

國立臺灣科技大學
八十九學年度碩士班招生考試試題

系所組別：資訊管理系乙組
科目：應用統計

1. A pond consists of t fish. To estimate the unknown t , the following steps are taken:

- (i) Randomly catch n ($n < t$) fish from the pond and tag each of them.
- (ii) Put n tagged fish back to the pond.
- (iii) Randomly catch m ($m < t$) fish and X tagged fish are found.

The principle of constructing a confidence interval for an unknown parameter is to include the parameter values that have high probability (e.g. $1 - \alpha$) in observing the sample. Give detailed algorithm for constructing a $(1 - \alpha)100\%$ confidence interval for t ? (8%)

2. Explain intuitively why the *maximum likelihood estimator* is a reasonable estimator. (9%)
3. Let U_1 and U_2 be independent random variables with common density

$$f(x) = \begin{cases} 1, & 0 < x < 1 \\ 0, & \text{elsewhere.} \end{cases}$$

Find the joint density of $\min(U_1, U_2)$ and $\max(U_1, U_2)$. (8%)

4. Consider the one-way ANOVA model:

$$Y_{ij} = \mu_i + \varepsilon_{ij}, \quad i = 1, 2, \dots, k, \quad j = 1, 2, \dots, n,$$

where Y_{ij} denotes the j th observation from population i and k denotes the number of populations. The goal is to test $H_0: \mu_1 = \mu_2 = \dots = \mu_k$ against $H_1: \text{not } H_0$.

- (a) State the required assumptions. (5%)
 - (b) Explain why the assumptions are required. (5%)
 - (c) Give detailed test procedure. (8%)
5. Bowl A_1 contains two red and four white chips; bowl A_2 contains one red and two white chips; and bowl A_3 contains five red and four white chips. Say that the probabilities for selecting the bowls are not the same but are given by $P(A_1) = 1/3$, $P(A_2) = 1/6$, and $P(A_3) = 1/2$, where A_i is the event that bowl A_i is chosen. Suppose now that we select one chip at random and the outcome of the experiment is a red chip. Please compute the conditional probability that the chip was drawn from bowl A_1 . (15%)



國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別： 資訊管理系乙組
科 目： 應用統計

6. Suppose you have been hired as a marketing representative for a clothing manufacturer that has developed a new line of casual clothing designed to appeal to college students. You are requested to select a representative sample of the students at your college and to survey their attitudes toward the new line of clothing.
- a. Using your college's student directory as a frame, how do you construct a representative sample of $n = 50$ students? (4%)
 - b. How do you evaluate how well your sample of $n = 50$ students reflect the underlying population of all students at your college? (4%)
7. For each of the following forecasting problems, suggest the forecasting method you would recommend, defend the selection of your chosen method, and suggest the relevant data you would use in the forecast. (4% for each)
- a. the unemployment rate in Taiwan for each of the next 12 months.
 - b. the demand for electrical power for each of the next 10 years by the resident and commercial users in Taiwan.
 - c. the sales of skis and skiing equipment by a large sporting goods chain during each of the next 24 months.
 - d. the sales over the next six months of a new diet drink being offered for the first time by the Coca-Cola Company.
 - e. the sales of term life insurance in Taiwan during the next calendar year.
8. During a given day the manager of a large supermarket observed the number of shoppers choosing each of the market's six checkout stands. The observed results are given in the table. Do these data present sufficient evidence to indicate that some checkout stands were preferred over others? (Assuming the critical value for the 5% significance level is 9.49) (14%)

Stand Number	1	2	3	4	5	6
Frequency	84	110	146	152	61	47

