

科目：生物統計

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請“✓”明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

Note: Normal, T and F tables are attached.

1. (50 points) In the US, the probability that an adult between the ages of 45 and 64 does NOT have health insurance coverage of any kind is denoted as π .

(π 代表母體中任選一人, 此人沒保險的機率)

Part 1: First assume that we know $\pi = 0.1$.

Suppose that you randomly select a 47-year-old woman and an unrelated 51-year-old man from this population.

- a. (5 points) What is the probability that both persons do NOT have any insurance plan?
- b. (5 points) What is the probability that both persons have insurance coverage?

Consider five unrelated persons in the population are selected.

- c. (10 points) What is the probability that all five persons do not have insurance coverage?

Part 2: In the real world, we usually do not know the value of π .

In order to make statistical inference of π , a random sample of 100 persons are selected. It is found that there are 17 persons who do not have any insurance plans.

- e. (5 points) Please estimate the value of π .

To test $H_0: \pi = 0.1$ vs. $H_a: \pi > 0.1$, we can calculate the p-value of the test which is

$$p = \Pr(X \geq 17), \text{ where } X \sim \text{Binomial}(n=100, \pi_0 = 0.1).$$

Note: π_0 is the value of π under H_0 .

- f. (20 points) Please apply the *Central Limit Theorem* to estimate p and explain why direct computation of this value is not easy.
- g. (5 points) Give your conclusion about whether H_0 should be rejected or not. Please explain.

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2. Suppose that 12 pigs were fed with three brands (say A, B & C) of cereal. Their weight gains after one month were measured. The number in each cell denotes the gain in weight.

Brand A	Brand B	Brand C
1	7	12
2	8	14
2	9	16
1	8	18

Denote μ_A, μ_B and μ_C as the means of weight gain for brands A, B and C respectively.

- a. (5 points) Suppose that we want to test whether $H_0: \mu_B = \mu_C$ versus $H_a: \mu_B \neq \mu_C$. Which test will you use (a two-sample t test or a paired-t test)? Explain.
- b. (5 points) Please calculate the means and standard deviations for Brand B and Brand C.
- c. (10 points) Use the information obtained in (a) and (b) to conduct the test $H_0: \mu_B = \mu_C$ vs. $H_a: \mu_B \neq \mu_C$. The level of significance is 5%.
For the t test that you choose in (a), please set the degree of freedom to be 3.
State clearly whether $H_0: \mu_B = \mu_C$ should be rejected or not. Justify your answer.
- d. (15 points) Please test $H_0: \mu_A = \mu_B = \mu_C$ vs. $H_a: \text{not } H_0$ based on 5% level of significance based on the ANOVA table given below. State clearly whether $H_0: \mu_A = \mu_B = \mu_C$ should be rejected or not. Justify your answer.

Source of variation	Sum of Squares	df	Mean Square
Between	368.0845	2	184.0423
Within	23	9	2.556
Total	385.0845	11	

- e. (5 points) Someone wants to combine the result of the three t tests, namely $H_0^{(1)}: \mu_A = \mu_B$, $H_0^{(2)}: \mu_A = \mu_C$ & $H_0^{(3)}: \mu_B = \mu_C$. Briefly state the problem for such a multiple comparison?