

PROJECT 2

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TASK 2

At significant level of 8% we conduct a Hypotheses test for Mean to find out is there enough evidence that population mean of App_size from the Google Play Store is greater than 25 MD.

Hypotheses:

H0: $\mu = 25$

H1: $\mu > 25$

```
##
## One Sample t-test
##
## data: apps_data$App_Size
## t = 2.8214, df = 163, p-value = 0.002688
## alternative hypothesis: true mean is greater than 25
## 92 percent confidence interval:
## 27.94954      Inf
## sample estimates:
## mean of x
## 30.90238
```

From One Sample t-test one can find that p-value is 0.002688 and we can Reject H0 null hypotheses because p-value is less than significance level of 0.08. As conclusion we can say that there is enough evidence that the population mean of App_Size from Google Play Store is greater than 25MB.

Also, from One Sample t-test we can see that at confidence level of 92% the Lower Confidence Bound for mean is $27.94954 < \mu$. The mean is 30.90238. Since 25 is not inside the interval, we can Reject H0 null hypotheses and conclude that there is enough evidence that the population mean is greater than 25 MB.

In Project 1 we determine that App_Size was not normally distributed but most of the time, we don't know about the shape of the distribution of the population, so people use the t-test regardless of whether the population distribution is normal. In general the t-test is not afraid of non-normal data so that is why we can use this test.

TASK 3

To determine if the mean of Reviews is different when an app is a game or not we conduct a Hypotheses test for variance. We compare if variance are equal or not at significance level of 7%. We perform Equal Variance Test and Test for the Difference of Means.

Hypotheses:

H0: $\sigma^2_{\text{game}}/\sigma^2_{\text{nogame}} = 1$

H1: $\sigma^2_{\text{game}}/\sigma^2_{\text{nogame}}$ is different of 1

```
##
## F test to compare two variances
##
## data:  game and nogame
## F = 7.7201, num df = 40, denom df = 122, p-value < 2.2e-16
## alternative hypothesis: true ratio of variances is not equal to 1
## 93 percent confidence interval:
##  4.963499 12.751215
## sample estimates:
## ratio of variances
##           7.720133
```

From test we can see that p-values is $< 2.2e-16$ and is less than significant level, so we can Reject H_0 (null hypotheses). We can conclude that there is enough evidence of difference in the variance between game and no game reviews. So, there is evidence that the variances are Not Equal.

For difference of means we initialize mean (μ_1) as game and mean (μ_2) as no game.

$\mu_1 = \text{game}$

$\mu_2 = \text{no game}$

Hypotheses:

$H_0: \mu_1 - \mu_2 = 0$

$H_1: \mu_1 - \mu_2$ is different of 0

```
##
## Welch Two Sample t-test
##
## data:  game and nogame
## t = 1.6701, df = 43.502, p-value = 0.1021
## alternative hypothesis: true difference in means is not equal to 0
## 93 percent confidence interval:
## -41347.14 777641.39
## sample estimates:
## mean of x mean of y
## 480220.9 112073.8
```

From test we can see that P-value is 0.1021. We Do Not Reject H_0 because p-value is bigger than significance level of 0.07, and we can conclude that there is not enough evidence that the mean of Reviews for non games is different between the mean for the game.

Also, we are 93% confident that the difference of mean is in the interval from -41347.14 and 777641.39. Since 0 is inside the interval, we Do Not Reject H_0 (null hypotheses) and can conclude that there is not enough evidence that the mean is between -41347.14 and 777641.39

TASK 4

To determine if Content_Rating varies by Category we perform Fisher Exact Test to see if two variables are independent at 4% of significance level.

Category	Everyone	Everyone 10+	Mature 17+	Teen
-----	-----	-----	-----	-----
FAMILY	69	6	2	11
GAME	14	4	6	17
TOOLS	35	0	0	0

Hypotheses:

H0: the variables are independent

H1: the variables are not independent

```
##
## Fisher's Exact Test for Count Data
##
## data:  table_app_data
## p-value = 2.314e-09
## alternative hypothesis: two.sided
```

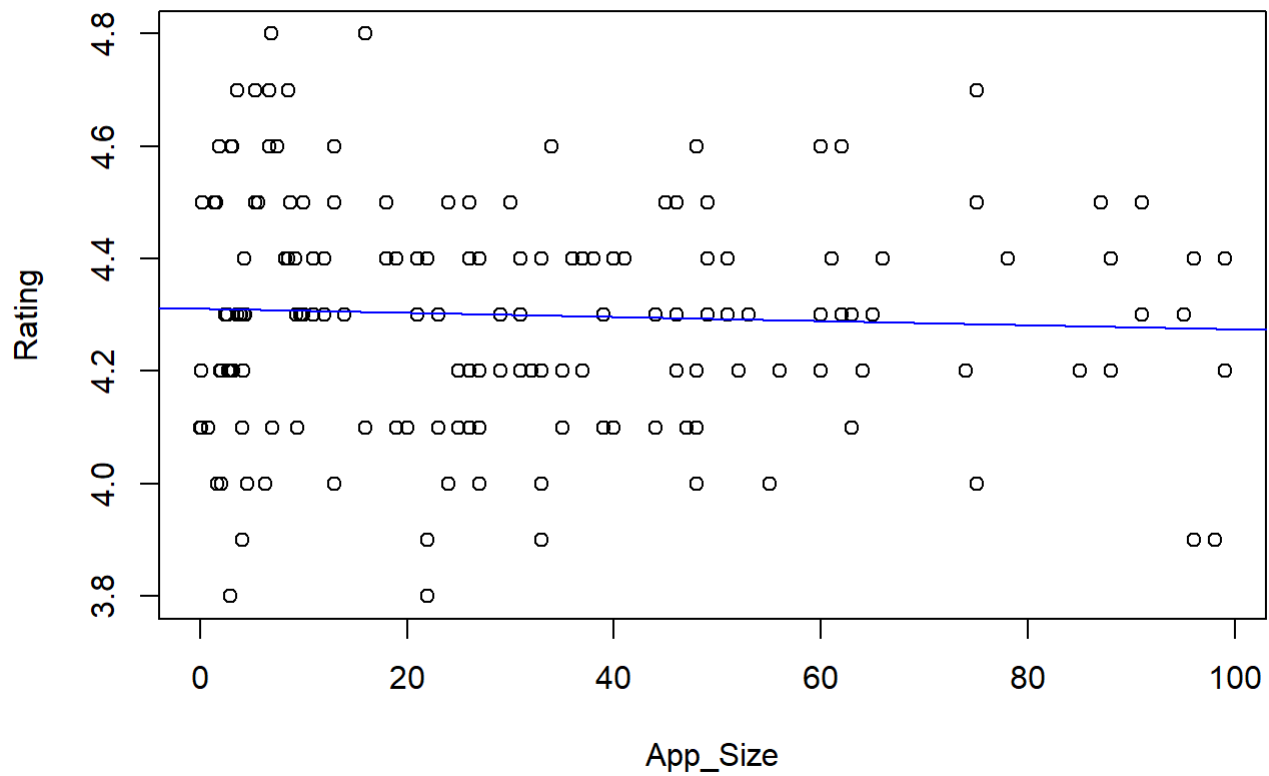
From test we can see that P-value is 2.314e-09 and we can Reject H0 (null hypotheses) since P-value is less than significance level of 0.04. So we can conclude that the experiment did establish an association and there is enough evidence that the variable are not independent.

TASK 5

To predict if app Rating is using App_Size we create a simple linear model.

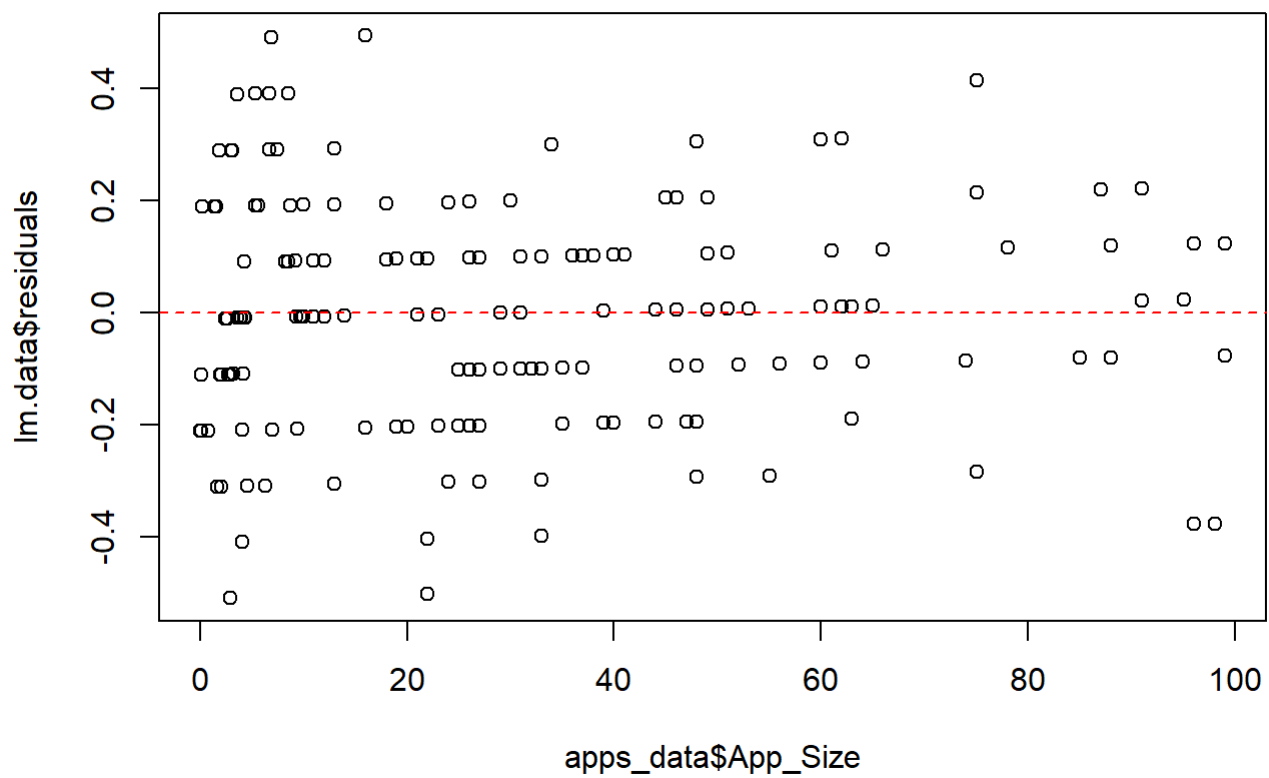
- First we check what is the Pearson Correlation coefficient.

Scatterplot of Rating against App_Size



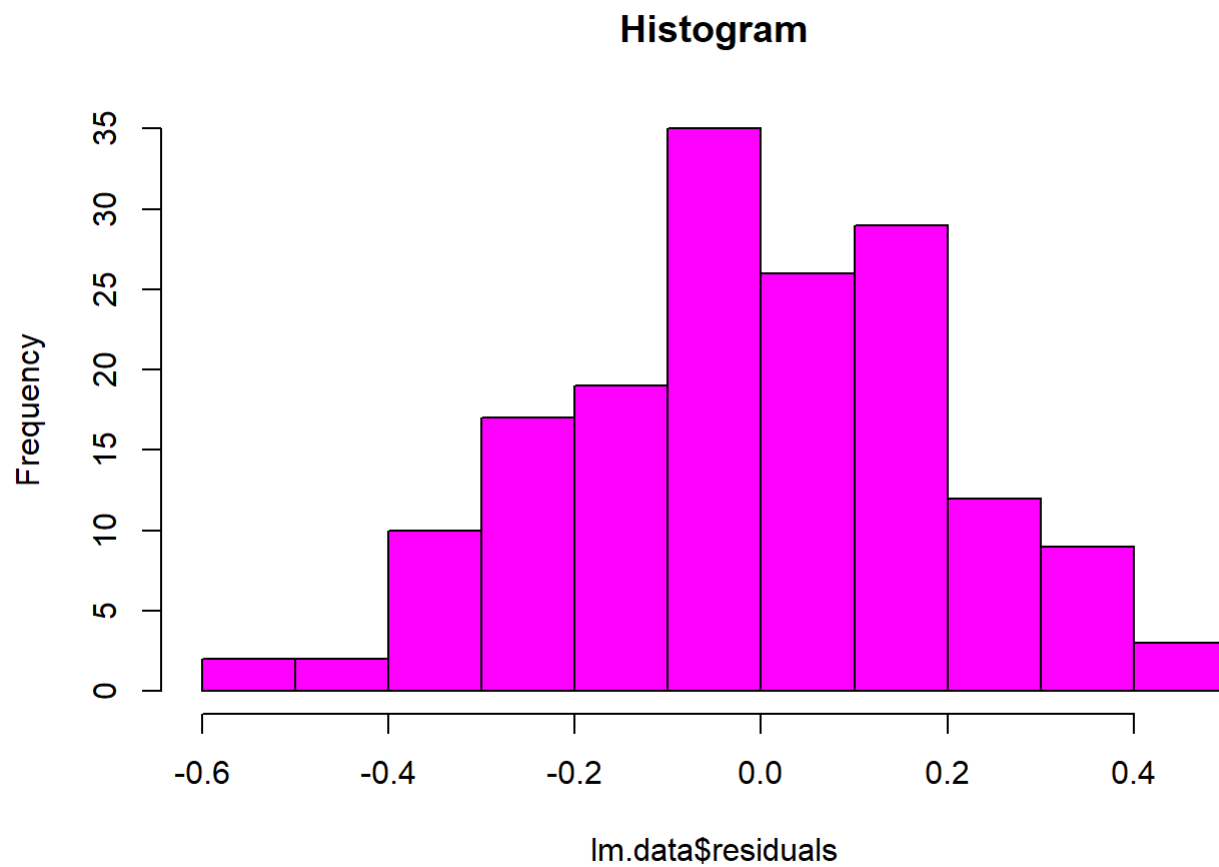
The value of correlation r is -0.0463975 , which means there is a moderate negative linear relationship.

