

1. 利用無母數統計方法時，對於樣本母體的假設、限制是什麼？(10%)
2. 在線性迴歸分析中，當判定係數  $R^2 = 0$  時，代表什麼意義？兩變數的相關係數  $r = 0$  時，代表什麼意義？(10%)
3. 柯教授甫由台灣大學至耶魯大學進行休假研究一年。在美國生活這麼一段時間一定需要有車子代步，柯教授他有下列三種選擇：
  - (a) 每個月以\$300 租一部車，租期一年，保險維護費用全包。
  - (b) 花\$6500 買一部全新的 Rover，另付\$500 保險費，由於原廠保固條件不錯一年內任何維修都免費。一年後應該可以以\$4000 的價格賣回給經銷商。更好的情形是有 30% 的機會一位柯教授的學生將至波士頓地區深造，他會非常願意以\$4500 購買教授的這部車子。
  - (c) 柯教授也可以花\$2500 買一部三年舊的二手車，另加保險費\$500。這部車子除了傳動系統有些問題外，車況相當不錯，不會花任何錢在其他維修項目上。談到傳動系統的問題，6 個月之後，這種車子會有 20% 的機會傳動系統無法修護，車子只好報銷，一文不值，保險費也無法退。如果不幸發生這種事，未來的日子柯教授只好以每月\$400 的代價租車代步。僥倖這部二手車能平平安安撐過一年，大概能以\$800 的價格賣回給車商，轉讓給要來進修的學生大約是\$1200。
  - (d) 請問像柯教授這樣的理性決策者，他的最佳選擇是哪一個？最佳選擇的期望值又是多少？(15%)
4. 如果已經有人偷偷告訴你被觀察的母體的平均值  $\mu$  是 203，但是你仍然吩咐人利用下列的檢定來做：  
     $H_0: \mu = 200$   
     $H_a: \mu \neq 200$   
     $\alpha = 0.05, \sigma = 10, n = 100$   
    請問 type-I 誤差還是 type-II 誤差在此題目有意義？(5%)
5. 請對下列問題描述，分別寫出其「虛擬假設」(null hypothesis)、與「對立假設」(alternate hypothesis)，不要去計算及檢定：
  - (a) 商檢局規定水果罐頭不良品的比例不得超過 0.01，現在抽查 A 工廠的水果罐頭成品 150 個，發現不良品 2 個，在  $\alpha = 0.05$  之下應如何處置。(5%)
  - (b) 某一五金商人宣稱其供應汽車工廠之設備零件至少有 95% 符合規定，檢查 100 件發現 9 件劣品，以  $\alpha = 0.01$  來驗證廠商誠實否。(5%)



6. In a completely randomized experimental design, 18 experimental units were used for the first treatment, 10 experimental units for the second treatment, and 15 experimental units for the third treatment. Part of the ANOVA table for this experiment is shown below. (20 points)

| Source of Variation       | Sum of Squares | Degrees of Freedom | Mean Square | F   |
|---------------------------|----------------|--------------------|-------------|-----|
| Between Treatments        | _____?         | _____?             | _____?      | 3.0 |
| Error (Within Treatments) | _____?         | _____?             | 6           |     |
| Total                     | _____?         | _____?             |             |     |

- Fill in **all** the blanks in the above ANOVA table.
  - At 95% confidence, test to see if there is a significant difference among the means.
7. You are given an ANOVA table below with some missing entries. (18 points)

| Source Variation   | Sum of Squares | Degrees of Freedom | Mean Square | F |
|--------------------|----------------|--------------------|-------------|---|
| Between Treatments |                | 3                  | 1,198.8     |   |
| Between Blocks     | 5,040          |                    | 840         |   |
| Error              | 5,994          |                    |             |   |
| Total              |                | 27                 |             |   |

- State the null and alternative hypotheses.
  - Compute the sum of squares between treatments.
  - Compute the mean square due to error.
  - Compute the total sum of squares.
  - Compute the test statistic F.
  - Test the null hypothesis stated in Part a at the 1% level of significance. Be sure to state your conclusion.
8. Consider the two-indicator two-factor model represented by the following equations:



$$A = 0.85F_1 + 0.12F_2 + U_A$$

$$B = 0.74F_1 + 0.07F_2 + U_B$$

$$C = 0.67F_1 + 0.18F_2 + U_C$$

$$D = 0.21F_1 + 0.93F_2 + U_D$$

$$E = 0.05F_1 + 0.77F_2 + U_E$$

$$F = 0.08F_1 + 0.62F_2 + U_F$$

The usual assumptions hold for the above model. Also, assume that the common factors  $F_1$  and  $F_2$  are uncorrelated.

- a. What is the pattern loading of indicators A and C on the factors  $F_1$  and  $F_2$ ?
- b. What is the structure loading of indicators A and C on the factor  $F_1$  and  $F_2$ ?
- c. Compute the correlations between A and C.
- d. What percentage of the variance of indicators A and C is not accounted for by the common factors  $F_1$  and  $F_2$ ? (12 points)