ANOVA 유의미 (= 그룹 간 만족도 차이가 있다.)

-> Duncan LSR 사용하여 그룹 간 만족도 차이 다중비교

```
> aov(restaurant_N ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_N ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares   15.1093  376.3801
Deg. of Freedom        3       278

Residual standard error: 1.163566
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_N ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   15.1   5.036   3.72 0.0119 *
Residuals   278  376.4   1.354
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
1 observation deleted due to missingness
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_N

Mean Square Error:  1.353885

grade,  means

          restaurant_N      std  r Min Max
3rd_grade     2.560000 1.214874 50   1   5
4th_grade     3.012987 1.282406 77   1   5
freshman      3.243590 1.021660 78   1   5
sophomore     2.870130 1.139606 77   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_N groups
freshman      3.243590      a
4th_grade     3.012987      a
sophomore     2.870130     ab
3rd_grade     2.560000      b
```

음식점 N

```
> aov(restaurant_O ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_O ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares   7.73287 234.07209
Deg. of Freedom        3       278

Residual standard error: 0.9175979
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_O ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   7.73   2.578   3.061 0.0286 *
Residuals   278 234.07   0.842
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_O

Mean Square Error:  0.841986

grade,  means

          restaurant_O      std  r Min Max
3rd_grade     3.800000 1.0101525 50   1   5
4th_grade     3.935065 0.8935097 77   1   5
freshman      3.525641 0.8174137 78   2   5
sophomore     3.883117 0.9729773 77   1   5

Groups according to probability of means differences and alpha level( 0.05

Means with the same letter are not significantly different.

          restaurant_O groups
4th_grade     3.935065      a
sophomore     3.883117      a
3rd_grade     3.800000     ab
freshman      3.525641      b
```

음식점 O

```
> aov(restaurant_P ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_P ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares   23.7340  219.9599
Deg. of Freedom        3       277

Residual standard error: 0.8911112
Estimated effects may be unbalanced
2 observations deleted due to missingness
> aovmodel <- aov(restaurant_P ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value   Pr(>F)
grade         3  23.73   7.911   9.963 2.94e-06 ***
Residuals   277 219.96   0.794
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_P

Mean Square Error:  0.7940792

grade,  means

          restaurant_P      std  r Min Max
3rd_grade     3.480000 1.0349012 50   1   5
4th_grade     3.947368 1.0695137 76   1   5
freshman      3.166667 0.5903261 78   1   5
sophomore     3.571429 0.8495908 77   2   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_P groups
4th_grade     3.947368      a
sophomore     3.571429      b
3rd_grade     3.480000      b
freshman      3.166667      c
```

음식점 P

```
> aov(restaurant_J ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_J ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares   17.58024 270.74600
Deg. of Freedom        3       278

Residual standard error: 0.986867
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_J ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value   Pr(>F)
grade         3  17.58   5.860   6.017 0.000552 ***
Residuals   278 270.75   0.974
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '
1 observation deleted due to missingness
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_J

Mean Square Error:  0.9739065

grade,  means

          restaurant_J      std  r Min Max
3rd_grade     3.220000 1.2663623 50   1   5
4th_grade     3.844156 1.0521274 77   1   5
freshman      3.294872 0.7577988 78   1   5
sophomore     3.636364 0.9163585 77   1   5

Groups according to probability of means differences and alpha level( 0.05

Means with the same letter are not significantly different.

          restaurant_J groups
4th_grade     3.844156      a
sophomore     3.636364      a
freshman      3.294872      b
3rd_grade     3.220000      b
```

음식점 J

```
> aov(restaurant_L ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_L ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares   10.48708 275.88526
Deg. of Freedom        3       278

Residual standard error: 0.9961893
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_L ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3  10.49   3.496   3.522 0.0155 *
Residuals   278 275.89   0.992
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
1 observation deleted due to missingness
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_L

Mean Square Error:  0.992393

grade,  means

          restaurant_L      std  r Min Max
3rd_grade     3.520000 1.1471349 50   1   5
4th_grade     3.766234 0.9582894 77   1   5
freshman      3.282051 1.0431899 78   1   5
sophomore     3.363636 0.8722188 77   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_L groups
4th_grade     3.766234      a
3rd_grade     3.520000     ab
sophomore     3.363636      b
freshman      3.282051      b
```