- Second check the assumption of Linearity



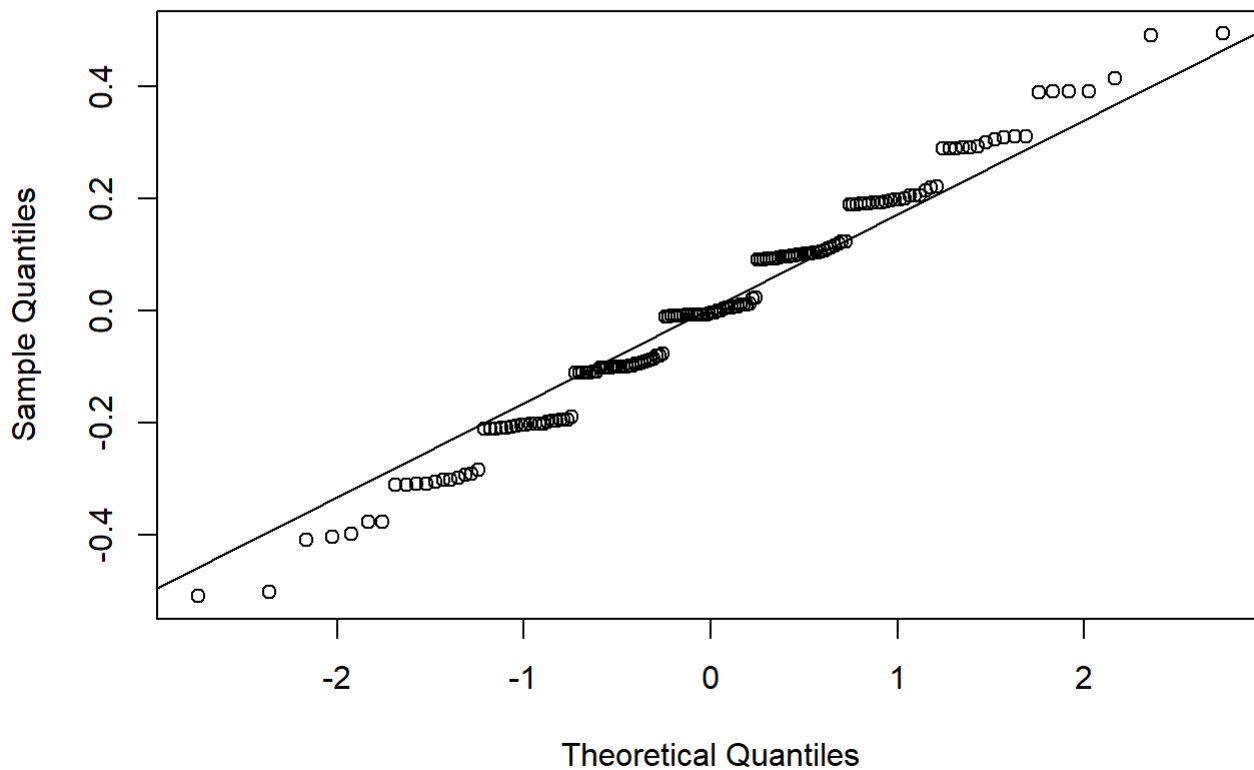
Analyzing plot we can see that linearity assumption is met because the points in residual plot are randomly scattered.

- Third check Normality



We can say that that normality appear plausible because the histogram is bell-shaped.

Normal Q-Q Plot



From graph we can see that it does follow reference line so data is normal.

Hypotheses:

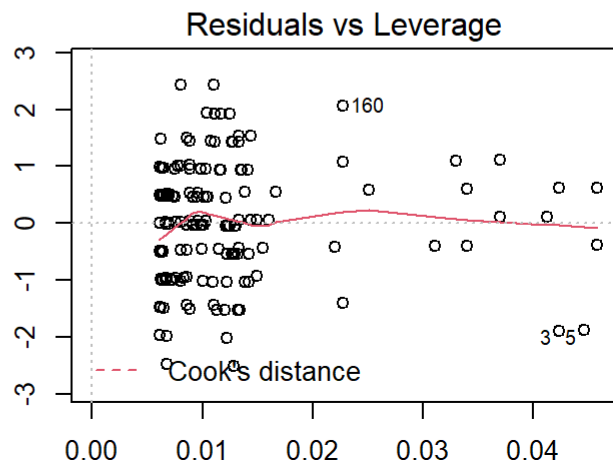
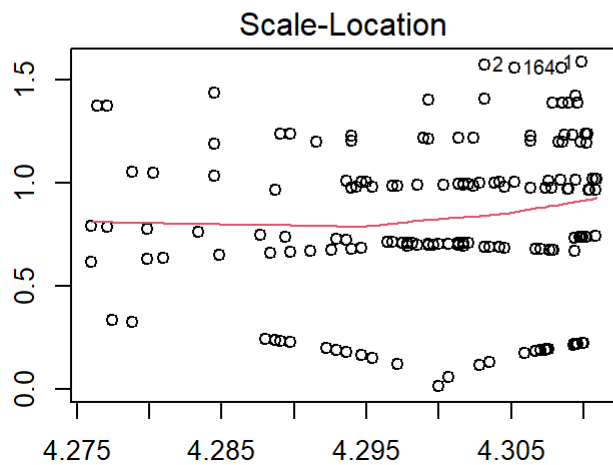
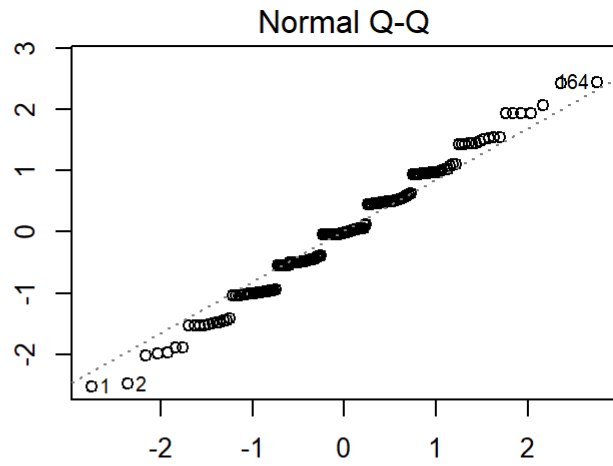
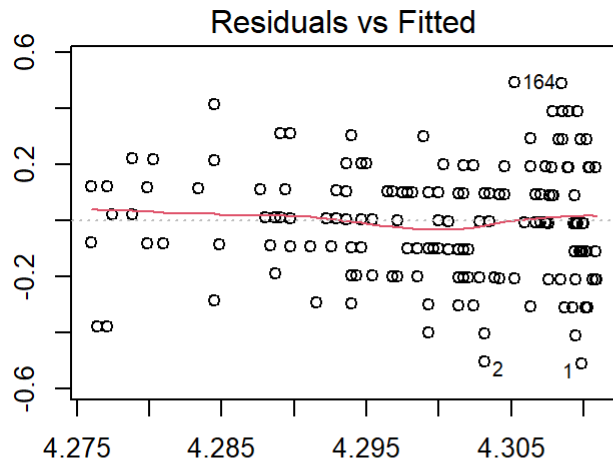
H0: Errors are normally distributed

H1: Errors are not normally distributed

```
##  
##  Shapiro-Wilk normality test  
##  
## data:  lm.data$residuals  
## W = 0.98765, p-value = 0.1587
```

From Shapiro-Wilk Test we can see that the p-value is 0.1587 and is bigger than significance level, so we Do Not Reject H0 (null hypotheses). We can conclude that there is not enough evidence that the errors are not normally distributed. Overall this assumption is met.

- Fourth check the assumption of Equal Variance.



Analyzing Residual versus Fitted Values plot we can conclude that Equal Variance assumption is not met because we can see a pattern.

To check if overall model is significant :

Hypotheses test:

$H_0: \beta_1 = 0$

$H_1: \beta_1$ is different of 0


```
##
## Call:
## lm(formula = apps_data$Rating ~ apps_data$App_Size)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.50986 -0.10998 -0.00472  0.11747  0.49475
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.3108829   0.0243315  177.173   <2e-16 ***
## apps_data$App_Size -0.0003522   0.0005957   -0.591    0.555
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2038 on 162 degrees of freedom
## Multiple R-squared:  0.002153,    Adjusted R-squared:  -0.004007
## F-statistic: 0.3495 on 1 and 162 DF,  p-value: 0.5552
```

As result we see that F-statistic is 0.3495 and p-value is 0.5552. We Do Not Reject H0 (null hypotheses) because p-value is bigger that significance level of 0.03. So, we can conclude that there is not enough evidence of a significant linear relationship between Rating and App_Size.

```
##      (Intercept) apps_data$App_Size
##      4.3108828780      -0.0003521695
```

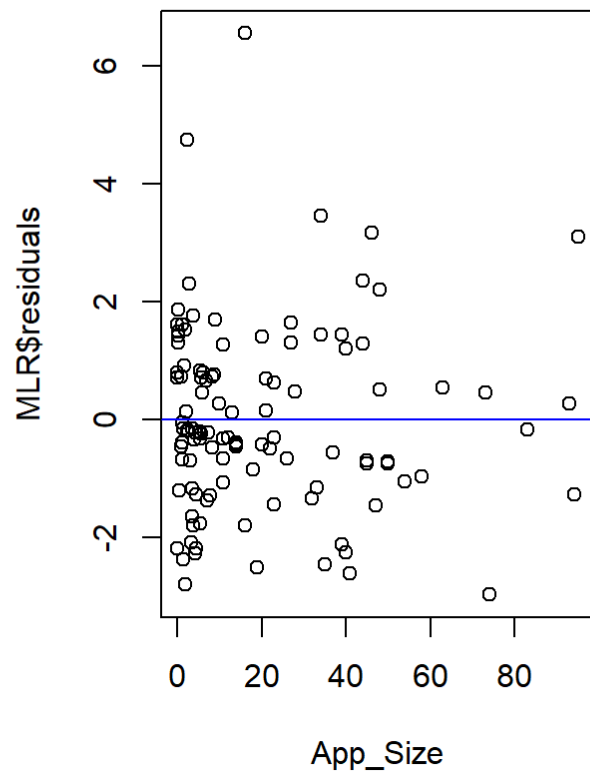
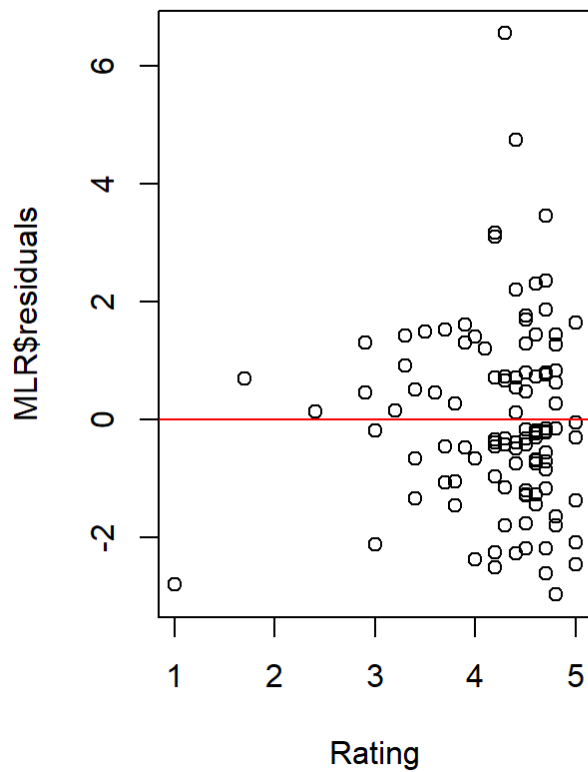
Equation of the Model is $\hat{y} = 4.3108 - 0.00035X$. The value of Coefficient of Determination is 0.00215 and Coefficient of Correlation is -0.004007. At 0.215% of the variability of Rating is explained by the App_Size. Coefficient of Determination and Coefficient of Correlation of 0 indicates that the regression predictions are not perfectly fit the data. So, if Coefficient of Determination is equal to 0, then the dependent variable cannot be predicted from the independent variable so there is no linear associations between the variables.

