Statistics (2) Quiz-3

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1. A researcher calculated the ANOVA summary table for an experiment, but accidentally spilled grape juice over the first line of the output. Please answer the following questions.

a. How many groups for the experiment? (7)
b. Finish the ANOVA table.
c. State the hypothesis for the analysis of variance.
d. What is the test value, and find the critical value.
e. Will the null hypothesis be rejected? Explain the result.

Source	SS	d.f.	MS	F
Between	60	6	10.	2.475
Within	194	48	4.04	
Total	254	54		

c. $H_0: \mu_1 = \mu_2 = \dots = \mu_7$

$H_1: \mu_1, \mu_2, \dots, \mu_7$ 不全等

d. C.V. $F_{(6,48)} = 2.34$ or 2.29.

test value $= 2.475$

e. ∵ test value > C.V.

⇒ rej. H_0.

表示 $\mu_1, \dots \mu_7$ 不全等

2. A vending machine company wants to check three of its machines to determine if they are properly dispensing 360 milliliters of coffee. Use ANOVA, at $\alpha = 0.05$, to test whether there is a significant difference between the means for the vending machines? (use the 5 steps procedure & establish ANOVA table)

	A	B	C
	351 352 353 354 354	346 344 353 348 351	356 358 354 352 357
$\bar{X}$	352.8	348.4	355.4
S^2	1.7	13.3	5.8

$\bar{\bar{X}} = 352.2$

① $H_0: \mu_A = \mu_B = \mu_C$

$H_1: \mu_A, \mu_B, \mu_C$ 不全等

② C.V.: $F_{(2,12)} = 3.89$

③ $SSB = \sum n_i (\bar{X}_i - \bar{\bar{X}})^2 = 125.2$

$SSW = \sum (n_i - 1) S_i^2 = 83.2$

$SST = SSB + SSW = 208.4$

$MSB = 62.6$

$MSW = 6.93$

④ Decision:

∵ test value > CV

⇒ rej. H_0

⑤ Summary A.B.C 三種品牌的咖啡容量有顯著差異

Source	SS	d.f.	MS	F
Between	125.2	2	62.6	9.03
Within	83.2	12	6.93	
Total	208.4	14		

3. A diet center wanted to test three different methods for losing weight to determine if the average weight loss (reported in pounds/week) for each method is the same. The results for the three methods are tabulated below. Given that there is a significant difference between the three methods, use the Tukey test to determine if there is a significant difference between each pair of methods. At $\alpha = 0.01$, can the researcher conclude that there is a difference in the means? A computer printout for this problem is shown.

a. **Use the *P*-value method** to test the claim.

b. If the null hypothesis is rejected, use scheffe' test to see if there is a significant different in the pair of means.

Liquid Diet (A)	Low-Calorie Diet (B)	Low-Calorie Diet and Exercise (C)
2	4	5
3	5	4
3	5	6
3	2	7
1	5	4

$H_0: \mu_A = \mu_B = \mu_C$

a. ∵ p-value < α 0.01

⑤ ⇒ reject H_0 i.e. μ_A, μ_B, μ_C 不全等

$\bar{x}$ 2.4 4.2 5.2

b. $F' = (3-1)\,CV = 6.93 \times 2 = 13.86$

$F_{AB} = 5.79 \Rightarrow$ AB 無差異

$F_{AC} = 14 \leftarrow$ A、C 有顯著差異

$F_{BC} = 1.79 \Rightarrow$ BC 無差異

ANALYSIS OF VARANCE SOURCE TABLE

Source	d.f.	SS	MS	P-value
Bet Groups	2	20.133	10.07	0.009
W/I Groups	12	16.800	1.40	
Total	14	36.933	MSW	

$$F_S = \frac{(\bar{x}_i - \bar{x})^2}{MSW\left[\frac{1}{n_1} + \frac{1}{n_2}\right]}$$

4. A Two-Way ANOVA Summary Table is shown below and some values are missed. ($\alpha = 0.05$)

a. What are factors and factor levels?

b. What are the hypotheses?

c. What is the critical values for each of the hypotheses?

d. Finish the ANOVA table and make a conclusion.

Source	SS	d.f.	MS	F
Factor A	7207.5	b = 2	3603.75	10.43
Factor B	28020.1	3	9340.03	27.04
Interaction	a 12.2	6	2.03	0.005
Within	12781.6	c 36	345.45	
Total	48021.4	48 (47)		

a. Factor A → 3 levels

B → 4

2% × 7 = 14

① $\begin{cases} H_0: \text{There is no difference between the means for factor A.} \\ H_1: \text{There is a } \text{〃} \end{cases}$

② $\begin{cases} H_0: \\ H_1: \end{cases}$ for factor B

③ $\begin{cases} H_0: \text{There is no interaction effect between factor A and factor B.} \\ H_1: \text{〃 an 〃} \end{cases}$

	C.V.	test value	decision
①	$F(2,36) = 3.32$	10.43	rej. H_0 ⇒ Factor A 有顯著效果
②	$F(3,36) = 2.92$	27.04	rej. H_0 ⇒ 〃 B 〃
③	$F(6,36) = 2.42$	0.005	do not rej. H_0 ⇒ Factor A&B 無交互作用