.7858e+16 2.0817e+18 33405
##
## Step: AIC=33376.12
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + genre + budget:directorfl + budget:actor1fl +
##         budget:actor3fl + budget:castfl + budget:genre + duration:actor1fl +
##         duration:actor2fl + duration:castfl + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##         actor1fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS      AIC
## - budget:directorfl       1 6.8983e+15 1.9954e+18 33373
## - budget:actor3fl         1 1.2592e+16 2.0011e+18 33375
## - actor3fl:castfl         1 1.3724e+16 2.0022e+18 33376
## - actor1fl:actor3fl       1 1.3741e+16 2.0022e+18 33376
## <none>                      1.9885e+18 33376
## - budget:genre             3 4.4739e+16 2.0332e+18 33377
## - directorfl:actor3fl     1 1.8594e+16 2.0071e+18 33378
## - directorfl:castfl       1 2.6547e+16 2.0150e+18 33382

```

```

## - directorfl:actor1fl 1 2.7440e+16 2.0159e+18 33382
## - budget:castfl 1 2.7626e+16 2.0161e+18 33382
## - duration:actor1fl 1 2.8651e+16 2.0171e+18 33383
## - duration:actor2fl 1 2.9360e+16 2.0179e+18 33383
## - directorfl:actor2fl 1 2.9365e+16 2.0179e+18 33383
## - duration:castfl 1 3.3064e+16 2.0216e+18 33385
## - budget:actor1fl 1 3.4735e+16 2.0232e+18 33386
## - duration:genre 3 9.4970e+16 2.0835e+18 33399
##
## Step: AIC=33372.53
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + budget:actor1fl + budget:actor3fl +
##      budget:castfl + budget:genre + duration:actor1fl + duration:actor2fl +
##      duration:castfl + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##      actor1fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:actor3fl 1 1.2725e+16 2.0081e+18 33372
## - budget:genre 3 4.2191e+16 2.0376e+18 33372
## - actor1fl:actor3fl 1 1.3957e+16 2.0093e+18 33372
## - actor3fl:castfl 1 1.4026e+16 2.0094e+18 33372
## <none> 1.9954e+18 33373
## - directorfl:actor3fl 1 2.4235e+16 2.0196e+18 33377
## - budget:castfl 1 2.7589e+16 2.0230e+18 33379
## - directorfl:castfl 1 2.9115e+16 2.0245e+18 33379
## - duration:actor1fl 1 2.9521e+16 2.0249e+18 33379
## - duration:actor2fl 1 2.9780e+16 2.0252e+18 33380
## - directorfl:actor2fl 1 3.1162e+16 2.0266e+18 33380
## - directorfl:actor1fl 1 3.1679e+16 2.0271e+18 33380
## - duration:castfl 1 3.3819e+16 2.0292e+18 33381
## - budget:actor1fl 1 3.4180e+16 2.0296e+18 33382
## - duration:genre 3 9.3053e+16 2.0884e+18 33395
##
## Step: AIC=33371.66
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + budget:actor1fl + budget:castfl +
##      budget:genre + duration:actor1fl + duration:actor2fl + duration:castfl +
##      duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##      directorfl:actor3fl + directorfl:castfl + actor1fl:actor3fl +
##      actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:genre 3 4.1068e+16 2.0492e+18 33370
## <none> 2.0081e+18 33372
## - budget:castfl 1 1.7257e+16 2.0254e+18 33373
## - actor1fl:actor3fl 1 2.1859e+16 2.0300e+18 33375
## - duration:actor2fl 1 2.2804e+16 2.0309e+18 33375
## - actor3fl:castfl 1 2.2842e+16 2.0310e+18 33375
## - budget:actor1fl 1 2.2865e+16 2.0310e+18 33375
## - duration:actor1fl 1 2.7118e+16 2.0352e+18 33377
## - directorfl:actor3fl 1 2.7610e+16 2.0357e+18 33378
## - duration:castfl 1 3.0939e+16 2.0391e+18 33379
## - directorfl:castfl 1 3.2341e+16 2.0405e+18 33380

```