TASK 6

To predict Price by Rating and App_Size from Google Play Store we create a multiple linear regression where
 $y = \text{Price}$
 $x_1 = \text{Rating}$
 $x_2 = \text{App_Size}$

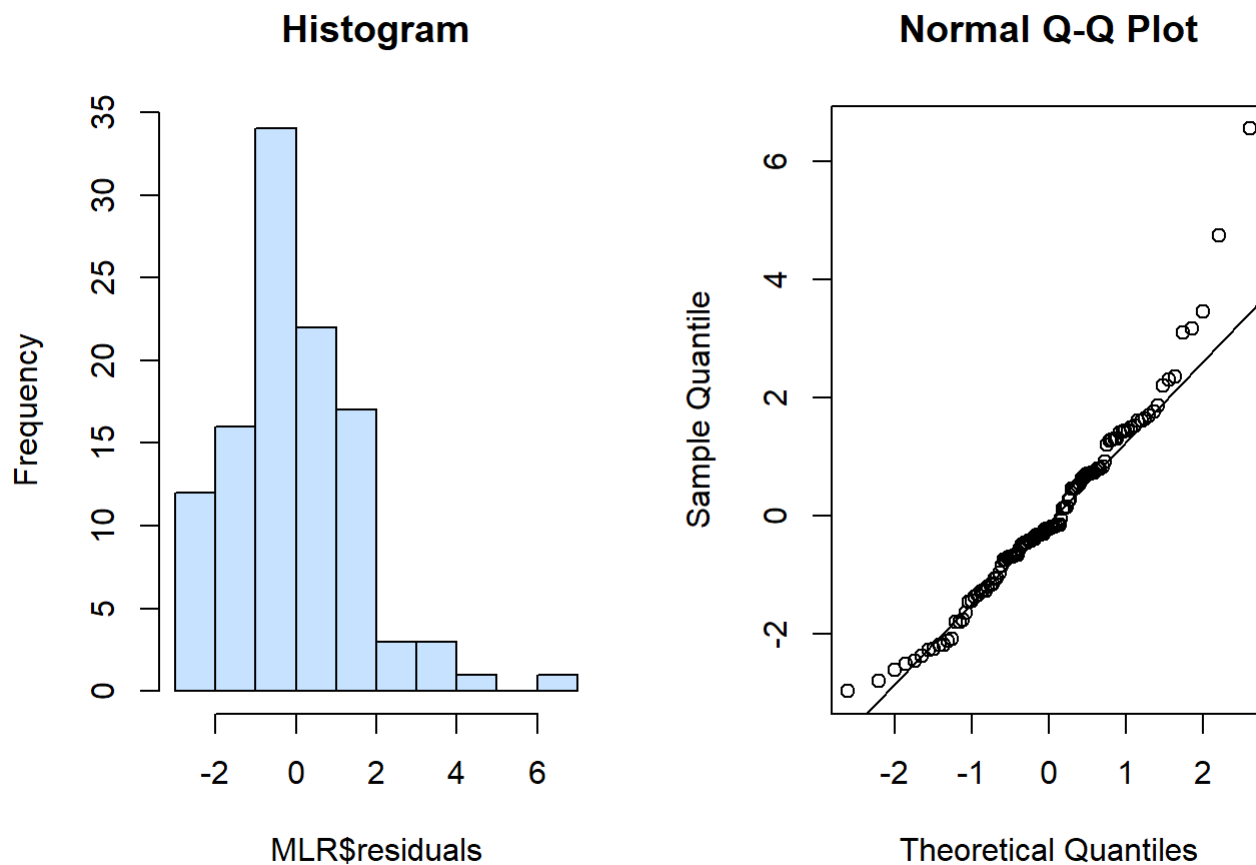
```
##      (Intercept)  pair_apps$Rating pair_apps$App_Size
##      4.57373768      -0.30866217      0.01170819
```

- First we check Linearity



Both plots have fanned pattern. The linear model is not appropriate. The models predicting power decrease/increases as the value of x increase so, linear assumption is not met.

- Second we check Normality



Analyzing histogram we can conclude that it is skewed right so it does not appear that normality is plausible. From QQ Plot we can see that it does not follow reference line very well. Large deviation are present in the top right, so probably not normal.

Hypotheses:

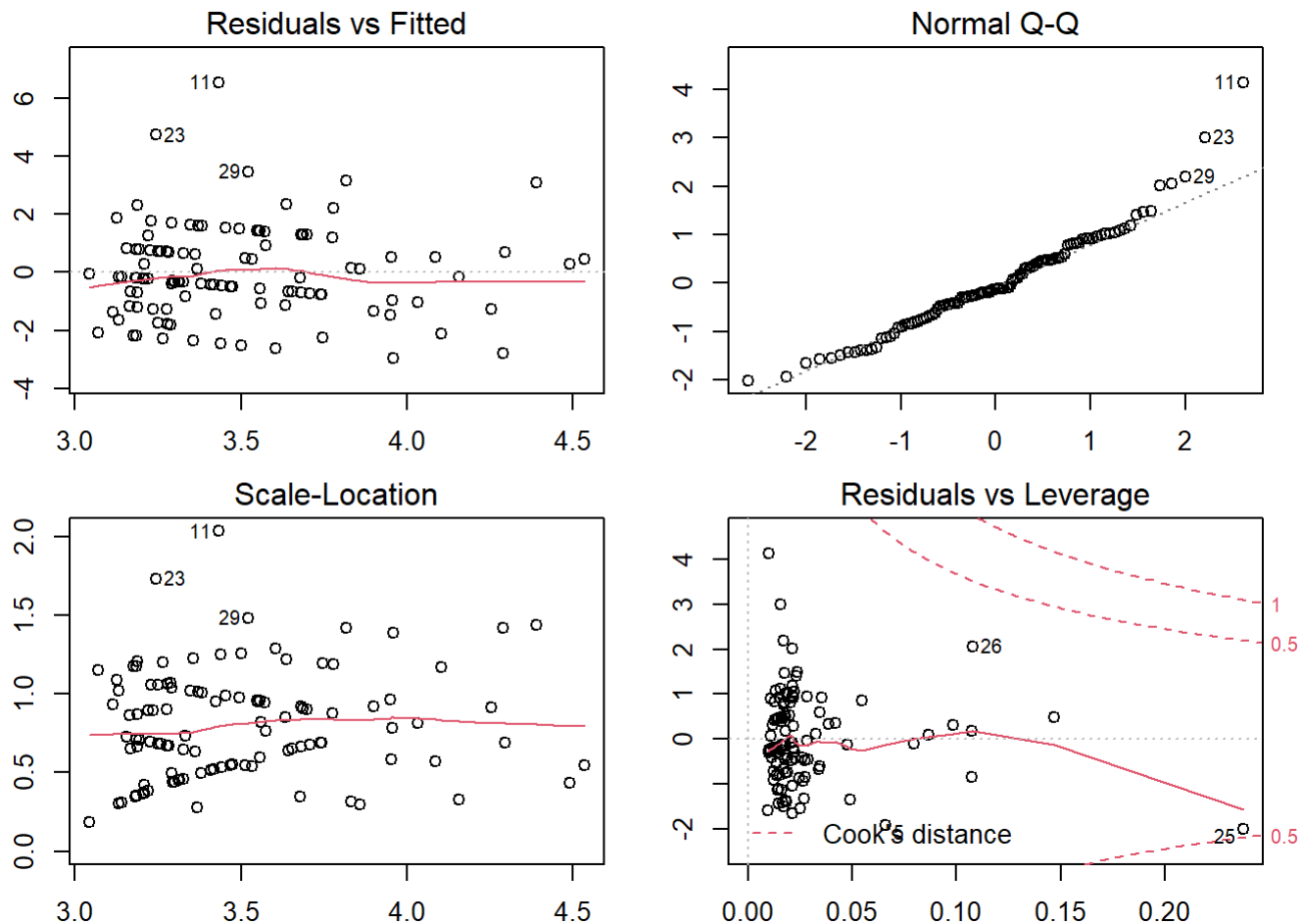
H0: Errors are normally distributed

H1: Errors are not normally distributed

```
##
## Shapiro-Wilk normality test
##
## data: MLR$residuals
## W = 0.95522, p-value = 0.001051
```

From Shapiro-Wilk Test we can see that the p_value is very small so we Reject H0 (null hypotheses) and can conclude that there are enough evidence that the error are not normally distributed. So, overall this assumption is not met.

3. Third check if assumption of Equal Variance is met



Analyzing Residual versus Fitted Values plot we can conclude that Equal variance are not met because we can see a pattern and outliers.

To check if overall model is significant :

```
##
## Call:
## lm(formula = pair_apps$Price ~ pair_apps$Rating + pair_apps$App_Size)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.9686 -1.0431 -0.2142  0.8050  6.5562
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.573738   1.004706   4.552 1.42e-05 ***
## pair_apps$Rating -0.308662   0.232152  -1.330  0.1865
## pair_apps$App_Size 0.011708   0.006692   1.750  0.0831 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.593 on 106 degrees of freedom
## Multiple R-squared:  0.04287,    Adjusted R-squared:  0.02481
## F-statistic: 2.374 on 2 and 106 DF,  p-value: 0.09803
```

Hypotheses:

H0: $\beta_1 = \beta_2 = 0$

H1: At least one β_j is different of 0

As result we see that F-statistic is 2.374 and p-value is 0.09803. We Reject H0 because p-value is small and can conclude that there is enough evidence that the Rating and App_Size explain some of the variability in Price. Coefficient of Determination is 0.04287 and Adjuster R-Square is 0.02481. At 4.287% of the variability in Price is explained by the regression of Rating and Apps_Size. Because overall model is significant we have to test Rating and App_Size separately.

x1= Rating

Hypotheses:

H0: $\beta_1 = 0$

H1: β_1 is different of 0

From Partial T-Test Values we see that for Rating t-value is -1.330 and p-value is 0.1865 so, we Do Not Reject H0(null hypotheses) because p-value is bigger that significance level of 0.10. To conclude, there is not enough evidence that X1(Rating) is important in explaining some of the variability in Price.

x2 = App_Size

Hypotheses:

H0: $\beta_2 = 0$

H1: β_2 is different of 0

From Partial T-Test Values we see that for App_Size t-value is 1.750 and p-value is 0.0831. We Reject H0(null hypotheses) because p-value is less than significance level of 0.10. To conclude, there is enough evidence that App_Size is important in explaining the variability in Price.

