

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：4221 經營管理系碩士班乙組

第二節 統計學 試題 (選考)

第一頁 共二頁

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. One measure of the development of a country is the Human Development Index (HDI) which combines life expectancy, literacy, educational attainment, and gross domestic product per capita into an index whose values lie between 0 and 1, inclusive. We randomly selected fifteen countries, of the 152 countries, below the top twenty-five most developed countries on the list. HDI is the response variable y , and Internet usage per 100 person, x , is the predictor variable. The data have the summary statistics as follows:

$$n = 15, \quad \bar{x} = 9.953 \quad \bar{y} = 0.6670; \quad S_{xx} = 1173.46, \quad S_{xy} = 20.471, \quad S_{yy} = 0.41772$$

- (1) Determine the equation of the best fitting straight line.....(10%)
- (2) Do the data substantiate the claim that Internet usage per 100 persons is a good predictor of HDI and that large values of both variables tend to occur together? (Hint: When $\alpha = 0.01, t_{0.01} = 2.650$ with d.f. = 13, we decide to test $H_0: \beta_1 = 0$ versus $H_1: \beta_1 > 0$).....(10%)
- (3) Estimate the mean value of HDI for 18 Internet users per 100 persons and construct a 95% confidence interval. (Hint: $t_{0.025} = 2.160$ with d.f. = 13).....(10%)
- (4) Find the predicted y for $x = 43$ Internet users per 100 persons.(5%)
- (5) How much of the variability in y is explained by the linear regression model?....(5%)

2. The following table is associated with the percentage of high school completers who were enrolled in college the October immediately after completing high school, from 1984 to 2007.

| 1984-1989 | 1990-1995 | 1996-2001 | 2002-2007 |
|--------------------|--------------------|--------------------|--------------------|
| $\bar{y}_1 = 57.0$ | $\bar{y}_2 = 61.8$ | $\bar{y}_3 = 63.7$ | $\bar{y}_4 = 66.3$ |
| $s_1 = 2.216$ | $s_2 = 0.897$ | $s_3 = 1.950$ | $s_4 = 1.610$ |
| $n_1 = 6$ | $n_2 = 6$ | $n_3 = 6$ | $n_4 = 6$ |

$$\text{where } s_i^2 = \sum_{j=1}^{n_i} (y_{ij} - \bar{y}_i)^2 / (n_i - 1)$$

Requirement: Use the relations for sums of squares and d.f. to complete the following ANOVA table for these data.....(24%)

| Source | Sum of Squares | d.f. |
|-----------|----------------|------|
| Treatment | | |
| Error | | |
| Total | | |

3. In June two years ago, chemical analyses were made of 85 water samples (each of unit volume) taken from various parts of a city lake and the measurements of chlorine content were recorded. During the next two winters, the use of road salt was substantially reduced in the catchment areas of the lake. This June, 110 water samples were analyzed and their chlorine contents recorded. Calculations of the mean and the standard deviation for the two sets of data give as follows:

| | Chlorine Content | |
|--------------------|------------------|--------------|
| | Two Years Ago | Current Year |
| Mean | 18.3 | 17.8 |
| Standard deviation | 1.2 | 1.8 |

Let μ_1 be the population mean two years ago and μ_2 the population mean in the current year. Because the claim that lower salt usage has reduced the amount of chlorine in the lake. We formulate the hypotheses as follows:

$$H_0: \mu_1 - \mu_2 = 0 \quad \text{versus} \quad H_1: \mu_1 - \mu_2 > 0$$

Requirement:

- (1) Calculate the Z test statistic.....(8%)
 - (2) If the significance probability of this observed value is: $P\text{-value} = P[Z \geq 2.32] = 0.0102$, base your decision on the P-value.....(3%)
4. Calculate the observed value s_{pooled}^2 from these two samples.....(10%)
- | | | | | | | |
|---------------------------|---|---|---|---|---|---|
| Sample from population 1: | 8 | 5 | 7 | 6 | 9 | 7 |
| Sample from population 2: | 2 | 6 | 4 | 7 | 6 | |

注意：背面尚有試題

5. In a larger scale statewide survey concerning television viewing by children, about 40% of the babies a few months old watch TV regularly. In a future random sample of 150 babies in this age group, let X be the number who regularly watch TV. Because the population is large, X has a binomial distribution.

Requirements:

- (1) Calculate the mean and standard deviation of X(10%)
- (2) Since the binomial distribution is well approximated by the normal distribution, what is the standardized variable?.....(5%)