系所組別： 公共衛生研究所甲乙組在職生、一般生

考試科目： 生物統計學

考試日期：0308，節次：2

※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

1. (25%)

Assume that a random variable X follow a normal distribution with mean μ and standard deviation σ. A sample of size n is randomly drawn and the data are represented by $x_1, x_2, ..., x_n$.

(1) Please state the sampling distribution of the sample mean $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$. (10 %)

(2) Please use the sampling distribution of the sample mean and explain a $(1-\alpha)\times 100\%$ confidence interval for μ where $1-\alpha$ is the so-called confidence level and is usually set at 0.95 (i.e., $\alpha = 0.05$). (15 %)

2. (25%)

(1) Please define the p-th percentile of a probability distribution and (10 %)

(2) Please explain how to construct a quantile-quantile plot from the observed data assumed to follow a specific probability distribution such as a normal distribution. (15 %)

(背面仍有題目,請繼續作答)

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3. (25%)

(1) What is type I error and what is type II error? Please explain. (10%)

(2) Let α represent the probability of the type I error and β represent the probability of the type II error. Please use an example to explain sample size estimation under the framework of hypothesis testing for statistical inference. (15%)

4. (25%)

Let ln(Y)=X where X follows a normal distribution with mean μ and standard deviation σ.

(1) Please derive the median and mean of Y. (10%)

(2) Please show that as σ increases, the mean of Y is further away from its median. (5%)

(3) Please use the result in (2) to explain why mean is Not an appropriate measure of centrality when the distribution is asymmetric. (10%)

Hint: The probability density function of a normal distribution with mean μ and standard deviation σ is given as

$$f(x)=\frac{1}{\sigma\sqrt{2\pi}}\times e^{-(1/2)\times\left(\frac{x-\mu}{\sigma}\right)^2},\ -\infty<x<\infty.$$