# R task2(anova result - первого варианта)

1.

```
> anova_result <- aov(MPG_City ~ Origin, data = data)
>
> # 查看ANOVA结果
> summary(anova_result)
             Df Sum Sq Mean Sq F value   Pr(>F)
Origin        2    962   481.1   19.01 1.24e-08 ***
Residuals   425  10754    25.3
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

| | | |
|---|---|---|
| anova_result | list [13] (S3: aov, lm) | List of length 13 |
| coefficients | double [3] | 22.01 -3.28 -2.94 |
| residuals | double [428] | -5.0127 1.9873 -0.0127 -2.0127 -4.0127 -4.0127 ... |
| effects | double [428] | -415.02 -17.46 -25.64 -1.85 -3.85 -3.85 ... |
| rank | integer [1] | 3 |
| fitted.values | double [428] | 22 22 22 22 22 22 ... |
| assign | integer [3] | 0 1 1 |
| qr | list [5] (S3: qr) | List of length 5 |
| df.residual | integer [1] | 425 |
| contrasts | list [1] | List of length 1 |
| xlevels | list [1] | List of length 1 |
| call | language | aov(formula = MPG_City ~ Origin, data = data) |
| terms | formula | MPG_City ~ Origin |
| model | list [428 x 2] (S3: data.frame) | A data.frame with 428 rows and 2 columns |

2.

```
> anova_result_with_Type <- aov(MPG_City ~ Origin + Type, data = data)
>
> # 查看ANOVA结果
> summary(anova_result_with_Type)
             Df Sum Sq Mean Sq F value   Pr(>F)
Origin        2    962   481.1   35.71 4.76e-15 ***
Type          5   5096  1019.3   75.66  < 2e-16 ***
Residuals   420   5658    13.5
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

| | | |
|---|---|---|
| anova_result_with_Type | list [13] (S3: aov, lm) | List of length 13 |
| coefficients | double [8] | 55.00 -3.12 -2.09 -32.27 -34.74 -37.51 ... |
| residuals | double [428] | -0.493 1.267 -0.733 -2.733 -4.733 -4.733 ... |
| effects | double [428] | -415.02 -17.46 -25.64 -27.49 -1.34 -26.81 ... |
| rank | integer [1] | 8 |
| fitted.values | double [428] | 17.5 22.7 22.7 22.7 22.7 22.7 ... |
| assign | integer [8] | 0 1 1 2 2 2 ... |
| qr | list [5] (S3: qr) | List of length 5 |
| df.residual | integer [1] | 420 |
| contrasts | list [2] | List of length 2 |
| xlevels | list [2] | List of length 2 |
| call | language | aov(formula = MPG_City ~ Origin + Type, data = data) |
| terms | formula | MPG_City ~ Origin + Type |
| model | list [428 x 3] (S3: data.frame) | A data.frame with 428 rows and 3 columns |

3.

```
> model_with_interaction <- aov(MPG_City ~ Origin * Type, data = data)
>
> # 检查交互效应的系数是否显著
> summary(model_with_interaction)
             Df Sum Sq Mean Sq F value   Pr(>F)
Origin        2    962   481.1   35.40 6.46e-15 ***
Type          5   5096  1019.3   75.00  < 2e-16 ***
Origin:Type   7     46     6.5    0.48    0.849
Residuals   413   5612    13.6
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

| | | |
|---|---|---|
| model_with_interaction | list [13] (S3: aov, lm) | List of length 13 |
| coefficients | double [18] | 55.0000 -3.1136 -0.0779 -32.1596 -34.7647 -37.6800 ... |
| residuals | double [428] | -0.32 1.16 -0.84 -2.84 -4.84 -4.84 ... |
| effects | double [428] | -415.02 -17.46 -25.64 -27.49 -1.34 -26.81 ... |
| rank | integer [1] | 15 |
| fitted.values | double [428] | 17.3 22.8 22.8 22.8 22.8 22.8 ... |
| assign | integer [18] | 0 1 1 2 2 2 ... |
| qr | list [5] (S3: qr) | List of length 5 |
| df.residual | integer [1] | 413 |
| contrasts | list [2] | List of length 2 |
| xlevels | list [2] | List of length 2 |
| call | language | aov(formula = MPG_City ~ Origin * Type, data = data) |
| terms | formula | MPG_City ~ Origin * Type |
| model | list [428 x 3] (S3: data.frame) | A data.frame with 428 rows and 3 columns |

4.

```
> model_final = aov(MPG_City ~ Origin + Type, data = data)
> summary(model_final)
             Df Sum Sq Mean Sq F value   Pr(>F)
Origin        2    962   481.1   35.71 4.76e-15 ***
Type          5   5096  1019.3   75.66  < 2e-16 ***
Residuals   420   5658    13.5
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

| | | |
|---|---|---|
| model_final | list [13] (S3: aov, lm) | List of length 13 |
| coefficients | double [8] | 55.00 -3.12 -2.09 -32.27 -34.74 -37.51 ... |
| residuals | double [428] | -0.493 1.267 -0.733 -2.733 -4.733 -4.733 ... |
| effects | double [428] | -415.02 -17.46 -25.64 -27.49 -1.34 -26.81 ... |
| rank | integer [1] | 8 |
| fitted.values | double [428] | 17.5 22.7 22.7 22.7 22.7 22.7 ... |
| assign | integer [8] | 0 1 1 2 2 2 ... |
| qr | list [5] (S3: qr) | List of length 5 |
| df.residual | integer [1] | 420 |
| contrasts | list [2] | List of length 2 |
| xlevels | list [2] | List of length 2 |
| call | language | aov(formula = MPG_City ~ Origin + Type, data = data) |
| terms | formula | MPG_City ~ Origin + Type |
| model | list [428 x 3] (S3: data.frame) | A data.frame with 428 rows and 3 columns |

5.

```
> model_group <- aov(MPG_City ~ Group, data = filtered_data)
> summary(model_group)
             Df Sum Sq Mean Sq F value   Pr(>F)
Group         1    446   445.9   22.42 4.33e-06 ***
Residuals   186   3699    19.9
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

| | | |
|---|---|---|
| model_group | list [13] (S3: aov, lm) | List of length 13 |
| coefficients | double [2] | 15.81 5.52 |
| residuals | double [188] | 2.669 0.669 -1.331 -3.331 -3.331 0.669 ... |
| effects | double [188] | -286.041 -21.115 -1.523 -3.523 -3.523 0.477 ... |
| rank | integer [1] | 2 |
| fitted.values | double [188] | 21.3 21.3 21.3 21.3 21.3 21.3 ... |
| assign | integer [2] | 0 1 |
| qr | list [5] (S3: qr) | List of length 5 |
| df.residual | integer [1] | 186 |
| contrasts | list [1] | List of length 1 |
| xlevels | list [1] | List of length 1 |
| call | language | aov(formula = MPG_City ~ Group, data = filtered_data) |
| terms | formula | MPG_City ~ Group |
| model | list [188 x 2] (S3: data.frame) | A data.frame with 188 rows and 2 columns |