國立臺灣師範大學 108 學年度碩士班招生考試試題

科目：**統計學**　　適用系所：**管理研究所**

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1. The marketing manager of a supermarket wants to make decision about the arrangement of a 3C product. In order to determine the effect on the **Sales** (Y) of the product of shelf **Space** (in 10, 15, and 20 square feet) and whether the product was placed at the front (=1) or back (=0) of the aisle (**Location**), he collected a random sample of sales of 12 days. The raw data is in Table 1, and results of regression and correlation analysis listed in Table 2:

Table 1

Day	Space	Location	Sales (Y)	Predicted sales
1	10	0	18	20.0
2	10	1	25	21.7
3	10	0	16	20.0
4	10	1	20	21.7
5	15	1	26	25.8
6	15	1	28	25.8
7	15	0	27	24.2
8	15	0	28	24.2
9	20	0	28	28.3
10	20	0	28	28.3
11	20	1	26	30.0
12	20	1	30	30.0
Mean	15	0.5	25	25
SD	4.26	0.52	4.49	3.62
SS	200	3	222	144.46

Table 2

Regression Statistics	
Multiple R	0.81
R Square	R^2
Adjusted R^2	0.57
Standard Error	2.94
Observation	12

Correlation	Space	Location	Sales
Space	1		
Location	0.00	1	
Sales (Y)	0.78*	0.19	1

* $p<.05$

ANOVA

	df	SS	MS	F ratio	p-value
Regression	**A**	**C**	**D**	**F**	0.0088
Residual	9	77.54	**E**		
Total	**B**	222.00			

	Coef.	SE	t Stat	p-value
Intercept	11.79	3.34	3.53	0.0064
Space	0.83	0.21	3.97	0.0032
Location	1.67	1.69	0.98	0.3511

(1) Explain the meaning and calculation formula of SS=222 in Table 1 (6 points)

(2) Indicate the values of A to F in Table 2 (6 points)

(3) Discuss the magnitude and statistical significance of correlation coefficients in Table 2 (6 points)

(4) Compute and interpret the meaning of the coefficient of multiple determination (R^2)(6 points)

(5) State the regression equation that predicts sales based on shelf space and location (6 points)

(6) Discuss the t-Stat and statistical significance of the predictors of regression (6 points)

(7) Explain the meaning of regression coefficients of 0.83 and 1.67 (6 points)

(8) Calculate the standardized regression coefficients (beta) (6 points)

(9) Indicate and compare the predicted residuals of sales for products in 10 square feet of shelf space situated at the front and back of the aisle (6 points)

(10) Predict the sales of product for a day with 8 square feet of shelf space situated at the front and back of the aisle (6 points)

2. Based on the marketing study data in question 1, the marketing manager applied a two-way ANOVA to test the effects of shelf **Space** and **Location** on the **Sales** of the 3C product. Results listed in Table 3, 4 and figure 1:

Table 3 Descriptive Statistics

Location		Space			
		10	15	20	Total
0:Back	Mean	17.00	27.50	28.00	24.17
	SD	1.41	0.71	0.00	5.60
1:Front	Mean	22.50	27.00	28.00	25.83
	SD	3.54	1.41	2.83	3.37
Total	Mean	19.75	27.25	28.00	25.00
	SD	3.86	0.96	1.63	4.49

Figure 1

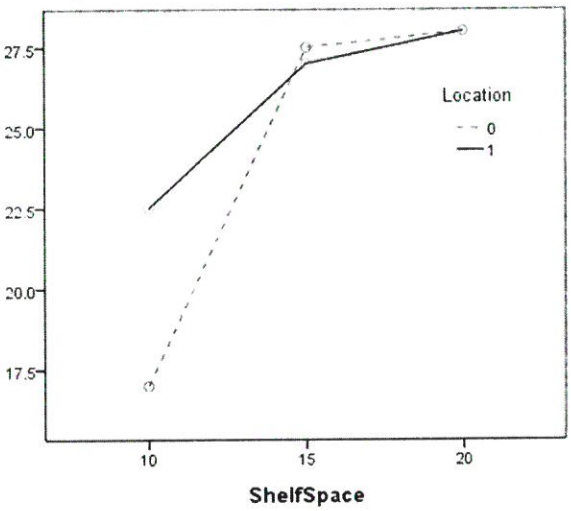

Table 4 ANOVA

	SS	df	MS	F	p
Space	166.50	2	83.25	19.98	0.0022
Location	8.33	1	8.33	2.00	0.2070
Space * Location	22.17	2	11.08	2.66	0.1489
Error	25.00	6	4.17		
Total	222.00	11			

(1) Interpret the meaning of the figure 1 using the information in Table 3 (10 points)

(2) Discuss the statistical significance of main and interaction effects in Table 4 (10 points)

(3) The conclusions of the ANOVA in Table 4 may violate Type I or Type II error? Why? (10 points)

(4) Explain the similarities and differences of the design of ANOVA in Table 2 and 4 (10 points)