TASK 7

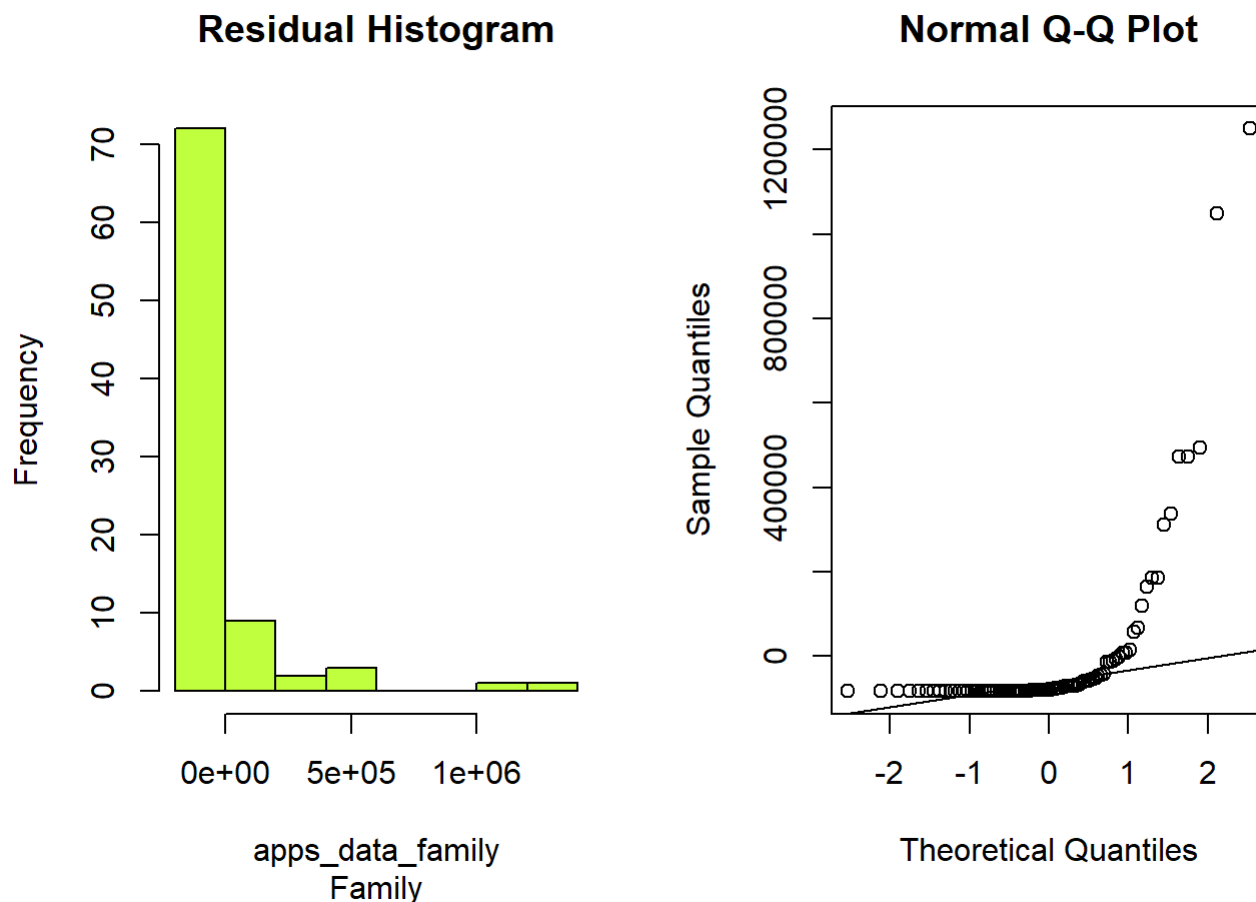
To see if the mean of Reviews varies by category we conduct One-Way ANOVA at significant level of 4%

```
## Analysis of Variance Table
##
## Response: apps_data$Reviews
##              Df      Sum Sq   Mean Sq F value   Pr(>F)
## apps_data$Category    2 4.4234e+12  2.2117e+12   3.3492 0.03758 *
## Residuals           161 1.0632e+14  6.6038e+11
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

GAME	FAMILY	TOOLS
-----	-----	-----
41	88	35

Check for Normality of Residuals of each category

FAMILY



Analyzing histogram of Residuals of category FAMILY we can see that it is skewed right which mean the data is not normally distributed plus multiple gaps. Form QQ Plot it does not follow the reference line very well. Large deviation are present in the top right so probable data is not normal.

Hypotheses:

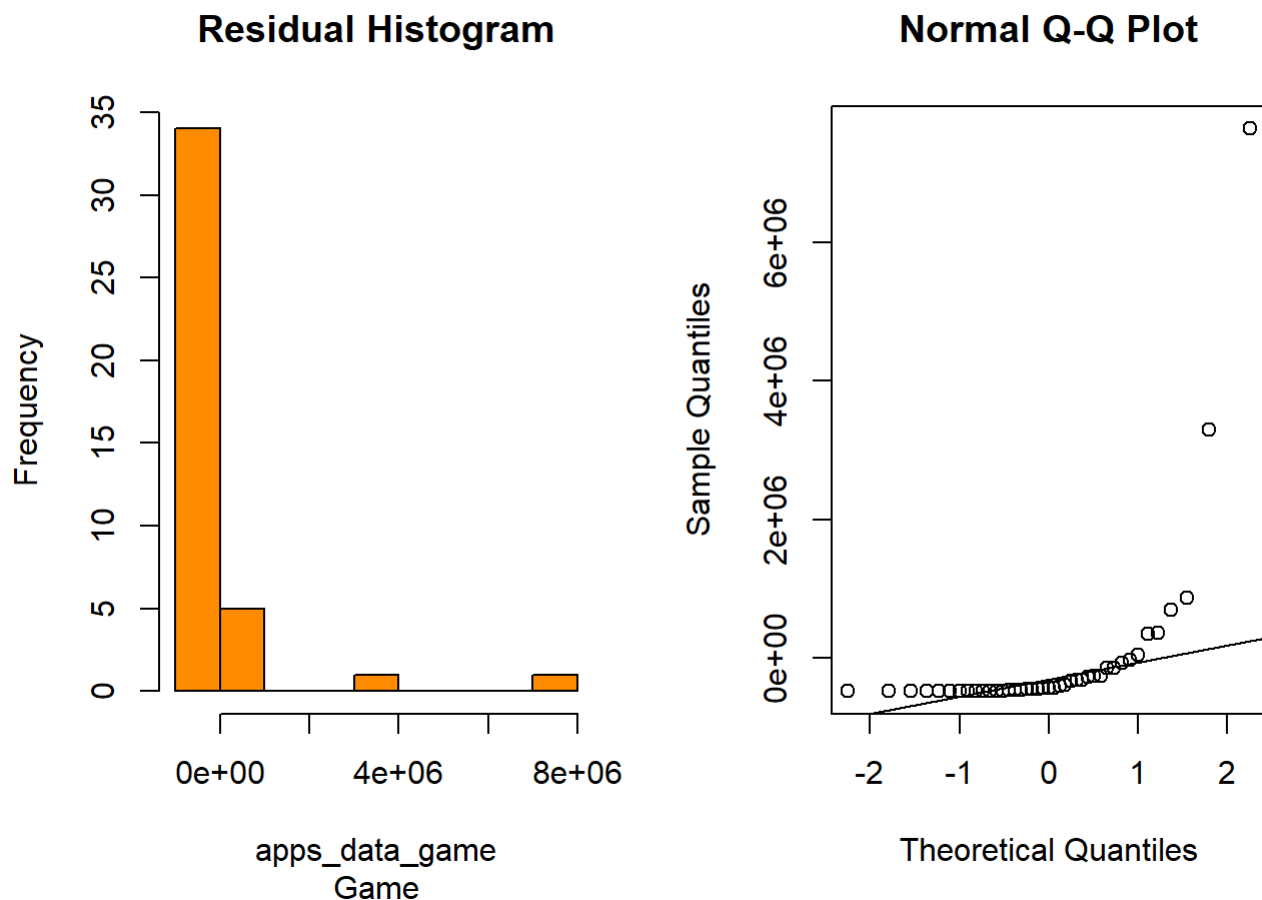
H0: Errors are normally distributed

H1: Errors are not normally distributed

```
##
##  Shapiro-Wilk normality test
##
## data:  apps_data_family
## W = 0.43362, p-value < 2.2e-16
```

From Shapiro-Wilk Test we can see that the p_value is small ($< 2.2e-16$) and is smaller than significance level of 0.04 so we can Reject H0 (null hypotheses). There is enough evidence that the error is not normal. Overall conclusion is that Normality does not seems plausible.

GAME



Analyzing histogram of Residuals of category GAME we can see that it is skewed right which mean the data is not normally distributed plus multiple gaps. Form QQ Plot it does not follow the reference line very well. Large deviation are present in the top right so probable data is not normal.

Hypotheses:

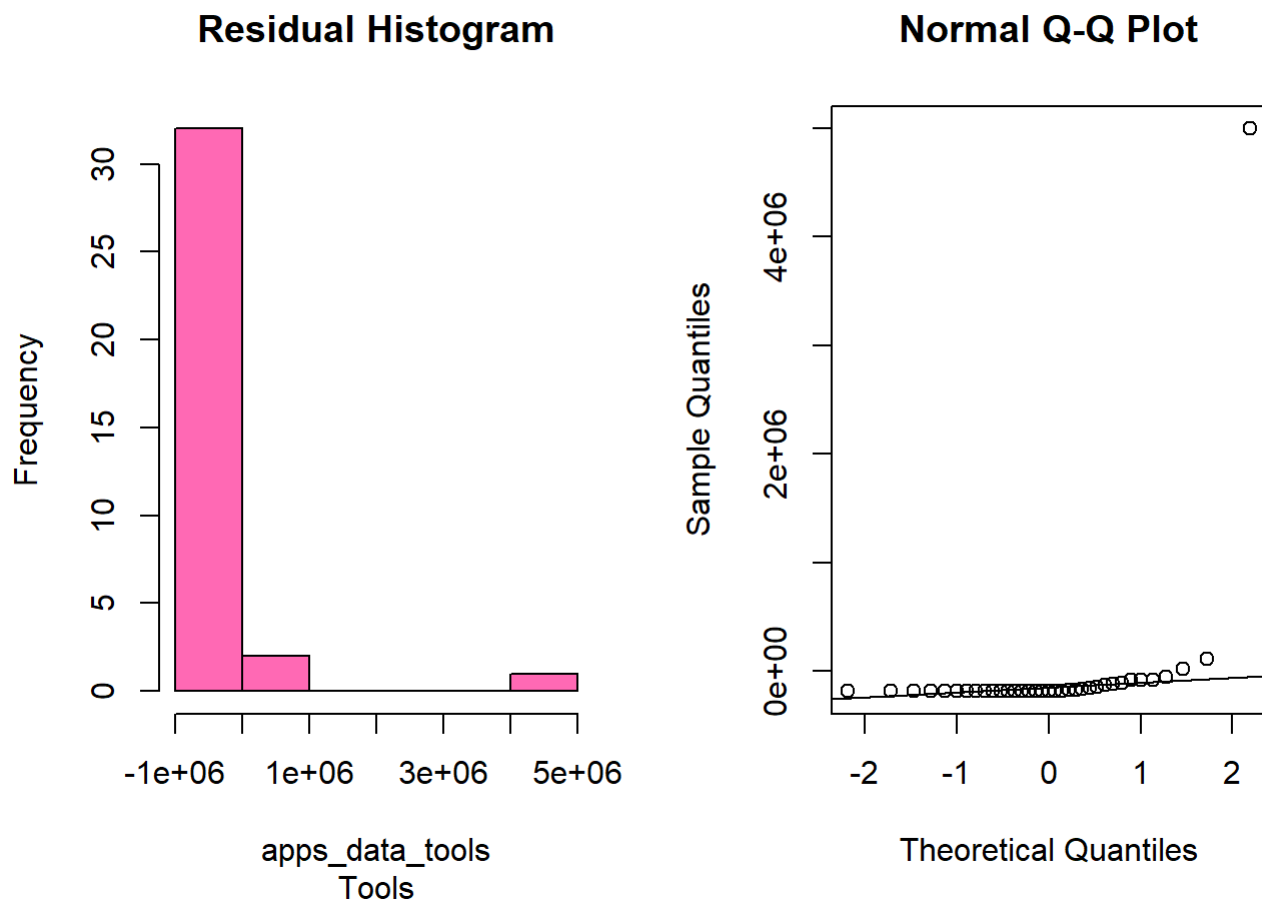
H0: Errors are normally distributed

H1: Errors are not normally distributed

```
##
##  Shapiro-Wilk normality test
##
## data:  apps_data_game
## W = 0.37045, p-value = 4.734e-12
```

From Shapiro-Wilk Test we can see that the p_value is small ($4.734e-12$) and is smaller than significance level of 0.04 so we can Reject H0 (null hypotheses). There is enough evidence that the error is not normal. Overall conclusion is that Normality does not seems reasonable.

TOOL



Analyzing histogram of Residuals of category TOOLS we can see that it is skewed right which mean the data is not normally distributed plus multiple gaps. Form QQ Plot it does not follow the reference line very well. Large deviation are present in the top right so probable data is not normal.

Hypotheses:

H0: Errors are normally distributed

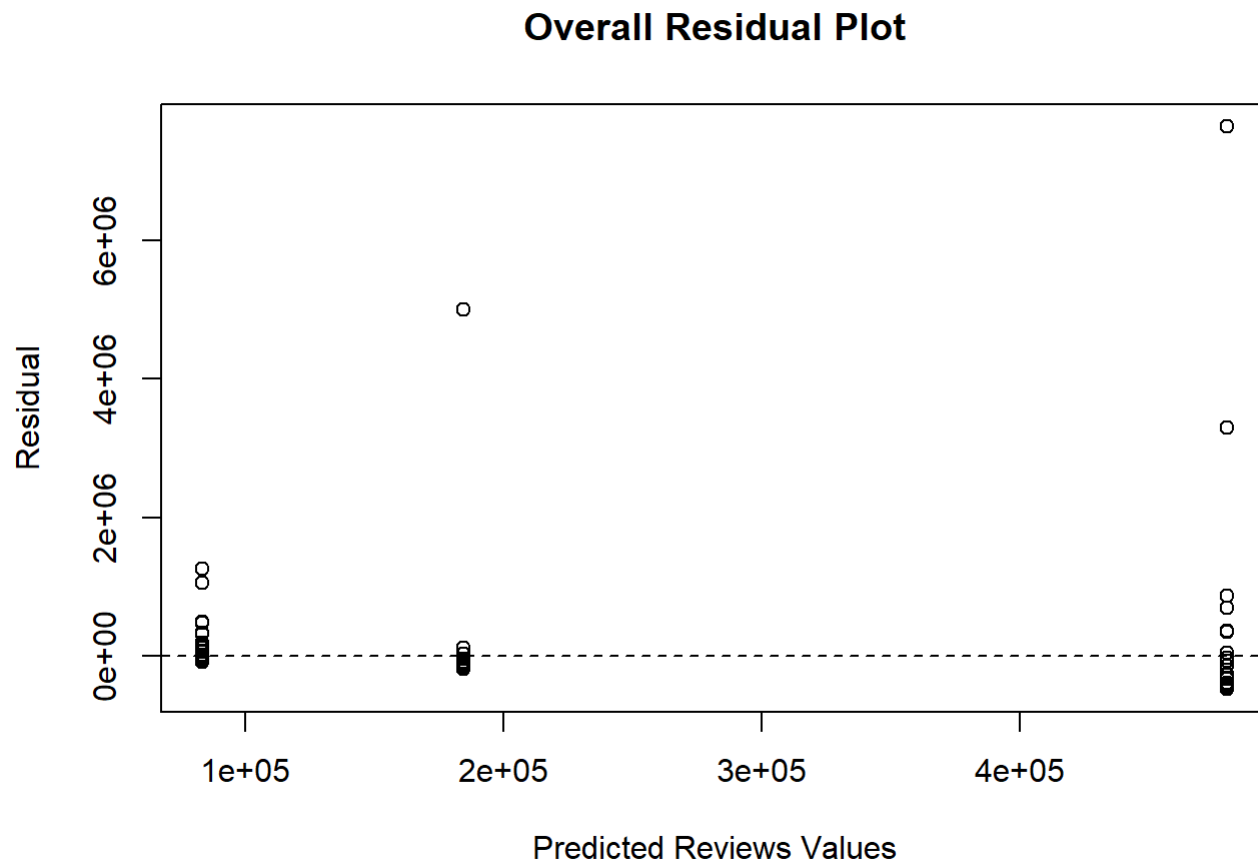
H1: Errors are not normally distributed

