Assignment_1 of Quantitative Methods（I）

Date: 2024/09/29
From: Tse-Wen Hong 洪哲文 11204604
To: Professor S.M. Lin
Subject: Assignment 1 (Two-way ANOVA)

Question
How do two different diets (Diet A and Diet B) and time (measured at 3 time points: Week 1, Week 4, and Week 8) influence weight loss in participants? Conduct a two-factor repeated measures ANOVA to determine if there are statistically significant differences based on diet, time, and their interaction.

Data

Participant	Diet	Week 1 (kg)	Week 4 (kg)	Week 8 (kg)
1	A	80	78	76
2	A	85	82	79
3	A	78	76	74
4	B	90	87	84
5	B	92	89	86
6	B	88	85	83

Hypothesis
For the sample question involving the effects of two different diets (Diet A and Diet B) and time (Week 1, Week 4, and Week 8) on weight loss, the null hypothesis (H_0) would be:
1.Main Effect of interaction: There is no significant change in weight loss by interaction effect between diet method and time period,
2..Main Effect of Time: There is no significant change in weight loss over time.
3.Main Effect of Diet: There is no significant difference in weight loss between participants on Diet A and Diet B.

I use Google sheet add-ons: XLMiner analysis ToolPak

and here comes the result,

Anova: Two-Factor With Replication

SUMMARY	Diet	Week 1 (kg)	Week 4 (kg)	Total
A				
Count	3	3	3	9
Sum	243	236	229	708
Average	81	78.67	76.33	78.67
Variance	13	9.33	6.33	11.25
B				
Count	3	3	3	9
Sum	270	261	253	784
Average	90	87	84.33	87.11
Variance	4	4	2.33	8.61
Total				
Count	6	6	6	
Sum	513	497	482	
Average	85.5	82.83	80.33	
Variance	31.1	26.17	22.67	

ANOVA

ource of Variati	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
diets	320.889	1	320.889	49.36752	0.00001	4.74723
week(kg)	80.111	2	40.056	6.16239	0.01441	3.88529
Interaction	0.778	2	0.389	0.05983	0.94220	3.88529
Within	78	12	6.5			
Total	479.778	17				

Ho: There is no interaction of weight loss between Diets and time periods.
Ha: There are interactions of weight loss between Diets and time periods.
alpha: 0.05
Do not reject Ho, There is no interaction's evidence that has been observed.

Ho: μ_Week1(kg) = μ_Week4(kg) = μ_Week8(kg)
Ha: At least one pair of above is not equal.
alpha: 0.05
Reject Ho and conclude that the weight(kg) changed over the time.

Ho: μ_dietA = μ_dietB
Ha: diet A and diet B have different effects of weight loss.
alpha: 0.05
Reject Ho and conclude that the effect of weight loss between diet A and B are different.