

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Problems and discussions (申論題) 每題 20 分

Hint for mathematical expression: \bar{X} \rightarrow sample mean, n \rightarrow sample size, s \rightarrow sample standard deviation, population mean $\rightarrow \mu$, population size $\rightarrow N$, and σ \rightarrow population standard deviation

1. (a) Please explain the concepts, definitions, and relationship between type I error, type II error, and the power of the test. (b) How are these factors relevant to sample size?
2. According to the previous question (1.), a data scientist found his (her) experimental results with statistical test was $P = 0.051$. To our common understanding, this p value shows there is no statistical significance on the data, please answer and discuss the following questions
 - a) How do you explain this p value properly and encourage him/her?
 - b) How do you help him/her?
3. (a) What's difference between sample standard (標準差) deviation and standard error/standard error of the mean (SEM, 標準誤)? (b) In the statement of scientific report or article, there are two ways to express confidence interval for the mean. How? (c) Based on the same sample, what is the major difference between 95% and 99% confident interval? (d) What is the general sampling distribution to estimate the confidence interval of population mean and variance respectively?
4. Normally economy-sized boxes of potato chips average 50 oz with a standard deviation of 5.0 oz. To improve quality control a new process is developed that you hope will significantly decrease variability. Forty boxes packed by the new process are weighted and have a standard deviation of 4.0 oz. Please describe the sequential typical steps in a statistical test of hypothesis (e.g. formulation of null and alternative hypotheses in terms of the variance, express the statistic ...)?
5. What are the major concerns and proper statistical testing methods of two samples used for (a) continuous data type (under parametric approach) and (b) categorical data type?