음식점 L

```
> aov(restaurant_M ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_M ~ grade, data = anusatis)

Terms:
                   grade Residuals
Sum of Squares    9.28039 294.32599
Deg. of Freedom        3       278

Residual standard error: 1.028944
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_M ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   9.28   3.094   2.922 0.0344 *
Residuals   278 294.33   1.059
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_M

Mean Square Error:  1.058727

grade,  means

          restaurant_M      std  r Min Max
3rd_grade     2.560000 1.1457107 50   1   5
4th_grade     2.766234 1.1686261 77   1   5
freshman      3.076923 0.7519538 78   1   5
sophomore     2.935065 1.0429924 77   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_M groups
freshman      3.076923      a
sophomore     2.935065      a
4th_grade     2.766234     ab
3rd_grade     2.560000      b
```

음식점 M

```
> aov(restaurant_D ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_D ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares   12.32105 215.19132
Deg. of Freedom         3       279

Residual standard error: 0.8782341
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_D ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value  Pr(>F)
grade         3  12.32   4.107   5.325 0.00139 **
Residuals   279 215.19   0.771
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 > install.packages("agricolae")
 Error in install.packages : Updating loaded packages
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_D

Mean Square Error:  0.7712951

grade,  means

          restaurant_D       std  r Min Max
3rd_grade     3.420000 0.9278019 50   1   5
4th_grade     3.675325 1.0814410 77   1   5
freshman      3.166667 0.6529984 78   1   5
sophomore     3.217949 0.8161906 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_D groups
4th_grade     3.675325      a
3rd_grade     3.420000     ab
sophomore     3.217949      b
freshman      3.166667      b
```

음식점 D

```
> aov(restaurant_F ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_F ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares    6.69203 159.12712
Deg. of Freedom         3       278

Residual standard error: 0.756571
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_F ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value  Pr(>F)
grade         3   6.69  2.2307   3.897 0.00943 **
Residuals   278 159.13  0.5724
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_F

Mean Square Error:  0.5723997

grade,  means

          restaurant_F       std  r Min Max
3rd_grade     2.720000 0.8580947 50   1   5
4th_grade     2.753247 1.0020485 77   1   5
freshman      3.090909 0.4033354 77   2   5
sophomore     2.756410 0.6681220 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_F groups
freshman      3.090909      a
sophomore     2.756410      b
4th_grade     2.753247      b
3rd_grade     2.720000      b
```

음식점 F

```
> aov(restaurant_H ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_H ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares   11.8202  332.8358
Deg. of Freedom         3       278

Residual standard error: 1.09419
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_H ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   11.8   3.940   3.291 0.0211 *
Residuals   278  332.8   1.197
---
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_H

Mean Square Error:  1.197251

grade,  means

          restaurant_H       std  r Min Max
3rd_grade     2.820000 1.2237447 50   1   5
4th_grade     3.328947 1.1591739 76   1   5
freshman      3.282051 0.9383245 78   1   5
sophomore     2.961538 1.0864252 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_H groups
4th_grade     3.328947      a
freshman      3.282051      a
sophomore     2.961538     ab
3rd_grade     2.820000      b
```

음식점 H

```
> aov(restaurant_A ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_A ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares   14.90976 255.47186
Deg. of Freedom         3       279

Residual standard error: 0.9569063
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_A ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value  Pr(>F)
grade         3  14.91   4.970   5.428 0.00122 **
Residuals   279 255.47   0.916
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> install.packages("agricolae")
Error in install.packages : Updating loaded packages
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_A

Mean Square Error:  0.9156698

grade,  means

          restaurant_A       std  r Min Max
3rd_grade     3.800000 1.0497813 50   1   5
4th_grade     4.259740 0.8491884 77   1   5
freshman      3.743590 0.9728242 78   1   5
sophomore     3.717949 0.9789663 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_A groups
4th_grade     4.259740      a
3rd_grade     3.800000      b
freshman      3.743590      b
sophomore     3.717949      b
```