```
##
##  Shapiro-Wilk normality test
##
## data:  apps_data_tools
## W = 0.20486, p-value = 1.435e-12
```

From Shapiro-Wilk Test we can see that the p_value is small (1.435e-12) and is smaller than significance level of 0.04 so we can Reject H0 (null hypotheses). There is enough evidence that the error is not normal. Overall conclusion is that Normality does not seems reasonable.

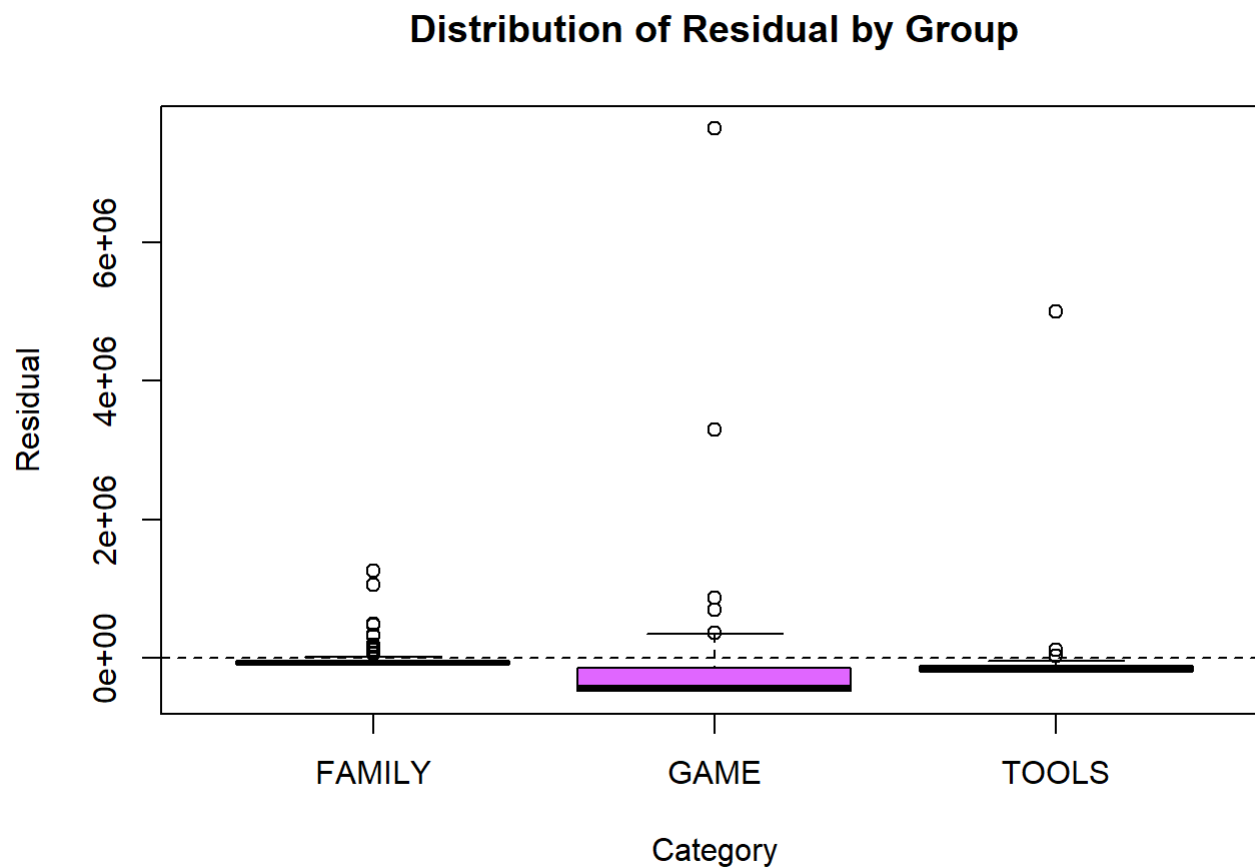
*Check for Equal Variance of Residuals

Residuals versus Fitted Values Scatter plot



From scatter plot we can see that the spread is different in each group. The equal variance assumption is not met.

Residual versus Group Averages Boxplots



From boxplot we can see presents of outliers, the range is different, looks odd. The equal variance assumption is not met.

var_f= variance of family

var_g = variance of game

var_t = variance of tools

Hypotheses:

H0: $\text{var}_f = \text{var}_g = \text{var}_t$

H1: not all variance are the same

```
## Warning: package 'car' was built under R version 4.1.3
```

```
## Loading required package: carData
```

```
## Warning: package 'carData' was built under R version 4.1.3
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group  2  3.2215 0.04248 *
##      161
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

From Levene's Test we can see that p-value is 0.04248, we Do Not Reject H_0 (null hypotheses) since p-value is bigger than significance level of 0.04. There is not enough evidence for Equal Variance. So, assumption is not met.

To see if overall Model is significant we conduct Mean Model

ANOVA Table

	Sum Sq	Df	Mean Sq	F_stat	F_pval
Regression	4.4234e+12	2	2.2117e+12	3.3492	0.03758
Errors	1.0632e+14	161	6.6038e+11		
Total	1.1074e+14	163			

muF = Mean of Family

muG = Mean of Game

muT = Mean of Tools

Hypotheses:

H_0 : $\mu_F = \mu_G = \mu_T$

H_1 : At least one of the means is different

As result we see that F-statistic is 3.3492 and p-value is 0.03758. We Reject H_0 (null hypotheses) because p-value is small than significance level of 0.04 and can conclude that there is enough evidence at least one mean is different. So overall model is significant.

To see which difference are significant we perform Tukey Test.

```
##      Df    Sum Sq  Mean Sq F value Pr(>F)
## Category    2 4.423e+12  2.212e+12   3.349 0.0376 *
## Residuals  161 1.063e+14  6.604e+11
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Tukey multiple comparisons of means
## 96% family-wise confidence level
##
## Fit: aov(formula = Reviews ~ Category, data = apps_data)
##
## $Category
##      diff      lwr      upr    p adj
## GAME-FAMILY 396907.7 19716.9 774098.5 0.0286411
## TOOLS-FAMILY 101072.9 -297563.3 499709.1 0.8080690
## TOOLS-GAME -295834.8 -754906.3 163236.7 0.2564046
```

For GAME-FAMILY: p-value is 0.0286411. We Reject H_0 (null hypotheses) since p-value is less than significance level 0.04. So, this means that there is a significant difference between the GAME Mean Reviews and the FAMILY Mean Reviews.

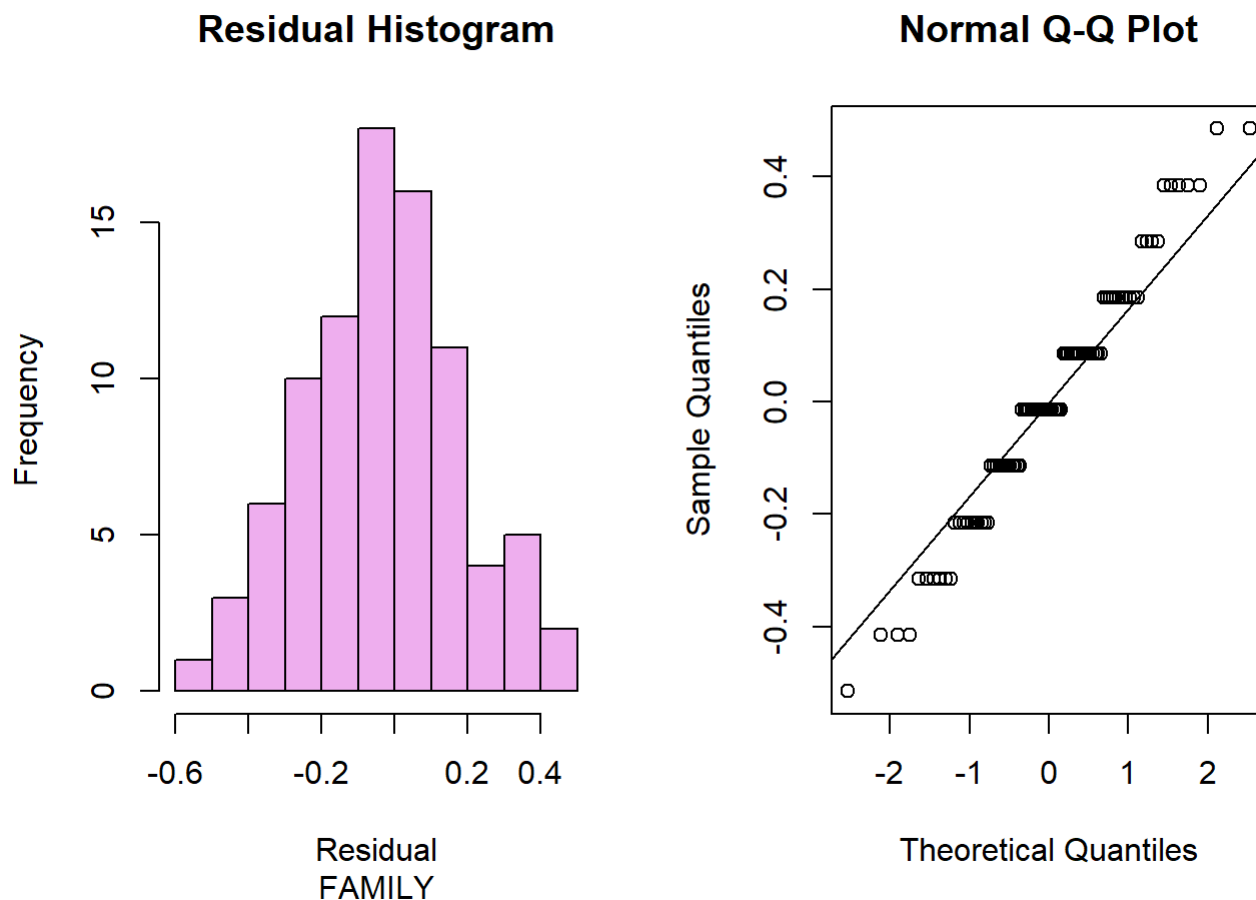
For TOOLS-FAMILY : p-value is 0.8080690. We Do Not Reject H_0 (null hypotheses) since p-value is bigger than significance level 0.04 So, this means that there is a not significant difference between the TOOLS Mean Reviews and the FAMILY Mean Reviews.

For TOOLS-GAME : p-value is 0.2564046. We Reject H_0 since p-value is less than significance level 0.04. So, this means that there is a significant difference between the TOOLS Mean Reviews and the GAME Mean Reviews.

TASK 8

To see if the mean of Rating varies by category we conduct One-Way ANOVA at significant level of 3%

Check for Normality of Residuals of each category
FAMILY



Analyzing histogram of Residuals of category FAMILY we can see that it looks symmetric and bell-shaped. Normality is plausible. From QQ Plot it does follow the reference line. Probably normal distributed.

