

國 立 清 華 大 學 命 題 紙

95 學年度 科技管理研究所 系(所) 乙、丙 組碩士班入學考試

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可用中文作答。答案請依題號順序安排，並請標示清楚。

(1) It can be shown that when the population is normal, the sample median is normally distributed. The expectation and variance of the sampling distribution of median are  $E(\text{median}) = \mu$  and  $V(\text{median}) = (1.253 \sigma)^2 / n$ , where  $\mu$  is the population mean,  $\sigma^2$  is the population variance, and  $n$  is the sample size.

(a) Develop the confidence interval estimator of the population mean using median. (10%)

(b) Given the information below, determine the 90% confidence interval estimate of the population mean using the sample median.

Sample median=50,  $\sigma = 10$ , and  $n = 100$ . (5%)

( $Z_{0.01}=2.33$ ,  $Z_{0.025}=1.96$ ,  $Z_{0.041}=1.74$ ,  $Z_{0.042}=1.73$ ,  $Z_{0.05}=1.645$ ,  $Z_{0.1}=1.28$ )

(2) The probability of success on any trial of a binomial experiment is 0.25. Find the probability that the number of successes in 100 trials is greater than or equal to 32. (10%)

(3) A random sample of 16 observations was drawn from a normal population. The sample mean and sample standard deviation were computed as

$\bar{x} = 12.55$  and  $s = 6$ .

(a) Can you infer at the 5% significance level that the population mean is greater than 10? (5%).

(b) Re-do part (a) assuming that you know the population standard deviation is equal to 6. (5%)

( $t_{13,0.05}=1.771$ ,  $t_{14,0.05}=1.761$ ,  $t_{15,0.05}=1.753$ ,  $t_{16,0.05}=1.746$ ,  $t_{17,0.05}=1.740$ )

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- (4) In testing the following hypotheses about the mean  $\mu$  of a normal population with standard deviation 5:

$$H_0: \mu = 50 \quad \text{vs.} \quad H_1: \mu > 50,$$

we shall take a sample of size  $n$  and reject  $H_0$  if and only if the sample mean

$\bar{x} \geq c$ . Determine  $n$  and  $c$  so that the probability of type I error is equal to

0.025 and the probability of type II error is less than 0.05 when  $\mu = 55$ .

(15%)

- (5) In a complete  $3 \times 2$  factorial experiment with 4 replicates. A partial ANOVA table is shown below:

Source of variation	d.f.	SS	MS	F
Factor A	*	*	92	*
Factor B	*	28	*	*
Interaction	*	8	*	*
Error	*	*	*	
total	*	400		

- (a) Fill in the missing values (identified by \*) in the above ANOVA table.

(15%)

- (b) Test at the 5% significance level to determine if factor A and factor B interact. (5%)

$$(F_{0.05;2,18}=3.55, F_{0.05;3,18}=3.16, F_{0.05;2,24}=3.40, F_{0.05;3,24}=3.01)$$

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- (6) To study the relationship between a dependent variable  $y$  and 5 independent variables, a regression analysis was performed. The following information was obtained :

The sample size = 16.

The sample variance of  $y$ ,  $S_y^2 = 800$ .

The coefficient of determination,  $R^2 = 0.8$ .

- (a) Develop the ANOVA table:

Source of variation	d.f.	SS	MS	F
Regression	*	*	*	*
Error	*	*	*	
Total	*	*		

(15%)

- (b) Test the overall validity of the model at the 5% significance level. (5%)

$$(F_{0.05;5,10}=3.33, F_{0.05;5,16}=2.85, F_{0.05;6,10}=3.22, F_{0.05;6,16}=2.74)$$

- (7) The following long-term trend line and seasonal indexes were computed from a time series of the quarterly sales during the years 2001~2005. Forecast the sales for the four quarters of the year 2006. (10%)

$$\text{Trend line: } \hat{y}_t = 1500 + 90t, \quad t = 1, 2, \dots;$$

Quarter	Seasonal Index
1	1.3
2	1.2
3	0.9
4	0.6