編號： 201 國立成功大學 105 學年度碩士班招生考試試題

系　　所：製造資訊與系統研究所

考試科目：統計方法　　考試日期：0227，節次：1

※ 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。

一、

單選題 (72%): 每題 4 分，答錯者倒扣 1 分

1. The most common types of variables are quantitative variable (continuous and discrete), Ranked (ordinary) variables and categorical data. For the categorical data is
   A. Length, weight, temperature, volume, and height
   B. Trees per hectare, arms per sea star, or items per quadrat
   C. Species, gender, genotype, healthy/disease, and material status
   D. None of above
2. According to previous question (1.), which appropriate method can be used for testing a hypothesis involving two independent samples?
   A. Chi-square test
   B. Unpaired ***t*** test
   C. Wilcoxon rank sum test
   D. Welch's approximate ***t*** test
3. Beside sample variance, standard deviation, and range to obtain measures of the spread and variability, "quartiles" divide a distribution in quarters and generate five-number summaries. The visual counterpart to a five-number summary is
   A. Scatter plot
   B. Box plot
   C. Histogram
   D. Bar chart/graph
4. Suppose that on a field trip to Guatemala (瓜地馬拉) you decide to study handsome fungus beetles (偽瓢蟲科). The population you investigate is composed of 70% females and 30% males. Additionally, it has two color morphs, dull brown (60%) and bronze (40%). Half of all the insects are dull brown females. What is the probability that a randomly selected individual is either dull brown or female?
   A. 0.8
   B. 0.7
   C. 0.2
   D. 0.6
5. For probability distributions, we generally consider two classes of random variables, discrete and continuous. Which one in the following is NOT used for a discrete variable distribution?
   A. Binomial distribution
   B. Normal distribution
   C. Poisson distribution
   D. None of above

6. The probability that a continuous random variable (***X***) takes any specific value (***c***), P(***X***=***c***),
   A. depends on the probability density function
   B. is very closed to 1.0
   C. is at least 0.5
   D. is equal to zero
7. Which following distribution is used to estimate confidence interval for the variance?
   A. Binomial distribution
   B. Student's ***t*** distribution
   C. ***F*** distribution
   D. X^2 distribution
8. To determine a confidence interval for the population mean, which number is NOT required?
   A. Null and alternative hypotheses
   B. A point estimate, the sample mean
   C. A measure of variability, the standard error of the mean
   D. The sampling distribution of the point estimate, standard normal distribution
9. Which typical steps in the following is NOT included in the general methodology of a statistical test of hypothesis?
   A. Formulate null and alternative hypotheses based on problem statement
   B. Determine the critical value and ***P*** value based on the level of significance and appropriate test statistic
   C. Estimate sample size based on confidence interval of the sample mean
   D. Compare the test statistic to critical value and compare the ***P*** value to the chosen level of significance
10. We define the margin of error for a (1-α) 100% confidence interval for a population proportion to be $m = z_{1-\alpha/2}\mathrm{SE}_{\hat{p}} = z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$. The researcher specifies ***m*** and the confidence level, whose value of $z_{1-\alpha/2}$ is determined. Thus, to solve for the sample size ***n*** we simply need $\hat{p}$. However, since researcher has not yet done the study, is unknown. The way to solve for this equation is to fix the value (***n***) and maximize the term of $\hat{p}(1-\hat{p})$. By doing this, we will obtain
    A. $m \le z_{1-\alpha/2}\sqrt{\frac{0.25}{n}}$
    B. $m \le z_{1-\alpha/2}\sqrt{\frac{0.50}{n}}$
    C. $m \le z_{1-\alpha/2}\sqrt{\frac{0.90}{n}}$

D. $m \le z_{1-\alpha/2}\sqrt{\frac{0.99}{n}}$

11. When the confident level increases from 95% to 99%, the range of confident interval will
    A. become narrower
    B. be not changed
    C. become wider
    D. result in increasing ***P*** value
12. When applying chi-square test to your data, you find that at least one of the expected values is/are less than 5. What is the proper way to improve this statistical testing?
    A. Use Yales' correction for further analysis
    B. Change to Fisher's exact test
    C. Use Bonferroni correction for further analysis
    D. Change to Wilcoxon rank sum test
13. What type of error is the probability of accepting a false null hypothesis?
    A. Type I (α)
    B. Type II (β)
    C. Either Type I or Type II, depending on the level of significance
    D. Either Type I or Type II, depending on whether the test is one-tailed or two-tailed
14. If the level of significance of a hypothesis test is decline from 0.05 to 0.01, the power of the test
    A. Will also decrees from 0.05 to 0.01
    B. Will not change
    C. Will increase
    D. Will decrease
15. In which following condition, Student's ***t*** distribution will approximate to the standard normal distribution?
    A. Increase sample size
    B. Decrease degree of freedom
    C. Raise confident level
    D. Lower Type I error
16. Before applying two-sample test of hypothesis to you data, which following option is NOT necessary:
    A. Check whether population's distribution is normal or non-parametric
    B. Check if the two populations are normal and have equal variances
    C. Check the power of the test
    D. Check the dependence between two samples
17. The following option is NOT required for the estimation of sample size?
    A. The intrinsic variability among observations, σ, standard deviation of population
    B. Degree of freedom

C. Type I error (α)
D. Type II error (β)

18. Regarding the model for regression analysis, the error term is a random variable with a mean or expected value of
    A. one
    B. sample mean
    C. any positive value
    D. zero

二、
簡答題 (28%):

1. What's difference between standard (標準差) deviation and standard error/standard error of the mean (SEM, 標準誤)? (6%)

2. A researcher 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 your data, please answer and discuss the following questions
    a) How do you explain this ***p*** value properly and encourage him/her? (5%)
    b) How do you help him/her? (5%)

3. 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.
    a. Please write down the formulation of null and alternative hypotheses in terms of the variance (5%)
    b. What is the name of the statistic that is used to test hull hypothesis? And write down the mathematical equation to express the statistic. (Hint: $n \rightarrow$ sample size, $s \rightarrow$ sample standard deviation, and $\sigma \rightarrow$ population standard deviation) (7%)