Hypotheses:

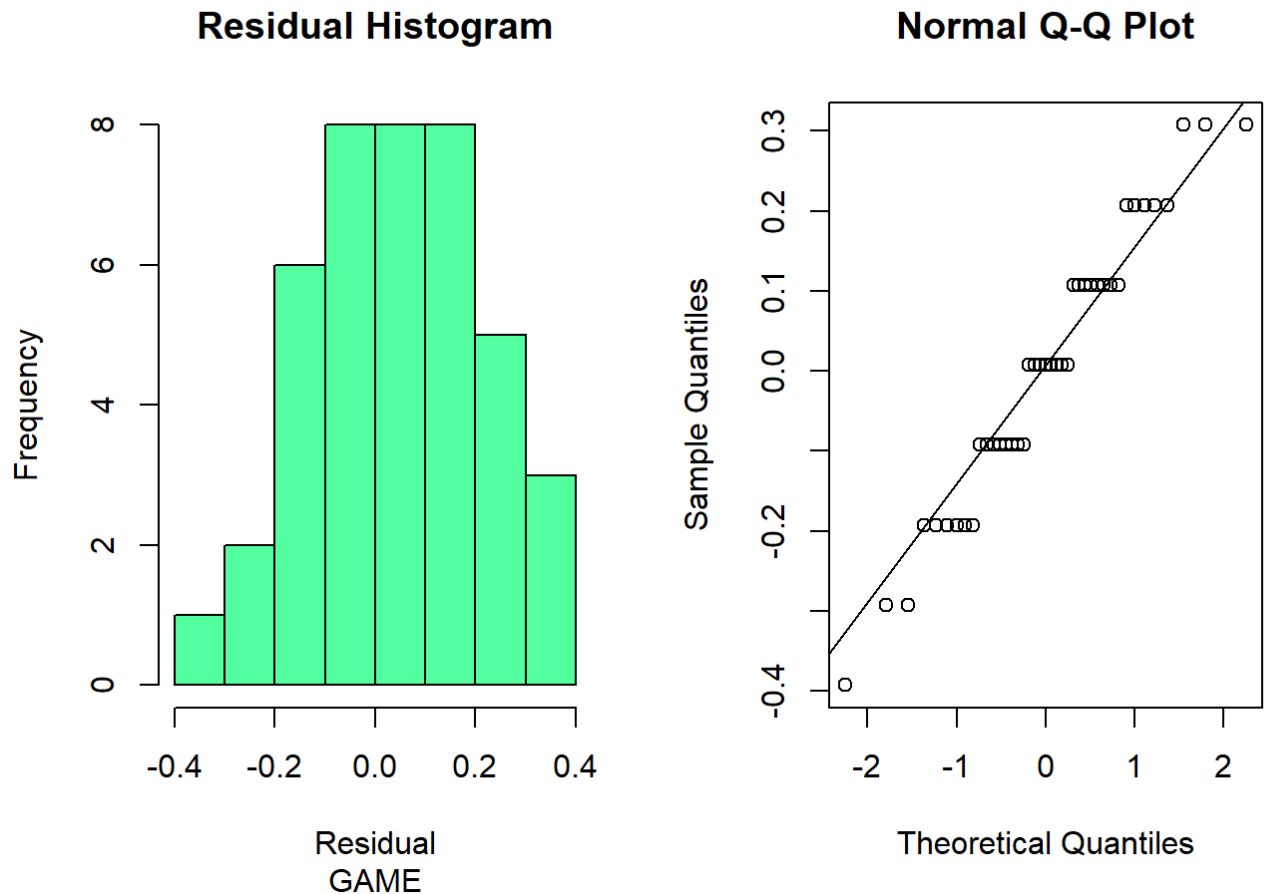
H_0 : Errors are normally distributed

H_1 : Errors are not normally distributed

```
##
##  Shapiro-Wilk normality test
##
## data:  apps_data_FAMILY_rating
## W = 0.97686, p-value = 0.1166
```

From Shapiro-Wilk Test we can see that the p_value is 0.1166, so we Do Not Reject H_0 (null hypotheses) since p_value is bigger than significant level of 0.03. To conclude there is not enough evidence that the error is not normal. Overall it does appear that the data follow a normal distribution.

- GAME



Analyzing histogram of Residuals of category GAME we can see that it looks symmetric and bell-shaped meaning the data is normally distributed. From QQ Plot it does follow the reference line, so probable data is normal.

Hypotheses:

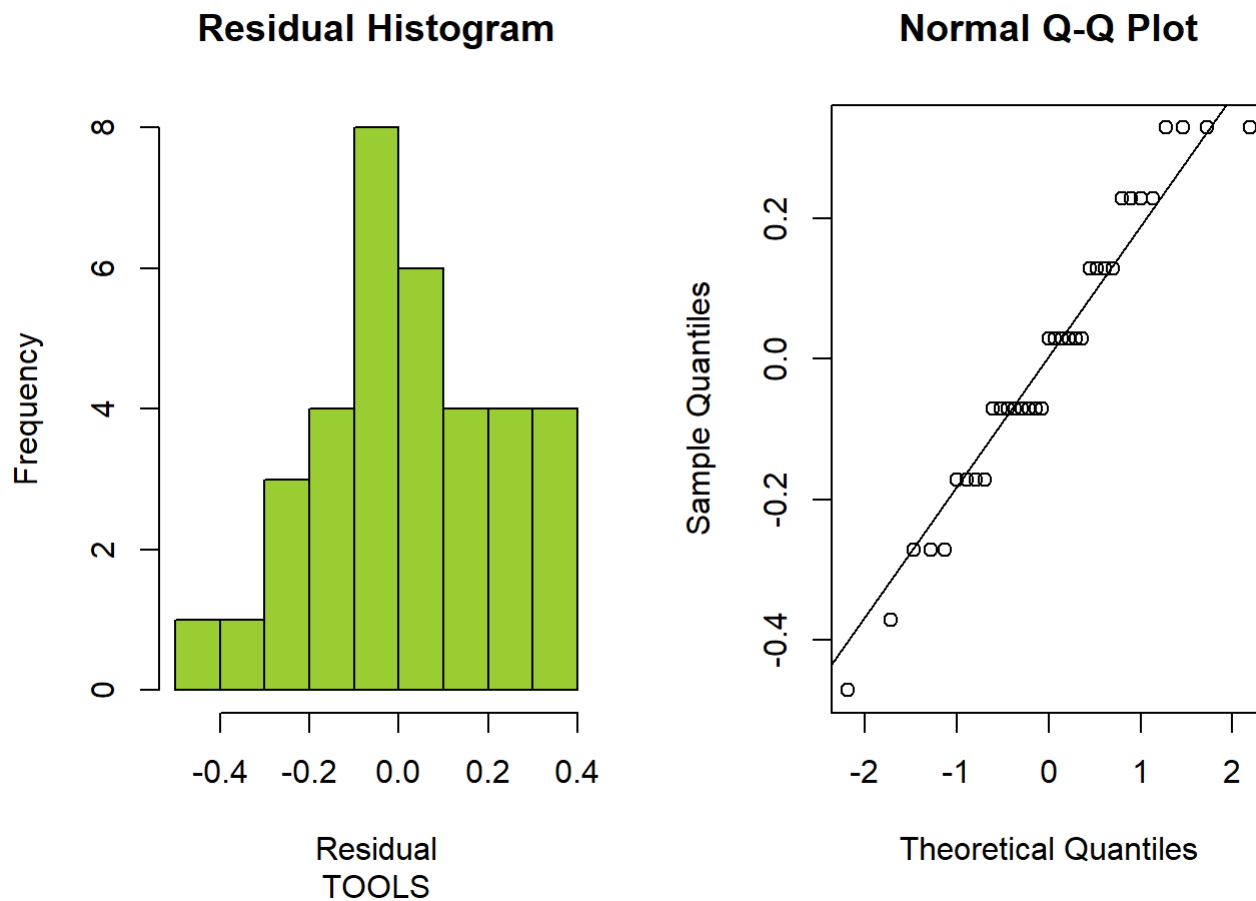
H_0 : Errors are normally distributed

H_1 : Errors are not normally distributed

```
##
##  Shapiro-Wilk normality test
##
## data:  apps_data_GAME_rating
## W = 0.96284, p-value = 0.1976
```

From Shapiro-Wilk Test we can see that the p_value is 0.1976 so, we Do Not Reject H_0 (null hypotheses) since p -value is bigger than significant level of 0.03. To conclude there is not enough evidence that the error is not normal. Overall it does appear that the data follow a normal distribution.

*TOOLS



Analyzing histogram of Residuals of category TOOLS we can see that it is skewed left which mean the data is not normally distributed. Analyzing QQ Plot we can see that it does follow the reference line, with some issues on the right top. Probable data is normal.

Hypotheses:

H_0 : Errors are normally distributed

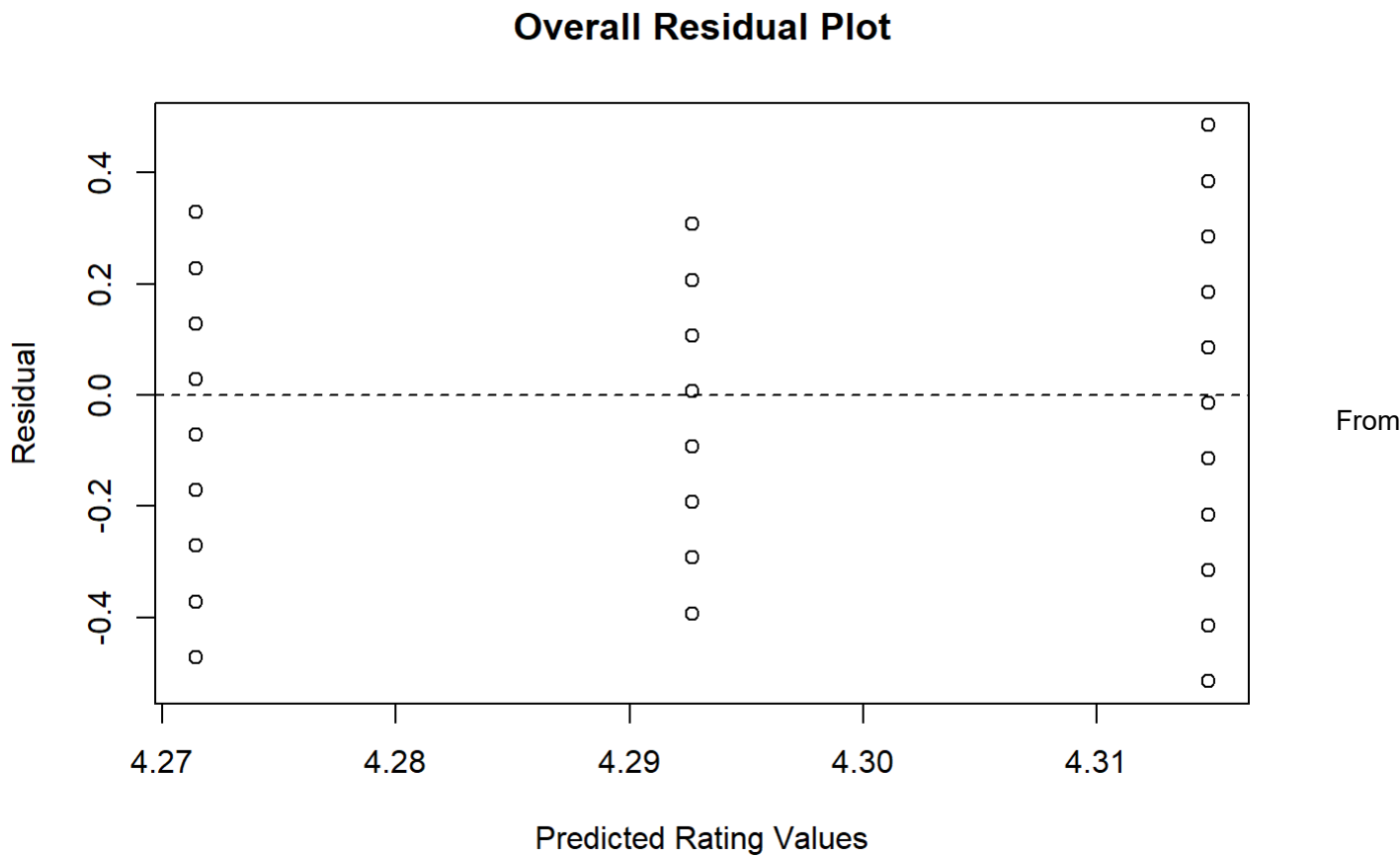
H_1 : Errors are not normally distributed

```
##
## Shapiro-Wilk normality test
##
## data:  apps_data_TOOLS_rating
## W = 0.96074, p-value = 0.2407
```

From Shapiro-Wilk Test we can see that the p_value is 0.2407 so, we Do Not Reject H_0 (null hypotheses) since p -value is bigger than significant level of 0.03. To conclude there is not enough evidence that the error is not normal. Overall it does appear that the data follow a normal distribution.

