Factorial ANOVA의 예1을 완전히 풀어서 제시하시오.

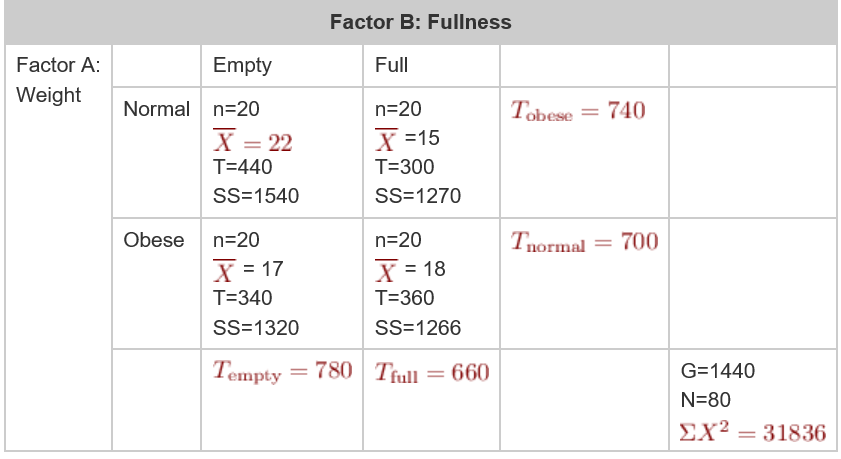
step 1. Build hypotheses

①Weight에 따라 number of crackers eaten에 차이가 있을 것이다($$\text{H1: } \mu_{A_1} \neq \mu_{A_2}$$)

②Fullness에 따라 number of crackers eaten에 차이가 있을 것이다($\text{H1: } \mu_{B_1} \neq \mu_{B_2} $)

③Fullness와 Weight의 상호작용에 따라 number of crackers eaten에 차이가 있을 것이다

(H1: Weight팩터와 Fullness팩터 간의 상호작용이 존재한다. 즉, 각각의 상태에 따라서 나타나는 평균의 차이가 두 팩터가 갖는 주효과에 의해서만 설명되지 않고 부가적으로 더 있다.)



step 2. Locate the critical range for F-ratio. calculate the $dfs$

$df_{total}$ = 20 + 20 + 20 + 20 – 1 = 79

$df_{within}$ = (20-1) + (20-1) + (20-1) + (20-1) = 76

$df_{between}$ = 4 – 1 = 3

$df_A$ = number of levels of A – 1 = 2 – 1 = 1

$df_B$ = number of levels of B – 1 = 2 – 1 = 1

* = df(between) – df(A) – df(B)

= 3 – 1 -1 = 1

Compute F-ratio SS

1. $SS_{total}$

$$SS_{total}=\Sigma{X^2}-\frac{G^2}{N}$$ = 31836 – 1440^2 / 80

= 31836 – 25920

= 5916

$\overline{X_{t}}= 18 $  
$\overline{X_{t}}^2= 324 $  
$N = 80 $  
$N*(\overline{X_t}^2) = 25920 $  
$\Sigma{X^2} - N*(\overline{X_t}^2) = 31836 - 25920 = 5916$

1. $SS_{within}$

$SS_{within} = \Sum{SS_{within}} = 1540 + 1270 + 1320 + 1266 = 5396$

1. $SS_{between}$ = SS(total) – SS(within) = 5916 – 5396 = 520

$$SS_{\text{between}}=\Sigma{\frac{T^2}{n}}-\frac{G^2}{N}$$ = 440^2/20 + 300^2/20 + 340^2/20 + 360^2/20 – 1440^2/80 = 9680 + 4500 + 5780 + 6480 – 25920 = 520

1. $SS_A$

$$SS_{between \; As} = SS_A = \Sigma{\frac{{T_A}^2}{n_A}} - \frac{G^2}{N}$$ = (440+300)^2/40 + (340+360)^2/40 – 25920 = 13690 + 12250 – 25920 = 20

1. $SS_B$ = (440+340)^2/40 + (300+360)^2/40 – 25920

= 15210 + 10890 – 25920

= 180

1. $SS_{AxB}$

$$SS_{A X B} = SS_{between} - SS_A - SS_B $$

= 520 – 20 – 180

= 320

MS

1. $MS_{A}$ = SS(A) / df(A) = 20/1 = 20
2. $MS_{B}$ = SS(B) / df(B) = 180/1 = 180
3. $MS_{AxB}$ = SS(A\*B) / df(A\*B) = 320/1 = 320
4. $MS_{Within}$ = SS(within) / df(within) = 5396/76 = 71

F-ratio

1. $F_{A}$(1,76) = MS(A) / MS(within) = 20/71 = 0.2817
2. $F_{B}$(1,76) = MS(B) / MS(within) = 180/71 = 2.5352
3. $F_{AxB}$(1,76) = MS(A\*B) / MS(within) = 320 / 71 = 4.5070

F(crit)(1,76) = 4.00

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In the literature (APA style)

The means and standard deviations are presented in Table 1. The two-factor analysis of variance showed no significant main effect for the weight factor, F(1,71)= 0.2817, p>.05; and no significant main effect for the fullness factor, F(1,71)= 2.5352, p>.05; but the interaction between weight and fullness was significant, F(1,71)= 4.5070, p<.05.

Make decision

①Weight에 따라 number of crackers eaten에 차이가 없다

②Fullness에 따라 number of crackers eaten에 차이가 없다

③Fullness와 Weight의 상호작용에 따라 number of crackers eaten에 차이가 있다

| **Result** | | | | |
| --- | --- | --- | --- | --- |
| Source | SS | df | MS | F |
| Between treatment | 520 | 3 |  |  |
| - Factor A (weight) | 20 | 1 | 20 | 0.2817 |
| - Factor B (fullness) | 180 | 1 | 180 | 2.5352 |
| - A x B interaction | 320 | 1 | 320 | 4.5070 |
| Within treatment | 5396 | 76 | 71 |  |
| Total | 5916 | 79 |  |  |
| weigth x fullness factorial design | | | | |

