

國立交通大學 97 學年度碩士班考試入學試題

科目：統計學(5014)

考試日期：97 年 3 月 9 日 第 3 節

系所班別：管理科學系

組別：管科系

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【可使用計算機】*作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

1. If X_1, X_2, \dots, X_n are independent random variables with moment generating function $M_{X_i}(t)$ and $Y = a_1X_1 + a_2X_2 + \dots + a_nX_n$.
 - (a) Find the moment generating function $M_Y(t)$ of Y . (10%)
 - (b) Give an example for the use of $M_Y(t)$. (10%)

2. Assume X_1, X_2, \dots, X_n are independent, $N(\mu, \sigma^2)$ random variables.
 - (a) Show $\sum_{i=1}^n (X_i - \mu)^2 / \sigma^2 = \sum_{i=1}^n (X_i - \bar{X})^2 / \sigma^2 + n(\bar{X} - \mu)^2 / \sigma^2$. (10%)
 - (b) What are the distributions of $\sum_{i=1}^n (X_i - \mu)^2 / \sigma^2$, $\sum_{i=1}^n (X_i - \bar{X})^2 / \sigma^2$, and $n(\bar{X} - \mu)^2 / \sigma^2$, respectively? Explain. (10%)

3. Suppose that a random sample of size n from a normal population with the known variance σ^2 is to be used to test the null hypothesis $\mu = \mu_0$ against the alternative hypothesis $\mu = \mu_1$, where $\mu_1 < \mu_0$, and that the probabilities of type I and type II errors are to have the preassigned values α and β .
 - (a) Plot the graph of the corresponding critical region, type I and type II errors of the test. (10%)
 - (b) Find the required sample size as a function of μ_0, μ_1, α and β . (10%)

4.
 - (a) What is the distinction between a quantitative and a qualitative variable? (10%)
 - (b) Write a multiple regression linear regression model relating response Y to two quantitative variables (X_1 and X_2) and a qualitative variable W at three levels. (10%)

5. A factorial experiment involving two factors, A and B, each at four levels, was replicated three times. The ANOVA table for the analysis of the resulting data is partially reproduced in the following table.

Source	df	SS	MS
A	?	60.9	?
B	?	12.3	?
AB	?	?	4.2
Error	?	?	?
Total	?	239.0	

- (a) Complete the ANOVA table. (10%)
- (b) What is the null distribution of the test for a significant interaction between factor A and B? Do the data provide sufficient evidence to indicate there is an interaction between factor A and B? Test using the critical value of 2.19. (10%)