所別：經濟學系碩士班 科目：統計學

1. Multiple choice (50%, each question weights equally.)

(1) Which of the following statement is true?

a. The probability density function of a continuous random variable can always be derived from the corresponding cumulative density function.

b. A random variable is continuous if the corresponding probability density function is continuous.

c. If X is a continuous random variable, then $P(X \le a) = P(X < a)$

d. All of the above.

(2) Which of the following statement is incorrect?

a. If a random variable X is binomially distributed with successful probability $P = 0.5$, then X is symmetrically distributed.

b. $P(X = a) > 0$ if X is a random variable.

c. The variance of a binomial random variable is the largest among any other binomial random variable when the successful probability equals to 0.5.

d. None of the above.

(3) Suppose X_1, X_2, X_3 are normally distributed with means μ_1, μ_2, μ_3 and variances $\sigma_1^2, \sigma_2^2, \sigma_3^2$, respectively. Which of the following statement is incorrect?

a. All of the following transformed variables, $(X_i - \mu_i)^2 / \sigma_i^2$ (i=1,2,3), are chi-square distributed.

b. The sum of the above three transformed variables, $\sum_{i=1}^{3} (X_i - \mu_i)^2 / \sigma_i^2$, is also a chi-square distribution.

c. The expectation of a chi-square distribution equals to its degrees of freedom.

d. None of the above.

(4) Which of the following statement is correct regarding p-value?

a. A p-value is the probability of the observed value of the test statistic or some value even more contradictory to the null hypothesis, when in fact H_0 is true.

b. A p-value is the abbreviation of the value of the power of the test, which is usually shown in the regression printout of the statistical software.

c. A p-value is the probability of rejecting a null hypothesis, when H_0 is not true.

d. Only statements (a) and (b) are correct.

(5) A political party does not want to change their potential candidate unless there is strong evidence that the potential candidate cannot win the election. After surveying a large sample of voters and doing a hypothesis test, the political party concludes that they have to select another candidate for election. In reaching the above conclusion, which of the following statement is applied?

a. A Type I error could have been made.

b. A Type II error could have been made.

c. Both Type I and Type II error were probably made.

d. None of the above.

(6) Which of the following statement is correct?

a.A statistic with smaller variance must be a better estimator than the one with larger variance.

b.The mean square error of the sample proportion $\hat{p}$ equals to the variance of $\hat{p}$.

c.Both statements (a) and (b) are correct.

(7) Which of the following statement is correct?

a.Suppose A and B are independent events, then A and B' are also independent.

b.Suppose A and B are mutually exclusive events, then A and B are independent.

c.For events A and B, $P(A \mid B') = P(A)/[1 - P(B)]$.

d.Only statements (a) and (b) are correct.

注意：背面有試題

(8) Suppose there are 10 balls in a brown bag, in which θ balls are red. A boy picks two balls out of the bag at one time. Define X as the number of red balls that the boy holds. His brother then wants to test the hypothesis that the red balls in the bag are not greater than 2. If the little boy has two red balls in hand, then his brother would reject the null hypothesis. Which of the following is incorrect.

a.The null and alternative hypotheses are $H_0: X \le 2$ and $H_1: X>2$, respectively.

b.The sample space S = {0, 1, 2}.

c. The critical region C = {2}.

d.Type one error $\alpha = 1/45$.

(9) A survey was conducted to study the relationship between the flu (i.e. influenza) infection and flu injection. There are 100 people interviewed. The table below summarizes the results. Which of the following statement is incorrect in testing the independence of the two variables? $\chi^2_{.05}(4) = 9.49$, $\chi^2_{.05}(1) = 3.841$.

	infected	not infected
with injection	4	32
without injection	16	48

a. The test statistic is 2.778.

b. The critical point of the test with $\alpha = 0.05$ is $\chi^2 > 9.49$.

c. One got infected is not related to whether he took the injection or not.

(10) Statement 1: The number of defects per square yard of cloth produced by a new machine.
Statement 2: The number of defective sweaters in a sample of 10 sweaters drawn from a population of size 100.
What distributions do statements 1 and 2 apply to?

a.Normal distribution and Poisson distribution, respectively.

b. Poisson distribution and Normal distribution, respectively.

c. Poisson distribution and Hypergeometric distribution, respectively.

d.Normal distribution and Hypergeometric distribution, respectively.

2. Please answer the following questions: (50%, each question weights equally.)
A manager aims to estimate the production of his company. A Cobb-Douglas production function, $Q = AK^{\alpha}L^{\beta}\varepsilon$, is adopted for his research with study time period from the first quarter of 1990 to the third quarter of 2000.($F_{0.05}(3,40) = 2.84$, $F_{0.05}(40,3) = 8.59$.)

(1) Can the manager employ the ordinary least square (OLS) for his research? Why or why not? If the OLS method is appropriate, how should the manager specify the corresponding empirical model for the regression?

(2) If serial correlation occurs in this case, what will he observe? Show it in a 2-dimention diagram with the axis specified as "time" and "residual".

(3) Suppose the slope coefficient estimates in question (1), $\hat{\alpha}$ and $\hat{\beta}$, are 0.48 and 0.53, respectively, and the corresponding standard errors are 0.15 and 0.08. The manager wants to test the hypothesis that the elasticity of labor equals to 0.50. What should he conclude according to the above empirical results?

(4) Suppose the manager would like to further control for the seasonal effect. Please modify his model in question (1).

(5) Suppose the error sum of squares for the original model in question (1) and the modified model in question (4) are 1384 and 1064, respectively. Which model is better in the sense of goodness of fit?