

國立臺灣科技大學
九十四學年度碩士班招生考試試題

系所組別：自動化及控制研究所碩士班乙組
科 目：統計學

1

共九題，總計 100 分。依序作答。

- 假設學校男女生比例為 2 比 1，今欲估計全校學生的平均身高，抽樣直到樣本中至少有一男一女。令 N 表示抽樣人數。求算
 - (5%) $E(N)$ 。
 - (5%) $P(N = 4)$ 。
- (10%) 由 20 雙 (即 40 隻) 鞋子中任取 8 隻，求算正好取出一雙鞋 (即另六隻不成雙) 的機率。(列出算式但不要算出數值)
- 針對下列兩種情況 (a) 及 (b)，判斷是否能相信候選人甲的支持率為 30%。
想一想應計算什麼機率來回答此一問題。針對不同情況，你的答案應包括 (1) 定義適當的隨機變數 (2) 說明所定義的隨機變數具有何種機率分配 (3) 列出機率算式 (勿求出數值) (4) 說明如何根據算得的機率作出統計推論。
 - (5%) 問了 5 個人，發現有 2 個支持者。
 - (5%) 問到第 5 人，發現第 2 個支持者。
- (10%) 假設 $\{X_1, X_2, \dots, X_{n+1}\}$ 是一抽自常態分配的隨機樣本。
令 $\bar{X} = \sum_{i=1}^n X_i/n$ 及 $S_n^2 = \sum_{i=1}^n (X_i - \bar{X})^2/n$ 。若其中 X_{n+1} 是一額外的觀察值，求算下列何者為適當的 k 值，使得 $k(\bar{X} - X_{n+1})/S_n$ 具有 t -分配。
必須寫出完整過程，否則不予計分。

A. $\frac{1}{\sqrt{n+1}}$ B. $\sqrt{\frac{1}{n+1}}$ C. $\sqrt{\frac{n-1}{n+1}}$ D. $\sqrt{n-1}$ E. $\sqrt{\frac{n}{n+1}(n-1)}$
- (10%) 欲檢定 $H_0: \mu = 50$ 相對於 $H_1: \mu > 50$ ，其中 μ 是一常態母體的平均數。隨機抽取一個樣本數為 100 的樣本。若母體標準差 $\sigma = 15$ 及「顯著水準」(significance level) 為 0.05，則下列何者約為當 $\mu = 52$ 時之「檢定力」(power)? 必須寫出完整過程，否則不予計分。
($P(Z > 1.645) = 5\%$, $P(Z > 1.96) = 2.5\%$, $P(Z > 1) \approx 16\%$, $P(Z > 0.5) \approx 31\%$)

A. 0.57 B. 0.38 C. 0.18 D. 0.05 E. 0.03
- The admissions office of a college is asked to accept deposits from a number of qualified prospective freshmen so that with probability about 0.95 the size of the freshman class will be less than or equal to 120. Consider that the applicants comprise a random sample from a population of applicants 80 percent of whom would actually enter the freshman class if accepted.
 - (5%) How many deposits should the admissions counselor accept?
 - (5%) If applicants in the number determined in part (a) are accepted, what is the probability that the freshman class size will be less than 105?



7

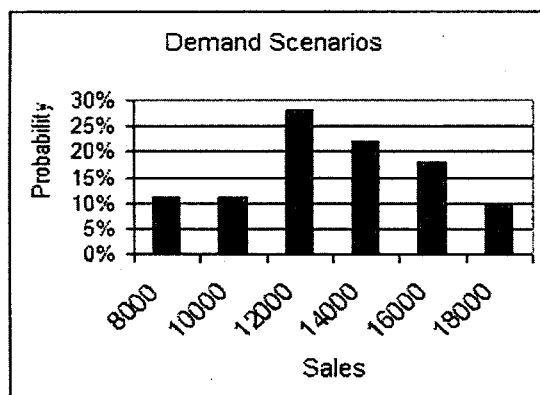
國立臺灣科技大學
九十四學年度碩士班招生考試試題

系所組別：自動化及控制研究所碩士班乙組
科 目：統計學

2

7. Possible scenarios for demand of a certain product in the coming season are as shown in the figure. The production setup cost is \$200,000. The variable production cost per unit equals \$160. The selling price of the product is \$250 per unit. Any product not sold during the season is sold to a discount store for \$40.

- (a) (5%) What is the probabilistic forecast of the demand?
- (b) (5%) What is the production quantity that maximizes average profit?
- (c) (10%) Suppose that producing 9,000 units or producing 16,000 units will lead to about the same average profit. If for some reason, we had to choose producing between these two, which one should we choose if we want the one with a lower risk?



8. (10%) When there exists uncertainty in the supply chain, the concept of risk pooling suggests that demand variability is reduced if one aggregates demand across locations. Similarly, the forecast of demand can be more accurate by aggregating across the product types. Please illustrate both of these phenomena.
9. Experimental evidence suggests that the anti-cancer drug, cyclophosphamide, may be effective in treating an often fatal disease of the blood vessels. Sixteen patients suffering from necrotizing vasculitis were treated with the drug and 13 out of the 16 patients recovered from the disease. This compares with a 48 percent survival rate using traditional methods of treatment. Do these data provide sufficient evidence to indicate that the probability of recovering using cyclophosphamide exceeds the probability of recovering when using the traditional method of treatment?

- (a) (5%) State the null and alternative hypotheses.
- (b) (5%) Conduct the test using a value of α near 0.05.

