

科目：統計學甲 適用：國企系甲組

編號：321

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本試題

共 3 頁

第 1 頁

## 一、選擇題（共 42 分，每題 3 分）

1. For a chi-square test of independence, we expect the actual frequencies in each cell to approximately match the corresponding expected cell frequencies when:
  - A) the variables are related to each other.
  - B)  $H_0$  is falsely accepted.
  - C)  $H_0$  is false.
  - D)  $H_0$  is true.
2. Of the last 100 customers entering a computer shop, 30 have purchased a computer. If the classical probability assessment for computing probability is used, the probability that the next customer will purchase a computer is
  - A) 1.00.
  - B) 0.75.
  - C) 0.50.
  - D) 0.30.
3. Which of the following statements regarding multicollinearity is not true?
  - A) It is a condition that exists when the independent variables are highly correlated with the dependent variable.
  - B) It is also called collinearity and intercorrelation.
  - C) It exists in virtually all multiple regression models.
  - D) It does not affect the F-test of the analysis of variance.
4. Assume a simple random sample selected from a normally distributed population. Test the claim that for the population of female college students, the mean weight is given by  $\mu=55\text{kg}$ . Sample data are summarized as  $n=16$ ,  $\bar{x}=60$ , and  $s=8\text{kg}$ . Use a significance level of  $\alpha=0.1$ . Find the test statistic  $t$ .
  - A) 2.5
  - B) -1.729
  - C) -2.5
  - D) 1.729
5. Which of the following statements is not true with respect to the sampling distribution of a proportion?
  - A) An increase in the sample size will result in a reduction in the size of the standard deviation.
  - B) The mean of the sampling distribution will equal the population proportion.
  - C) The sampling distribution is always close to normal distribution.
6. Suppose that  $B_1$  and  $B_2$  are mutually exclusive and complementary events, such that  $P(B_1)=0.4$  and  $P(B_2)=0.6$ . Consider another event  $A$  such that  $P(A|B_1)=0.3$  and  $P(A|B_2)=0.6$ . Find  $P(B_1|A)$ .
  - A) 0.625
  - B) 0.800
  - C) 0.250
  - D) 0.375

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7. A supermarket chain gathers data on the amount they spend on sales promotion tools (e.g., coupons, etc.) and sales revenue generated each quarter. The predictor variable is \_\_\_\_\_?

A) amount spent on sales promotion tools.      B) sales revenue.  
C) number of coupons offered.      D) supermarket chains.

8. In a simple regression model, which of the following will not tend to increase the standard error of the slope coefficient?

A) Decrease the variation in X.      B) Increase the value of  $\alpha$ .  
C) Decrease the SSE.      D) Increase the sample size.

9. An elections officer wants to model voter turnout ( $y$ ) in a precinct as a function of the type of precinct. Consider the model relating mean voter turnout,  $E(y)$ , to precinct type:

$$E(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

where  $x_1 = 1$  if urban, 0 if not;  $x_2 = 1$  if suburban, 0 if not; Base level = rural.

Interpret the value of  $\beta_0$ .

A) the difference between the mean voter turnout for urban and rural precincts  
B) the mean voter turnout for urban precincts  
C) the y-intercept of the line  
D) the mean voter turnout for rural precincts

10. A company has recorded annual sales for the past 14 years and found the following linear trend model:  $\hat{y} = 5.23 + 144.60t$ . This means that:

A) on average sales are increasing by of 5.23 per year.  
B) on average sales are increasing by of 144.6 per year.  
C) there is a seasonal component in the data.  
D) sales in year 1 were 144.60.

11. Incomes in a particular market area are known to be right-skewed with a mean equal to 100.

In a report issued recently, a manager stated that at least 89 percent of all incomes are in the range of 85 to 115, and this was based on Tchebysheff's theorem. Given these facts, what is the approximate standard deviation for the incomes in this market area?

A) 15      B) 10      C) 7.5      D) 5

12. Which value of the following coefficient of correlation indicates a stronger correlation than

0.50?      A) +0.53      B) -0.60      C) -0.40      D) +0.40

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13. Choose the appropriate test for the following situation: You wish to test whether an association exists between the type of vehicle a driver owns and the cost of speeding tickets.  
A) Chi-square test      B) ANOVA      C) Two-sample t-test      D) One-sample t-test
14. Data were collected on annual personal time taken by a random sample of 21 women and 11 men employed by a medium-sized company. The women took an average of 24 hours of personal time per year with a standard deviation of 2 hours. The men took an average of 20 hours of personal time per year with a standard deviation of 4 hours. The pooled estimate of the variance is      A) 22      B) 9      C) 8      D) 222

## 二、解釋名詞（共 8 分，每題 4 分）

以下是兩個與統計有關的英文專有名詞，試說明每個名詞的統計意義，只有英翻中則不計分

1. Interaction Effect
2. Central Limit Theorem

## 三、簡答計算題（共 50 分）

1. (10 分) 連續隨機變數  $x$  服從  $f(x) = \begin{cases} 3x^{-3}, & x > 1 \\ 0, & \text{其他} \end{cases}$ ，試求：
- (1) 期望值  $E(X)$  (5%)
  - (2) 變異數  $V(x)$  (5%)
2. (10 分) 聯合機率密度函數  $f(x, y) = \begin{cases} 3xe^{-y}, & 0 \leq x \leq 1, 0 \leq y < \infty \\ 0, & \text{其他} \end{cases}$ ，請問隨機變數  $x, y$  之間獨立嗎？
3. (10 分) 連續隨機變數  $x$  服從  $f(x) = \begin{cases} 3x, & 0 \leq x < 1 \\ 0, & \text{其他} \end{cases}$ ，若  $y = 5x + 2$ ，則  $y$  對應的機率密度函數為何？
4. (20 分) 連續隨機變數  $x$  服從  $f(x) = 0.03 \exp(-0.003x), x > 0$ ，請問：
- (1) 動差母函數(moment generating function)為何 (10%)？
  - (2) 請由此動差母函數產生期望值  $E(X)$  (5%) 和變異數  $V(x)$  (5%)