

國立臺灣海洋大學114學年度碩士班考試入學招生考試試題

考試科目：統計學

學系組名稱：航運管理學系碩士班商業管理組

***可使用本校提供之計算器**

1.答案以橫式由左至右書寫在答案卷上。2.請依題號順序，並標示題號作答。

第一部分

1. Before a debate, a random sample of 60 individuals was surveyed regarding their support for candidate A or candidate B. After the debate, another random sample of 50 individuals was drawn from the same population (without potential overlap), and their support was recorded. The results are summarized in the following table:

	Candidate A	Candidate B	Total
Before Debate	41	19	60
After Debate	30	20	50
Total	71	39	110

Please test whether there is a significant difference in support rates before and after the debate at $\alpha = 0.05$. (5%)

$$\chi^2_{0.05}(1) = 3.8416, z_{0.05} = 1.645, z_{0.025} = 1.96$$

2. To determine whether the average first-year salary Y of university graduates from the College of Science, Engineering, and Management is related to their college of graduation, three dummy variables are defined:

$$D_1 = \begin{cases} 1, & \text{if graduated from science college} \\ 0, & \text{otherwise} \end{cases}$$

$$D_2 = \begin{cases} 1, & \text{if graduated from engineering college} \\ 0, & \text{otherwise} \end{cases}$$

and

$$D_3 = \begin{cases} 1, & \text{if graduated from management college} \\ 0, & \text{otherwise} \end{cases}$$

Assume that the regression equation for Y in terms of D_1 and D_2 is given as:

$$\hat{Y} = 69 + 45D_1 + 18D_2$$

(a) Derive the regression equation for Y in terms of D_1 and D_3 . (5%)

(b) Derive the regression equation for Y in terms of D_2 and D_3 . (5%)

3. Consider the simple linear regression model $Y = \alpha + \beta X + u$, two estimation formulas are given:

$$\tilde{\beta} = \frac{1}{n-1} \sum_{i=1}^n \frac{Y_i - Y_{i-1}}{X_i - X_{i-1}}$$

and

$$\hat{\beta} = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^n (X_i - \bar{X})^2}.$$

Please answer the following questions.

- Is $\tilde{\beta}$ an unbiased estimator for β ? (5%)
 - Which estimator is more efficient? Please provide a detailed explanation and justification. (5%)
4. The following statistical reports are used to analyze the sale price of a home (Y) based on selected physical characteristics of the building and taxes (X1, X2, . . . , X9).

Table 1: ANOVA

Model		Sum of Squares	df	Mean Square	F	p
M ₁	Regression	(a)	9	(b)	(d)	0.000
	Residual	123.731	14	(c)		
	Total	831.510	(e)			

Table 2: Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
M ₀	(Intercept)	34.629	1.227		28.215	0.000
M ₁	(Intercept)	15.310	5.961		2.568	0.022
	X ₁	1.954	1.038	0.514	1.882	0.081
	X ₂	6.846	4.335	0.274	1.579	0.137
	X ₃	0.138	0.494	0.045	0.278	0.785
	X ₄	2.781	4.395	0.128	0.633	0.537
	X ₅	2.051	1.385	0.206	1.481	0.161
	X ₆	−0.556	2.398	−0.082	−0.232	0.820
	X ₇	−1.245	3.423	−0.117	−0.364	0.721
	X ₈	−0.038	0.067	−0.089	−0.565	0.581
	X ₉	1.704	1.953	0.125	0.873	0.398

Please answer the following questions.

- Complete the ANOVA table in Table 1. (10%)
- Determine the coefficient of determination and its interpretation. (5%)
- Do the conclusions from Tables 1 and 2 contradict each other? If so, what are the reasons for the inconsistency? How can this issue be resolved? Please provide a detailed explanation. (2%, 3%, 5%)

第二部分

(求解過程中，凡遇 $+$ 、 $-$ 、 $\times$ 、 $\div$ 、 $\sqrt{\quad}$ 一律取小數第三位，第四位四捨五入)

5. 投擲一公正骰子 2 次，已知其中一骰子出現 3 點，試求：

- (a) 另一骰子為奇數的機率。(5%)
- (b) 兩骰子點數和大於 5 的機率。(5%)

6. 104 人力銀行網路調查超過千位企業用人主管與人資，48%認為「明年的景氣和今年差不多」，今詢問其中 150 位受訪者，則

- (a) 請以常態分配求出此 150 位受訪者中，少於 125 位回答「明年的景氣和今年差不多」的機率為何?(5%)
- (b) 請說明(a)可以用常態分配來做計算的理由。(5%)

7. 若 X 與 Y 為二個連續隨機變數，且其聯合機率分配為：

$$f(x, y) = \begin{cases} ky^2, & 0 < x < y < 1 \\ 0, & \text{otherwise} \end{cases}.$$

- (a) 求 k 值。(4%)
- (b) 求 $E(X)$ 、 $E(Y)$ 及 $Cov(X, Y)$ 之值。(12%)

8. 在某一貨櫃集散站，貨櫃車進入該集散站的間隔時間呈指數分配，且平均間隔時間為 12 分鐘。

- (a) 令 X 為貨櫃車進入該集散站的間隔時間，請敘述 X 的機率密度函數。(4%)
- (b) 有一台貨櫃車在 11:11 進入該集散站，試求下一台貨櫃車在 11:20 前進入集散站的機率為何?(5%)
- (c) 請問在 1 小時內，恰有 6 台貨櫃車進入該集散站的機率為何?(5%)