國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：統計學　　系所：應用經濟學系　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

1. (25 points) To investigate the causal relationship between the salary of CEO and the annual firm sales, an economist collected data from 207 firms which contains the salary of CEO (Y in thousand dollars) and the sales of the firm (X in million dollars) Supposedly, in the population $\ln Y_i = \beta_0 + \beta_1 \ln X_i + u_i$. From the sample, he or she summarized the following information about the sample, $\sum \ln X \ln Y$ =121, $\sum (\ln X)^2$ =146, $\sum (\ln Y)^2$ =102, $\sum \ln X$ =173, $\sum \ln Y$ =145. Please answer the following questions. ($t_{.050,\infty}$=1.645; $t_{.025,\infty}$=1.96; $t_{.100,\infty}$=1.282)

   a. Find the estimated regression line and interpret the estimated slope coefficient.
   b. Compute the R^2 and describe what it tells you?
   c. Compute the 95% confidence interval of β_1. Can you conclude that the annual sales of firms will affect salary of the CEOs at 5% significant level ?
   d. Predict with 90% confidence the salary of the CEO when a firm's annual sales is $5 billion.

2. (25 points) Indicate if each of the following statements about the simple linear regression model is true or false and explain why. (5 points each. Note that no point will be taken without explanation)

   (a) The simple regression line estimated by the method of Least Squared passes through the sample mean of dependent and independent variable.
   (b) The sample covariance between the residuals from the least square regression and the explanatory variable is zero.
   (c) Adjusted R-squared will always increase when an additional independent variable is added into the regression.
   (d) If the slope estimator of the Least Squares regression line is zero, the explained sum of square is zero.
   (e). "Instead of carrying out a multiple regression, we can get the same information from simple linear regressions of the dependent variable on each independent variable."

科目：統計學　　系所：應用經濟學系　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

3. (20 pts) Let X denote the difference of {no. of heads –no. of tails} in three tosses of a fair coin.

   (1). List the possible value of X.
   (2). List the elementary outcomes associated with each value of X.
   (3). Find the p.m.f. of X.
   (4). Find the mean and variance of X.

4. (30 pts) Suppose that the household income of students from National University of Kaohsiung is followed a normal distribution with mean μ and variance σ^2. In order to estimate μ, an investigator randomly draws a sample of size n from the population, denoted as $X_1, X_2, \ldots, X_n$. However, there are several estimators that the investigator can used and they are listed as follow. Assume n is an even number.

$$M_1 = \frac{1}{n}\left(\tfrac{2}{3}X_1 + \tfrac{4}{3}X_2 + \tfrac{2}{3}X_3 + \tfrac{4}{3}X_4 + \ldots.. + \tfrac{2}{3}X_{n-1} + \tfrac{4}{3}X_n\right)$$

$$M_2 = \frac{1}{n-1}\left(X_1 + X_2 + X_3 + X_4 + \ldots.. + X_{n-1} + X_n\right)$$

$$M_3 = \frac{1}{2}\left[\max(X_i) + \min(X_i)\right]$$

$$M_4 = \frac{1}{n}\left(X_1 + X_2 + X_3 + X_4 + \ldots.. + X_{n-1} + X_n\right)$$

   (1). Please determine which estimators are unbiased for μ ?
   (2). What is the sampling distribution of M_2?
   (3). Which estimator is the most efficient one?
   (4). The estimators listed above are all liner estimators of μ, which means that they are a linear combination of the sample. Among all of possible linear estimator of μ, can you find an estimator more efficient than the estimator you find in (3)? Prove.