

STA 3180 Statistical Modelling: ANOVA

1. A researcher is interested in the effect of a new teaching method on student performance. She randomly assigns 30 students to either the new teaching method or the traditional teaching method and then measures their performance on a standardized test. Use ANOVA to determine if there is a significant difference in performance between the two groups.

Solution:

Null hypothesis: There is no difference in performance between the two groups.

Alternative hypothesis: There is a difference in performance between the two groups.

ANOVA table:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio
Treatment 1	SS(T)			
MS(T)	$F = MS(T)/MS(E)$	Error 28	SS(E)	MS(E)
Total	29	SS(T) + SS(E)		

Calculate the F-ratio:

$$F = MS(T)/MS(E)$$

If the calculated F-ratio is greater than the critical value of F, then the null hypothesis is rejected and the alternative hypothesis is accepted.

2. A researcher is interested in the effect of different types of exercise on weight loss. She randomly assigns 30 participants to one of three exercise regimens (aerobics, strength training, or a combination of both) and then measures their weight loss after 8 weeks. Use ANOVA to determine if there is a significant difference in weight loss between the three groups.

Solution:

Null hypothesis: There is no difference in weight loss between the three groups.

Alternative hypothesis: There is a difference in weight loss between the three groups.

ANOVA table:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio
Treatment 2	SS(T)			
MS(T)	$F = MS(T)/MS(E)$	Error 27	SS(E)	MS(E)
Total	29	SS(T) + SS(E)		

Calculate the F-ratio:

$$F = MS(T)/MS(E)$$

If the calculated F-ratio is greater than the critical value of F, then the null hypothesis is rejected and the alternative hypothesis is accepted.

3. A researcher is interested in the effect of different types of diets on cholesterol levels. She randomly assigns 30 participants to one of three diets (low-fat, low-carb, or a combination of both) and then measures their cholesterol levels after 8 weeks. Use ANOVA to determine if there is a significant difference in cholesterol levels between the three groups.

Solution:

Null hypothesis: There is no difference in cholesterol levels between the three groups.

Alternative hypothesis: There is a difference in cholesterol levels between the three groups.

ANOVA table:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio
Treatment	2	SS(T)	MS(T)	$F = MS(T)/MS(E)$
Error	27	SS(E)	MS(E)	
Total	29	SS(T) + SS(E)		

Calculate the F-ratio:

$$F = MS(T)/MS(E)$$

If the calculated F-ratio is greater than the critical value of F, then the null hypothesis is rejected and the alternative hypothesis is accepted.