음식점 A

```
> aov(restaurant_C ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_C ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares    7.41967 238.05030
Deg. of Freedom         3       279

Residual standard error: 0.9237028
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_C ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   7.42  2.4732   2.899 0.0355 *
Residuals   279 238.05  0.8532
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
Warning message:
패키지 'agricolae'는 R 버전 3.5.3에서 작성되었습니다
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_C

Mean Square Error:  0.8532269

grade,  means

          restaurant_C       std  r Min Max
3rd_grade     3.580000 1.0515295 50   1   5
4th_grade     3.961039 0.8802147 77   2   5
freshman      3.576923 0.7120344 78   2   5
sophomore     3.641026 1.0565118 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_C groups
4th_grade     3.961039      a
sophomore     3.641026      b
3rd_grade     3.580000      b
freshman      3.576923      b
```

음식점 B

```
> aov(restaurant_D ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_D ~ grade, data = anusatis)

Terms:
                    grade Residuals
Sum of Squares   12.32105 215.19132
Deg. of Freedom         3       279

Residual standard error: 0.8782341
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_D ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value  Pr(>F)
grade         3  12.32   4.107   5.325 0.00139 **
Residuals   279 215.19   0.771
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> library("agricolae")
> duncan.test(aovmodel, "grade", alpha = 0.05, console = TRUE)

Study: aovmodel ~ "grade"

Duncan's new multiple range test
for restaurant_D

Mean Square Error:  0.7712951

grade,  means

          restaurant_D       std  r Min Max
3rd_grade     3.420000 0.9278019 50   1   5
4th_grade     3.675325 1.0814410 77   1   5
freshman      3.166667 0.6529984 78   1   5
sophomore     3.217949 0.8161906 78   1   5

Groups according to probability of means differences and alpha level( 0.05 )

Means with the same letter are not significantly different.

          restaurant_D groups
4th_grade     3.675325      a
3rd_grade     3.420000     ab
sophomore     3.217949      b
freshman      3.166667      b
```

음식점 C

ANOVA 무의미 (= 그룹 간 만족도 차이가 없음)

```
> aov(restaurant_B ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_B ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    3.1814  235.9423
Deg. of Freedom        3       279

Residual standard error: 0.9196038
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_B ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   3.18  1.0605   1.254  0.291
Residuals   279 235.94  0.8457
```

음식점 B

```
> aov(restaurant_E ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_E ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    2.31943 267.10107
Deg. of Freedom         3       279

Residual standard error: 0.9784434
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_E ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   2.32  0.7731   0.808  0.491
Residuals   279 267.10  0.9574
```

음식점 E

```
> aov(restaurant_G ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_G ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    3.9065  290.1642
Deg. of Freedom        3       279

Residual standard error: 1.019811
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_G ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   3.91   1.302   1.252  0.291
Residuals   279 290.16   1.040
```

음식점 G

```
> aov(restaurant_R ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_R ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    2.77892 228.26009
Deg. of Freedom         3       278

Residual standard error: 0.9061343
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_R ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   2.78  0.9263   1.128  0.338
Residuals   278 228.26  0.8211
1 observation deleted due to missingness
```

음식점 R

```
> aov(restaurant_K ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_K ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    5.48379 280.28926
Deg. of Freedom         3       278

Residual standard error: 1.004109
Estimated effects may be unbalanced
1 observation deleted due to missingness
> aovmodel <- aov(restaurant_K ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   5.48   1.828   1.813  0.145
Residuals   278 280.29   1.008
1 observation deleted due to missingness
```

음식점 K

```
> aov(restaurant_I ~ grade, data = anusatis)
Call:
   aov(formula = restaurant_I ~ grade, data = anusatis)

Terms:
                  grade Residuals
Sum of Squares    6.41712 294.25426
Deg. of Freedom         3       279

Residual standard error: 1.026974
Estimated effects may be unbalanced
> aovmodel <- aov(restaurant_I ~ grade, data = anusatis)
> summary(aovmodel)
             Df Sum Sq Mean Sq F value Pr(>F)
grade         3   6.42   2.139   2.028   0.11
Residuals   279 294.25   1.055
```

음식점 I