```

## - directorfl:actor2fl  1 3.3353e+16 2.0415e+18 33380
## - directorfl:actor1fl  1 3.5049e+16 2.0432e+18 33381
## - duration:genre        3 9.3306e+16 2.1014e+18 33394
##
## Step: AIC=33370.15
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + budget:actor1fl + budget:castfl +
##      duration:actor1fl + duration:actor2fl + duration:castfl +
##      duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##      directorfl:actor3fl + directorfl:castfl + actor1fl:actor3fl +
##      actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:castfl            1 1.2824e+16 2.0620e+18 33369
## <none>                      2.0492e+18 33370
## - budget:actor1fl          1 1.7737e+16 2.0669e+18 33371
## - duration:actor2fl         1 2.1375e+16 2.0706e+18 33373
## - actor1fl:actor3fl         1 2.2114e+16 2.0713e+18 33373
## - directorfl:actor3fl       1 2.3348e+16 2.0725e+18 33374
## - actor3fl:castfl           1 2.3418e+16 2.0726e+18 33374
## - directorfl:castfl          1 2.7813e+16 2.0770e+18 33376
## - directorfl:actor2fl        1 2.8685e+16 2.0779e+18 33376
## - duration:actor1fl          1 2.9757e+16 2.0789e+18 33377
## - directorfl:actor1fl        1 3.0361e+16 2.0795e+18 33377
## - duration:castfl             1 3.1277e+16 2.0805e+18 33378
## - duration:genre              3 9.4996e+16 2.1442e+18 33392
##
## Step: AIC=33369.17
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + budget:actor1fl + duration:actor1fl +
##      duration:actor2fl + duration:castfl + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##      actor1fl:actor3fl + actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - budget:actor1fl          1 5.6921e+15 2.0677e+18 33365
## - actor1fl:actor3fl         1 1.2446e+16 2.0745e+18 33368
## - actor3fl:castfl           1 1.2854e+16 2.0749e+18 33368
## <none>                      2.0620e+18 33369
## - duration:actor2fl          1 1.8593e+16 2.0806e+18 33371
## - directorfl:actor3fl        1 2.7590e+16 2.0896e+18 33375
## - directorfl:castfl           1 3.1808e+16 2.0938e+18 33377
## - directorfl:actor2fl         1 3.2590e+16 2.0946e+18 33377
## - duration:castfl             1 3.3654e+16 2.0957e+18 33378
## - directorfl:actor1fl          1 3.4705e+16 2.0967e+18 33378
## - duration:actor1fl            1 3.5274e+16 2.0973e+18 33378
## - duration:genre               3 1.0246e+17 2.1645e+18 33394
##
## Step: AIC=33364.92
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + duration:actor1fl + duration:actor2fl +
##      duration:castfl + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##      actor1fl:actor3fl + actor3fl:castfl

```