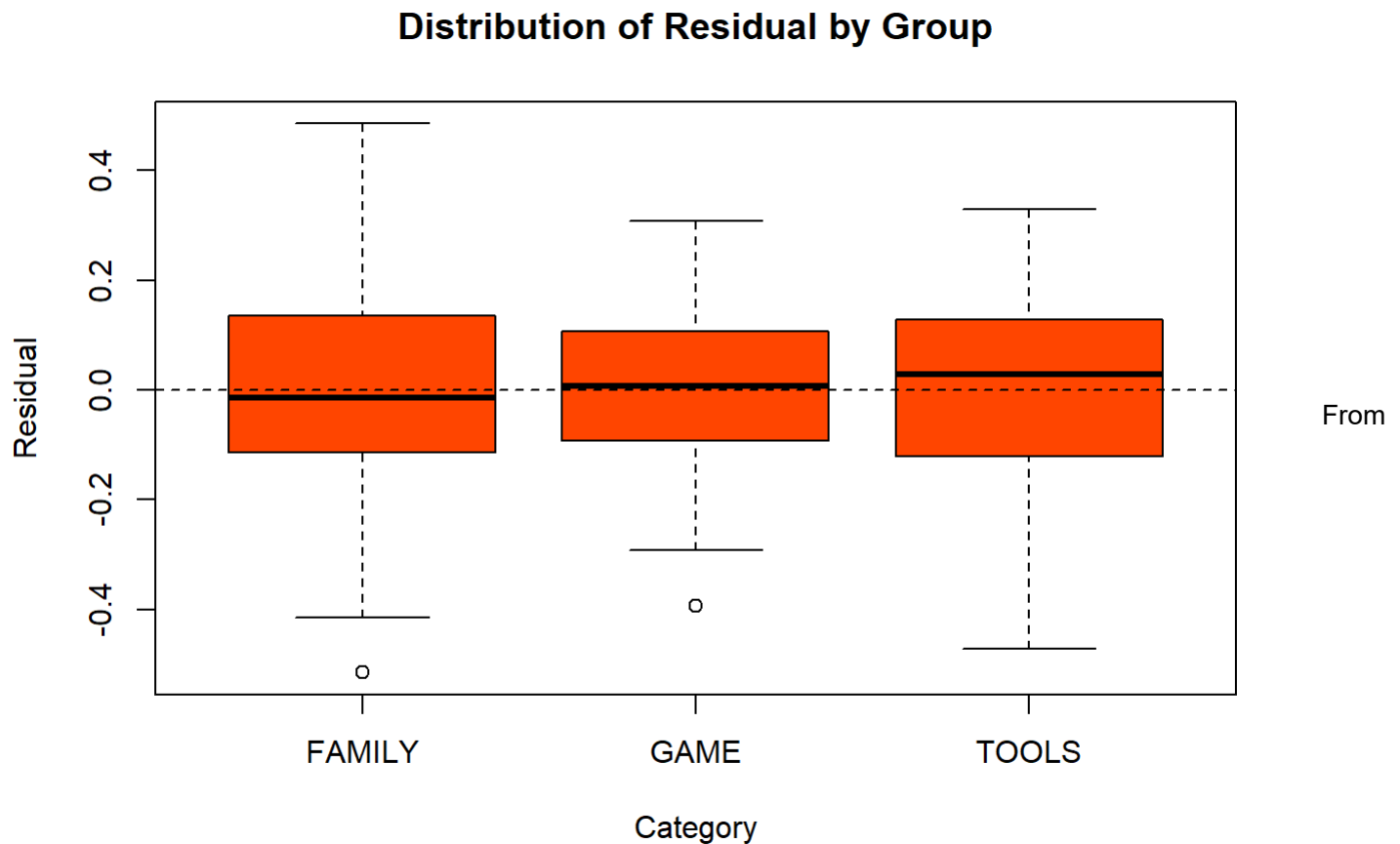
*Check for Equal Variance of Residuals

Residuals versus Fitted Values Scatterplot



scatterplot we can see that the spread is different in each group. The equal variance assumption is not met.

Residual versus Group Averages Boxplots



boxplot we can see outliers are present in two category. Family and Tools group look skewed. Equal variance assumption is not met.

var_f= variance of family

var_g = variance of game

var_t = variance of tools

Hypotheses:

H0: var_f = var_g = var_t

H1: Not all variance are the same

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group  2  0.7488 0.4746
##      161
```

From Levene's Test we can see that p-value is 0.4746, so we Do Not Reject H0 since p-value is bigger than significant level of 0.03. There is not enough evidence for equal variance. Overall assumption is not met.

To see if overall Model is significant we conduct Mean Model


