國立中央大學106學年度碩士班考試入學試題

所別： 企業管理學系 碩士班 一般甲組(一般生)
企業管理學系 碩士班 一般乙組(一般生)
企業管理學系 碩士班 一般丁組(一般生)
企業管理學系 碩士班 一般戊組(一般生)

科目： 統計學

本科考試禁用計算器

參考用

＊請在答案卷內作答

Please refer Appendix to look for the numbers and probabilities that you may need for the answers of the following questions.

（1） Company A is currently devoloping a new technique to remove a hazardous compound in contaminated soil. Suppose that you are an expert to be invited to check the effectiveness of this new technique. You took four soil specimens containmated with this hazardous compound and treated these specimens with company A's new technique. After 101 days of incubation, the percentage of this hazrdous compound removed from each soil specimen was measured. The mean percentage is 50 and the sample standard deviation is 2. Find and interpret a 95% confidence interval for the mean percentage of this hazardous compound removed from a soil specimen in which the new technique was used. In addition, please use a 95% confidence interval to estimate the true variance in the percentages of hazardous compound removed. (15%)

（2） A random sample of 5 pairs of observations were selected. The corresponding values for each pair are (38, 32), (28, 24), (31, 27), (26, 23), (24, 22).

(a). Use $\alpha = .05$ to test the null hypothesis H_0: $\mu_d = 0$ against H_a: $\mu_d \neq 0$, where $\mu_d = \mu_1 - \mu_2$. (10%)

(b). Form a 95% confidence interval for μ_d. (5%)

（3） In a sample of 196 women with skin disease from using makeup, 10 were diagnosed with a titanium allergy. Compute a 95% confidence interval for the proportion of women with skin disease from using makeup who have a titanium allergy. (10%)

（4） A salesperson claims that 99% of its USB drives are defect-free. You want to check whether his claim is accountable and hence you select 1,600 USB drives to be tested. The tests indicate that 10 CDs are defective. Assuming that the salesperson's claim is correct, what is the probability of finding 10 or more defective USB drives in a sample of 1,600? Do you have doubts on the salesperson's claim? (10%)

（5） A study claims that only 50% of shoplifters are turned over to police. A random sample of 50 grocery stores were questioned about the number of shoplifters that turned over to police last year. The results indicate that a total of 30 were turned over to police.

(a). Use $\alpha = .05$ to conduct a hypothesis test to evaluate whether the results provide sufficient evidence to contradict the study. (10%)

(b). Describe a Type II error in terms of this situation. (5%)

注意:背面有試題

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（6） For a given data set, the lower quartile is 46, the median is 52, and the upper quartile is 58. The minimum value in the data set is 30, and the maximum is 83. Please explain whether the minimum and the maximum values are outliers. (7%)

（7） In a population of 1,500 athletes, suppose 150 are doping. Of the users, suppose 75 would test positive for doping. Of the nonusers, suppose 15 would test positive. Given that the athlete is a user, find the probability that a drug test for doping will yield a positive result. (10%)

（8） Suppose that a survey was conducted of university presidents, of which 51 were from general private universities (Group 1), 18 were from general public universities (Group 2), and 51 were from science and technology universities (Group 3). Their responses were measured on a 7-point scale. Their means are 4.50, 3.50, and 3.31 for Group 1, Group 2, and Group 3, respectively. In order to compare the mean responses of university presidents from these three groups, the data were analyzed with a completely randomized design ANOVA. Please describe the null and alternative hypotheses for the ANOVA F-test. Besides, if the observed significance level of the test was found to be p-value < .004. What conclusion can you draw if you want to test at $\alpha = .05$? (8%)

（9） Consider the population described by the probability distribution shown in the following table.

x	1	2	3	4	5
$p(x)$	.3	.2	.2	.2	.1

Assume that a random sample of $n = 2$ measurements is randomly selected from the population. Describe the sampling distribution of the sample median and prove whether the median is an unbiased estimator of the population mean μ. (10%)

Appendix:

x	10	5	3.98	2.2	0.005	0.0211	0.000282
square root of x	3.16228	2.23607	1.99499	1.4832	0.07071	0.14526	0.01679

Degrees of Freedom	$\chi^2_{.95}$	$\chi^2_{.975}$	$\chi^2_{.99}$	$\chi^2_{.05}$	$\chi^2_{.025}$	$\chi^2_{.01}$
3	.351846	.215795	.114832	7.81473	9.34840	11.3449
4	.710721	.484419	.297110	9.48773	11.1433	13.2767
100	77.9295	74.2219	70.0648	124.342	129.561	135.807

Degrees of Freedom	$t_{.05}$	$t_{.025}$	$t_{.01}$
3	2.353	3.182	4.541
4	2.132	2.776	3.747
100	1.660	1.984	2.364

z	1.62	1.63
$P(0<Z<z)$	.4474	.4484