```

##                                     Df  Sum of Sq      RSS     AIC
## - actor1fl:actor3fl      1 1.4004e+16 2.0817e+18 33364
## - actor3fl:castfl       1 1.5062e+16 2.0828e+18 33365
## <none>                      2.0677e+18 33365
## - duration:actor2fl     1 1.9027e+16 2.0867e+18 33367
## - directorfl:actor3fl   1 2.4679e+16 2.0924e+18 33369
## - directorfl:castfl     1 2.8945e+16 2.0966e+18 33371
## - directorfl:actor2fl   1 2.9722e+16 2.0974e+18 33371
## - directorfl:actor1fl   1 3.1923e+16 2.0996e+18 33372
## - duration:castfl       1 3.6875e+16 2.1046e+18 33375
## - duration:actor1fl     1 4.4440e+16 2.1121e+18 33378
## - duration:genre        3 1.0029e+17 2.1680e+18 33389
## - budget                  1 4.3191e+17 2.4996e+18 33536
##
## Step:  AIC=33364.42
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + genre + duration:actor1fl + duration:actor2fl +
##         duration:castfl + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl +
##         actor3fl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - actor3fl:castfl       1 1.1133e+15 2.0828e+18 33358
## - duration:actor2fl     1 7.9849e+15 2.0897e+18 33361
## <none>                      2.0817e+18 33364
## - directorfl:actor3fl   1 2.0044e+16 2.1017e+18 33367
## - duration:castfl       1 2.2896e+16 2.1046e+18 33368
## - directorfl:castfl     1 2.3503e+16 2.1052e+18 33368
## - directorfl:actor2fl   1 2.4194e+16 2.1059e+18 33368
## - directorfl:actor1fl   1 2.6076e+16 2.1078e+18 33369
## - duration:actor1fl     1 3.0436e+16 2.1121e+18 33371
## - duration:genre        3 1.1571e+17 2.1974e+18 33395
## - budget                  1 4.2324e+17 2.5049e+18 33532
##
## Step:  AIC=33358.07
## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##         actor3fl + castfl + genre + duration:actor1fl + duration:actor2fl +
##         duration:castfl + duration:genre + directorfl:actor1fl +
##         directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl
##
##                                     Df  Sum of Sq      RSS     AIC
## - duration:actor2fl     1 7.0847e+15 2.0899e+18 33354
## <none>                      2.0828e+18 33358
## - directorfl:actor3fl   1 1.9258e+16 2.1021e+18 33360
## - duration:castfl       1 2.2314e+16 2.1051e+18 33361
## - directorfl:castfl     1 2.2652e+16 2.1055e+18 33361
## - directorfl:actor2fl   1 2.3280e+16 2.1061e+18 33362
## - directorfl:actor1fl   1 2.5190e+16 2.1080e+18 33363
## - duration:actor1fl     1 3.1300e+16 2.1141e+18 33365
## - duration:genre        3 1.1769e+17 2.2005e+18 33389
## - budget                  1 4.2746e+17 2.5103e+18 33527
##
## Step:  AIC=33354.42

```

```

## gross ~ budget + duration + directorfl + actor1fl + actor2fl +
##      actor3fl + castfl + genre + duration:actor1fl + duration:castfl +
##      duration:genre + directorfl:actor1fl + directorfl:actor2fl +
##      directorfl:actor3fl + directorfl:castfl
##
##                                     Df   Sum of Sq      RSS     AIC
## <none>                               2.0899e+18 33354
## - duration:castfl      1 2.1108e+16 2.1110e+18 33357
## - directorfl:actor3fl  1 2.2038e+16 2.1119e+18 33357
## - directorfl:actor2fl  1 2.2571e+16 2.1125e+18 33358
## - directorfl:castfl    1 2.4579e+16 2.1145e+18 33359
## - duration:actor1fl   1 2.6882e+16 2.1168e+18 33360
## - directorfl:actor1fl  1 2.7662e+16 2.1176e+18 33360
## - duration:genre       3 1.2716e+17 2.2171e+18 33389
## - budget                1 4.2267e+17 2.5126e+18 33521
summary(forwardModel)

##
## Call:
## lm(formula = gross ~ budget + actor3fl + duration + genre + actor3fl:duration +
##      duration:genre, data = dataset)
##
## Residuals:
##      Min        1Q        Median         3Q        Max 
## -213971588 -23685972 -9320783  16174689  424275788
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) -1.927e+08  2.534e+07 -7.601 7.15e-14 ***
## budget        8.627e-01  5.979e-02 14.428 < 2e-16 ***
## actor3fl     -1.339e+04  4.910e+03 -2.726 0.00652 ** 
## duration      1.756e+06  2.285e+05  7.683 3.95e-14 ***
## genreComedy  1.606e+08  3.242e+07  4.954 8.66e-07 *** 
## genreDrama   1.975e+08  2.817e+07  7.010 4.59e-12 *** 
## genreTerror   1.871e+08  3.735e+07  5.009 6.54e-07 *** 
## actor3fl:duration  1.534e+02  3.792e+01  4.045 5.66e-05 *** 
## duration:genreComedy -1.189e+06  2.997e+05 -3.967 7.83e-05 *** 
## duration:genreDrama -1.715e+06  2.392e+05 -7.172 1.51e-12 *** 
## duration:genreTerror -1.484e+06  3.446e+05 -4.307 1.83e-05 *** 
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 48370000 on 929 degrees of freedom
## Multiple R-squared:  0.6107, Adjusted R-squared:  0.6065 
## F-statistic: 145.7 on 10 and 929 DF,  p-value: < 2.2e-16
summary(backwardModel)