```
## Analysis of Variance Table
##
## Response: apps_data$Rating
##              Df Sum Sq Mean Sq F value Pr(>F)
## apps_data$Category  2    0.05  0.024986   0.6013 0.5493
## Residuals        161    6.69  0.041553
```

ANOVA Table

	Sum Sq	Df	Mean Sq	F_stat	F_pval
-----	-----	-----	-----	-----	-----
Regression	0.05	2	0.024986	0.6013	0.5493
Errors	6.69	161	0.041553		
Total	6.74	163			

Hypotheses:

H0: $\mu_F = \mu_G = \mu_T$

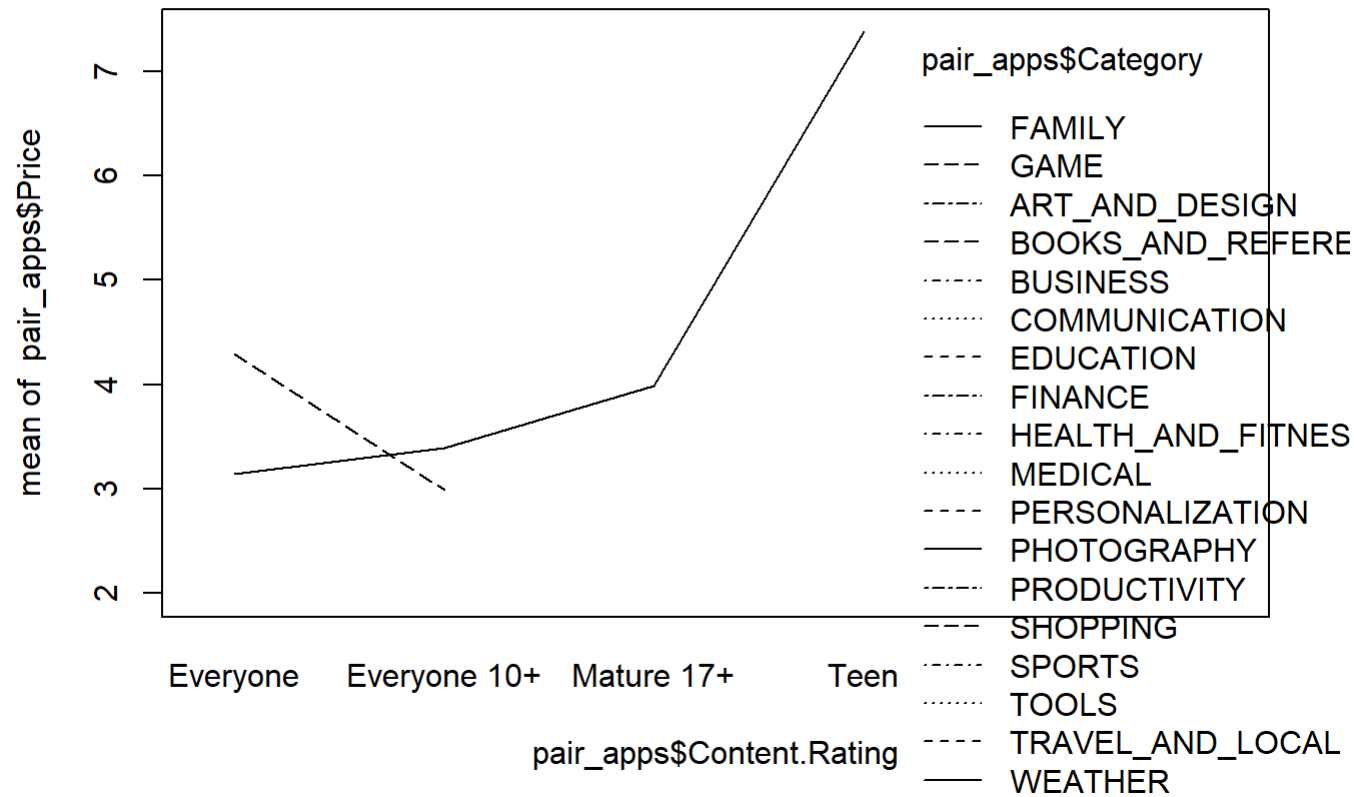
H1: at least one of the means is different

As result we see that F-statistic is 0.6013 and p-value is 0.5493. We Do Not Reject H0 since p-value is bigger than significance level of 0.03 and we can conclude there is not enough evidence that at least one mean is different. So overall model is not significant.

TASK 9

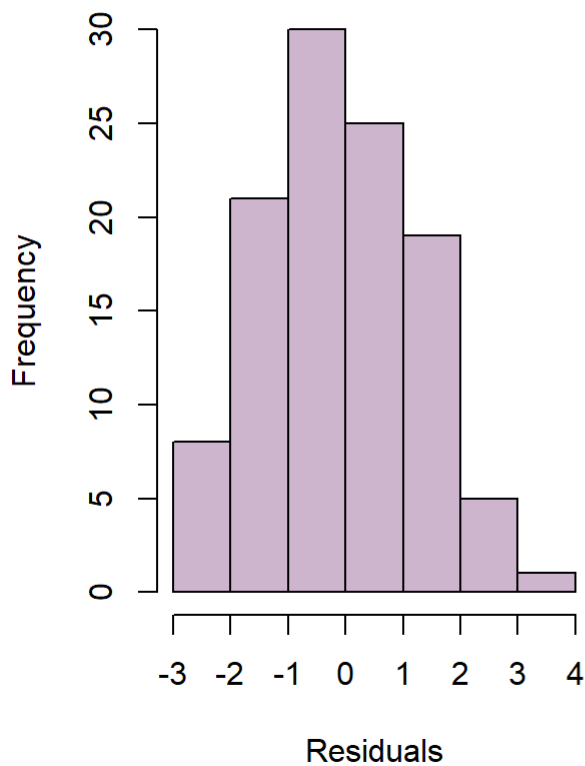
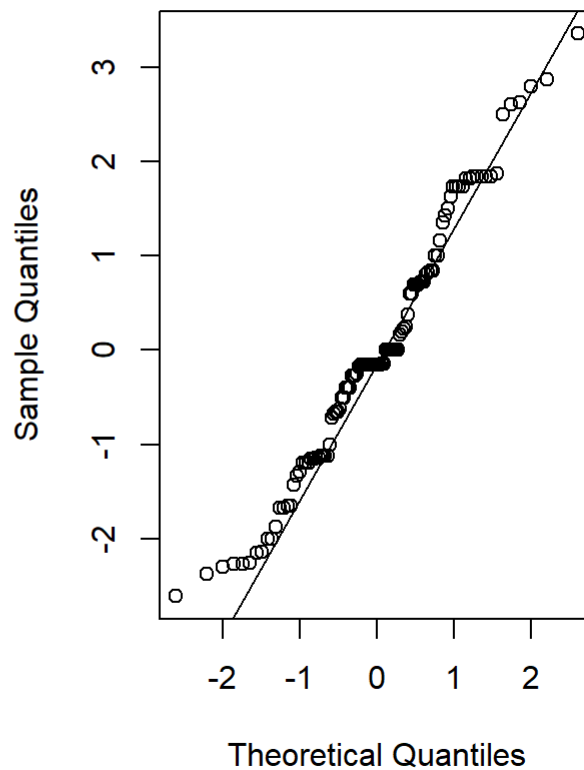
To test the effect of Content.Rating and Category on Price from Google Play Store we perform Two-Way ANOVA

Intersection plot



There appears to be an interaction present. Since there appear to be interactions present, we should not consider main effects.

*Check the Normality of Residual Assumption

Residual Histogram**Normal Q-Q Plot**

Analyzing histogram of Residuals we can see that it is look symmetric , bell-shaped. Normality is plausible . From QQ Plot we can see that it does follow the reference line but there are some issues at the left bottom. So data is normal.

Hypotheses:

H0: Errors are normally distributed

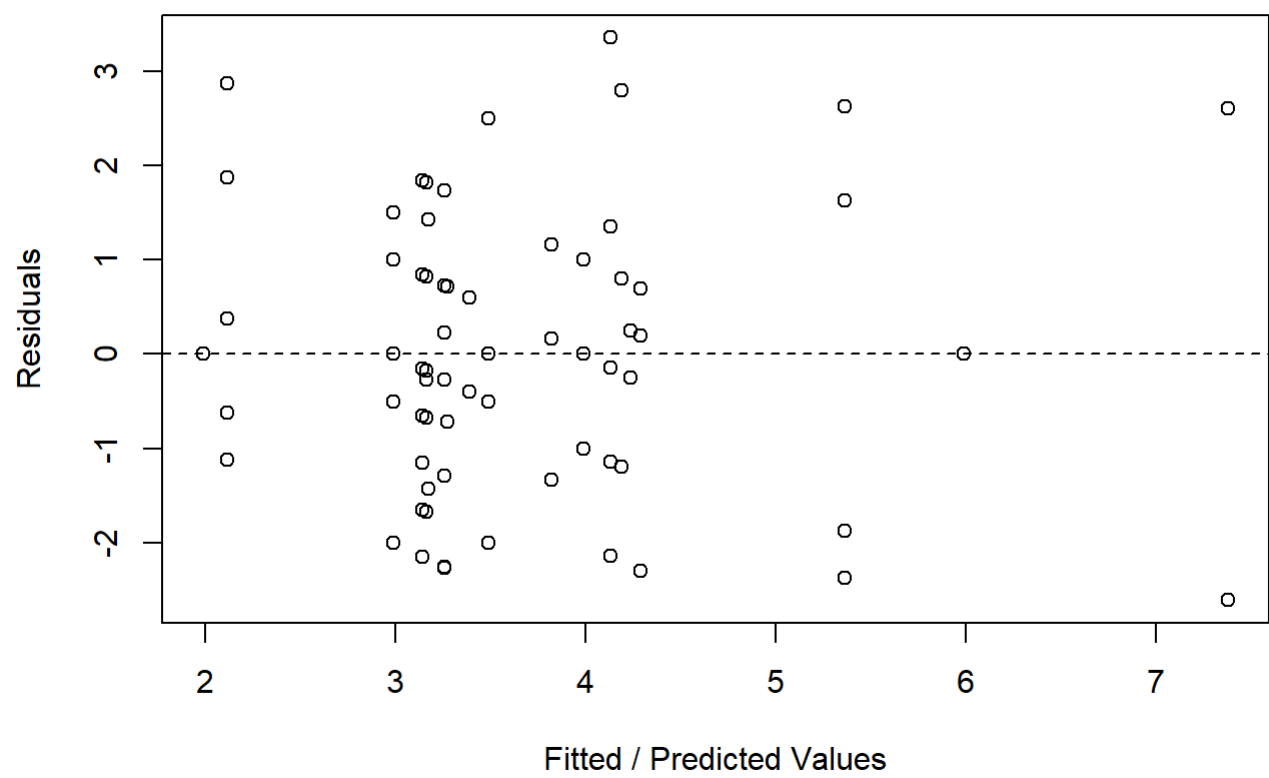
H1: Errors are not normally distributed

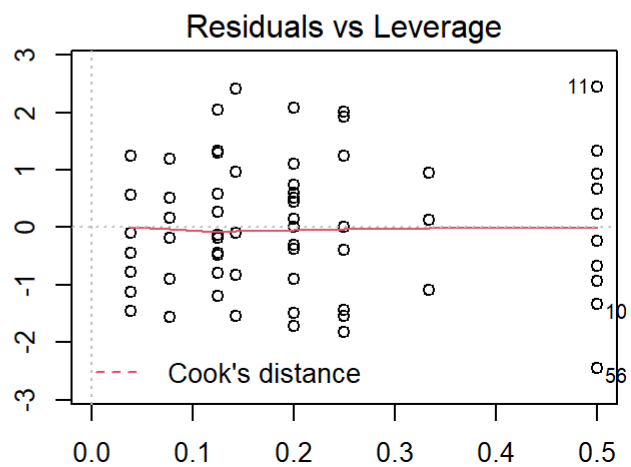
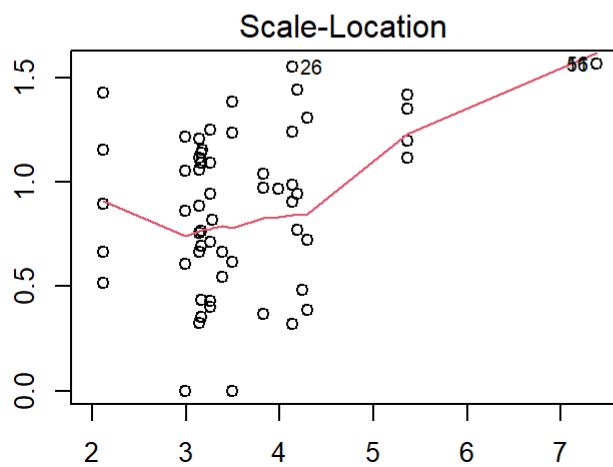
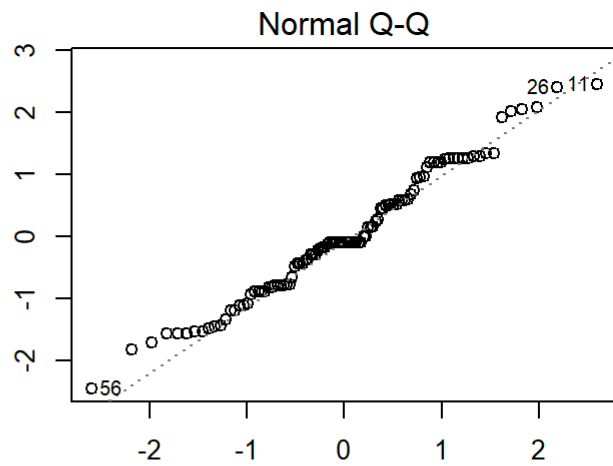
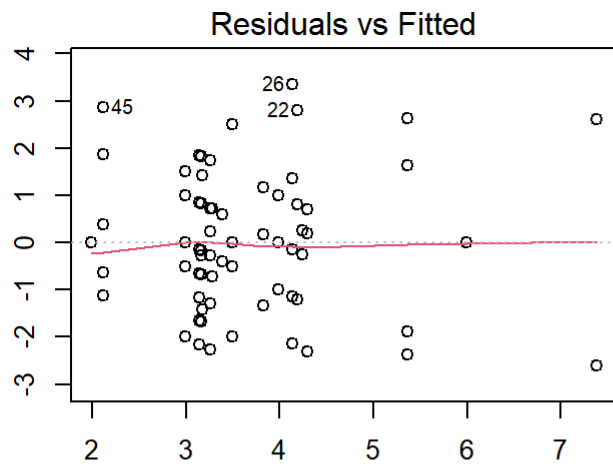
```
##
##  Shapiro-Wilk normality test
##
## data:  lm.price$residuals
## W = 0.97584, p-value = 0.04457
```

From Shapiro-Wilk Test we can see that the p_value is 0.04457 , so we Do Not Reject H0(null hypotheses) since p_value is bigger than significant level 0.025. There is not enough evidence that the error is not normal. Overall conclusion normality is met.

- Check the Equal Variance of Residual Assumption
- Plot of Residuals vs Fitted Values

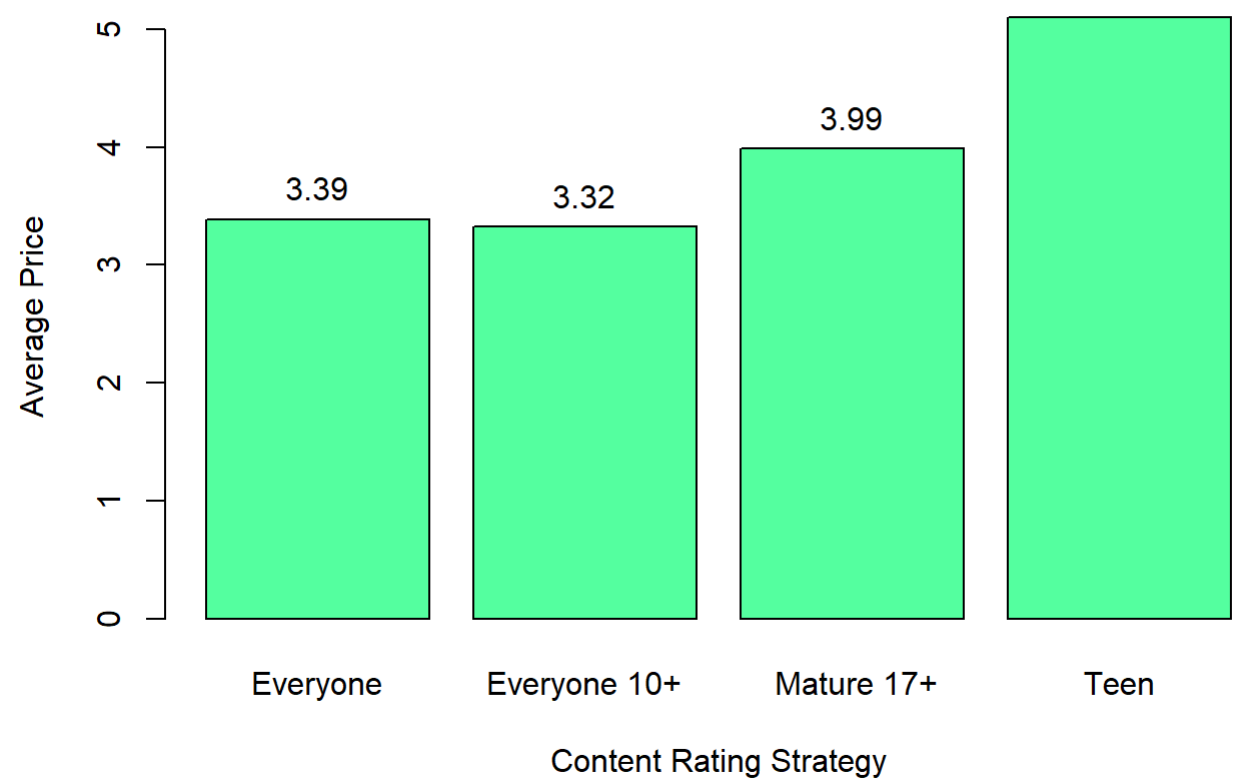
Plot of Residuals vs Fitted Values





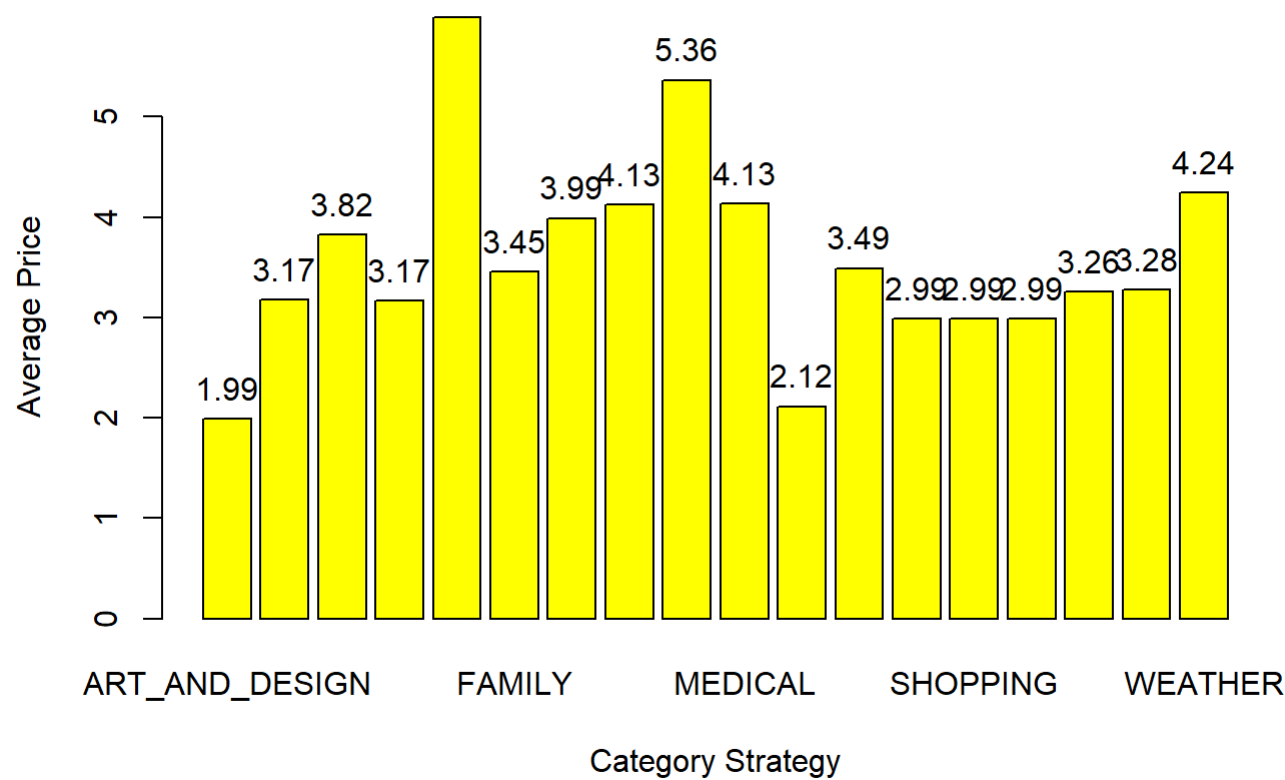
The spread of the majority of the groups seems approximately the same so we conclude that equal variance assumption is met.

Bar graph of different Content.Rating mean



From histogram we can see that category Teen has the highest average price of 5.101 forward by Mature 17+ with 3.99. The smallest group is Everyone 10+ with 3.32.

Bar graph of different Category mean



From the histogram we can see that the highest price by Category has EDUCATION with 5.99, HEALTH_AND_FITNESS with 5.36, WEATHER with 4.24. The lowest category is ART_AND_DESIGN with 1.99

```
## Analysis of Variance Table
##
## Response: pair_apps$Price
##
##           Df Sum Sq Mean Sq F value Pr(>F)
## pair_apps$Content.Rating      3  19.564   6.5214   2.8698 0.04107
## pair_apps$Category           17  45.940   2.7024   1.1892 0.29059
## pair_apps$Content.Rating:pair_apps$Category    2   20.178  10.0892   4.4399 0.01462
## Residuals                     86 195.427   2.2724
##
## pair_apps$Content.Rating      *
## pair_apps$Category
## pair_apps$Content.Rating:pair_apps$Category *
## Residuals
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

ANOVA Table

	Sum Sq	Df	Mean Sq	F_stat	F_pval
-----	-----	-----	-----	-----	-----
pair_apps\$Content.Rating	19.564	3	6.5214	2.8698	0.04107
pair_apps\$Category	45.940	17	2.7024	1.1892	0.29059
pair_apps\$Content.Rating:pair_apps\$Category	20.178	2	10.0892	4.4399	0.01462
Residuals	195.427	86	2.2724		
Total	281.109	108	21.5854		

Let α_i = Content.Rating

Let β_j = Category

Let $(\alpha\beta)_{ij}$ = interaction of Content.Rating and Category

Model Statement:

$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}$

Hypotheses:

H0: $(\alpha\beta)_{ij} = 0$

H1: At least one $(\alpha\beta)_{ij}$ is different of 0

From ANOVA table we see that F-statistic is 4.4399 and p-value is 0.01462, so we Reject H0 (null hypotheses) since p-value is less than significant level 0.025. There is enough evidence that interaction are present.