

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：資訊管理系碩士班

組別：乙組

科目：應用統計

1. 有人假設：「當網際網路上，有超過 26%的人都會看網路廣告的時候，網路廣告的時代就來臨了。」您被邀請作一研究計畫，抽樣調查「在台灣，網路廣告的時代是否已經來臨？」
 - (a) 請列出您的統計檢定假設。(5%)
 - (b) 抽樣的方式有哪幾種？您會用哪一種？你的樣本數又如何決定？為什麼？(15%)
 - (c) 請就您的檢定假設，設計相關問卷。您的問卷屬於何種 Scale (Nominal, Interval, Ordinal, Ratio, or others)？不同的 Scale 在統計分析上有何不同的特性。(10%)
 - (d) 您的檢定公式與過程為何？(5%)
 - (e) 您的結果可信嗎？什麼是信賴區間？何為 Type I 與 Type II errors？(15%)

2. Suppose that a random sample of size $n = 100$ is sampled from a normal population with unknown mean μ and variance $\sigma^2 = 40^2$. The goal is to test $H_0 : \mu = 50$ against $H_1 : \mu > 50$ at 2.5% significance level. Compute the power when $\mu = 62$. If the sample mean $\bar{X} = 54$ is observed, what is the p -value and your conclusion? (20%) ($P\{Z > 2\} \approx 0.025, P\{Z > 1\} \approx 0.16$, where Z stands for the standard normal random variable.)

3. Consider the regression model

$$Y_i = \beta x_i + \epsilon_i, i = 1, 2, \dots, n,$$
 where $\epsilon_i \stackrel{i.i.d.}{\sim} N(0, \sigma^2)$.
 - (a) Find the least squares estimator $\hat{\beta}$. (5%)
 - (b) Find the distribution of $\hat{\beta}$, including distribution form and parameters. (5%)

4. When estimating $\mu_X - \mu_Y$, we collect two samples of equal size $\{X_1, X_2, \dots, X_n\}$ and $\{Y_1, Y_2, \dots, Y_n\}$ and use $\bar{X} - \bar{Y}$ to estimate $\mu_X - \mu_Y$. Two options are possible: (1) *blocking* — making X_i and Y_i positively correlated for every i , and (2) independent samples. State the advantage and disadvantage of using *blocking*. (10%)

5. (a) When testing $H_0 : \mu = \mu_0$ against $H_1 : \mu > \mu_0$, p -value is defined as $P\{\bar{X} > \bar{x} | H_0 : \mu = \mu_0\}$, where $\bar{X} = \sum_{i=1}^n X_i/n$ and $\bar{x}$ is the realization of $\bar{X}$. Find the distribution of p -value. (5%)
 - (b) Find the distribution of $F(X)$, where $F(\cdot)$ denotes the cdf of the continuous random variable X . (5%)