##
## Call:
## lm(formula = gross ~ budget + duration + directorfl + actor1fl +
##      actor2fl + actor3fl + castfl + genre + duration:actor1fl +
##      duration:castfl + duration:genre + directorfl:actor1fl +
##      directorfl:actor2fl + directorfl:actor3fl + directorfl:castfl,

```

```

##      data = dataset)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -189679139 -22555903 -9526258 16714244 410695081
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -2.139e+08  2.591e+07 -8.256 5.19e-16 ***
## budget                  8.249e-01  6.048e-02 13.640 < 2e-16 ***
## duration                1.947e+06  2.350e+05  8.285 4.15e-16 ***
## directorfl              6.208e+02  1.032e+03  0.601 0.547657
## actor1fl                 5.263e+02  2.916e+03  0.180 0.856803
## actor2fl                -5.465e+03  1.752e+03 -3.119 0.001873 **
## actor3fl                -5.694e+03  2.409e+03 -2.364 0.018302 *
## castfl                   1.757e+03  2.535e+03  0.693 0.488286
## genreComedy              1.625e+08  3.223e+07  5.041 5.59e-07 ***
## genreDrama                2.050e+08  2.836e+07  7.230 1.02e-12 ***
## genreTerror               1.889e+08  3.721e+07  5.078 4.61e-07 ***
## duration:actor1fl        -6.266e+01  1.821e+01 -3.440 0.000608 ***
## duration:castfl            3.933e+01  1.290e+01  3.048 0.002367 **
## duration:genreComedy     -1.233e+06  2.974e+05 -4.145 3.71e-05 ***
## duration:genreDrama      -1.797e+06  2.421e+05 -7.423 2.60e-13 ***
## duration:genreTerror     -1.513e+06  3.439e+05 -4.399 1.22e-05 ***
## directorfl:actor1fl      1.637e+00  4.691e-01  3.490 0.000507 ***
## directorfl:actor2fl      1.462e+00  4.639e-01  3.152 0.001673 **
## directorfl:actor3fl      2.882e+00  9.254e-01  3.115 0.001898 **
## directorfl:castfl        -1.535e+00  4.668e-01 -3.289 0.001042 **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 47660000 on 920 degrees of freedom
## Multiple R-squared:  0.6257, Adjusted R-squared:  0.618
## F-statistic: 80.94 on 19 and 920 DF,  p-value: < 2.2e-16

```

Check the presence of multicollinearity. If there is some non-interaction multicollinearity in the model, make the corresponding corrections.

```

car::vif(forwardModel)

##                               GVIF Df GVIF^(1/(2*Df))
## budget                  3.541305  1      1.881836
## actor3fl                37.395201  1      6.115162
## duration                9.061748  1      3.010274
## genre                    70073.898079  3      6.420853
## actor3fl:duration      38.483049  1      6.203471
## duration:genre          75721.204208  3      6.504335

car::vif(backwardModel)

##                               GVIF Df GVIF^(1/(2*Df))
## budget                  3.731434  1      1.931692
## duration                9.866015  1      3.141021
## directorfl               3.980337  1      1.995078
## actor1fl                 2027.247202  1      45.024962

```

```
## actor2fl          47.455214 1      6.888774
## actor3fl          9.268605 1      3.044438
## castfl           2066.844582 1     45.462562
## genre            75813.253895 3     6.505652
## duration:actor1fl 810.510092 1     28.469459
## duration:castfl   588.713938 1     24.263428
## duration:genre    82558.200118 3     6.598725
## directorfl:actor1fl 308.695523 1     17.569733
## directorfl:actor2fl 51.927199 1      7.206053
## directorfl:actor3fl 31.930128 1      5.650675
## directorfl:castfl  742.590291 1     27.250510
```