

科目：統計學

適用：國企系

編號：233

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 5 頁

第 1 頁

一、選擇題（共 60 分，每題 3 分）

1. What is $z_{\alpha/2}$ when $(1-\alpha)\% = 90\%$?

- A) 1.645 B) 1.88 C) 1.96 D) 2.33

2. In a one-factor ANOVA having four group levels with five observations in each group, the between group degrees of freedom (DFA) is equal to

- A) 2 B) 3 C) 4 D) 20

3. In regression models, multicollinearity arises when the:

- A) independent variables are highly correlated with the dependent variable.
B) error terms do not have the same variance.
C) independent variables are highly correlated with one another.
D) dependent variables are highly correlated with one another.

4. Suppose we want to test $H_0: \mu \geq 30$ versus $H_1: \mu < 30$. Which of the following possible sample results based on a sample of size 36 gives the strongest evidence to reject H_0 in favor of H_1 ?

- A) $\bar{x} = 25, s = 8$ B) $\bar{x} = 25, s = 4$ C) $\bar{x} = 30, s = 8$ D) $\bar{x} = 32, s = 2$

5. If $P(X) = 0.3$ and $P(Y) = 0.4$, and if X and Y are mutually exclusive, find $P(X \text{ or } Y)$.

- A) 0.3 B) 0.4 C) 0.7 D) 0.9

6. If a sample of size 100 is taken from a population whose standard deviation is equal to 100, then the standard error of the mean is equal to:

- A) 10 B) 20 C) 100 D) 10,000

7. A parameter is _____.

- A) a characteristic of a population B) measured on a sample
C) a characteristic of a sample D) the same as a statistic

科目：統計學

適用：國企系

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 5 頁

第 2 頁

編號：233

8. A family doctor wants to examine the variables that affect his female patients' total cholesterol. He randomly selects 14 of his female patients and asks them to determine their average daily consumption of saturated fat. The output from MINITAB shows the following regression analysis.

Predictor	Coef	SE Coef	T	P
Constant	90.84	15.99	5.68	0.000
AGE	1.0142	0.2427	4.18	0.002
VEGETARIAN	-32.443	6.632	-4.89	0.000

Please state the regression equation for CHOLESTEROL, using AGE and VEGETARIAN as variable names.

- A) CHOLESTEROL = 90.84 + 1.0142 AGE - 32.443 VEGETARIAN
 B) CHOLESTEROL = 15.99 + 0.2427 AGE + 6.632 VEGETARIAN
 C) CHOLESTEROL = 5.68 + 4.18 AGE - 4.89 VEGETARIAN
 D) CHOLESTEROL = 90.84 + 1.0142 AGE + 32.443 VEGETARIAN

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:

$$E(y) = \beta_0 + \beta_1 D_1 + \beta_2 D_2, \quad \text{where } D_1 = 1 \text{ if rural, } 0 \text{ if not} \\
D_2 = 1 \text{ if suburban, } 0 \text{ if not} \\
(\text{Base level} = \text{urban})$$

Interpret the value of β_2 .

- A) the difference between the mean voter turnout for suburban and rural precincts
 B) the difference between the mean voter turnout for suburban and urban precincts
 C) the mean voter turnout for urban precincts
 D) the mean voter turnout for suburban precincts

10. If a hypothesis test for a single population variance is to be conducted using a significance level of 0.10, a sample size of $n = 16$, and the test is a one-tailed upper-tail test, the critical value is:

- A) $z = 1.28$. B) $t = 1.345$. C) $F = 24.9958$. D) $\chi^2 = 22.3071$.

科目：統計學

適用：國企系

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 5 頁

第 3 頁

編號：233

11. Suppose that past history shows that 70% of college students prefer Coca-Cola. A sample of 1,000 students is to be selected. Which of the following distributions would you use to figure out the probability that at least half of them will prefer Coca-Cola?

- A) Uniform distribution B) Exponential distribution
C) Normal distribution D) Poisson distribution

12. In a regression model with two predictors X_1 and X_2 , an interaction term may be used when:

- A) the effect of X_2 on the dependent variable is not influenced by X_1 .
B) both the variables are independent variables.
C) the effect of X_1 on the dependent variable is influenced by X_2 .
D) both variables are influential to each other.

13. For sample size $n=10$, the sampling distribution of the mean will be normally distributed

- A) only if the shape of the population is symmetrical.
B) regardless of the shape of the population.
C) only if the population values are positive.
D) only if the population is normally distributed.

14. If the age distribution of customers at a major retail chain is thought to be bell-shaped with a mean equal to 40 years and a standard deviation equal to 5 years, the percentage of customers between the ages of 35 and 45 years is:

- A) at least 75. B) approximately 68. C) approximately 95. D) approximately 80.

15. A bag of colored candies contains 20 red, 20 yellow, and 20 orange candies. An experiment consists of randomly choosing one candy from the bag and recording its color. What is the sample space for this experiment?

- A) {20, 20, 20} B) {1/3, 1/3, 1/3} C) {60} D) {red, yellow, orange}

科目：統計學

適用：國企系

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 5 頁

第 4 頁

編號：233

16. Suppose a 95% confidence interval for μ turns out to be (1,000, 2,000). Give a definition of what it means to be "95% confident" in an inference.

- A) 95% of the observations in the entire population fall in the given interval.
- B) In repeated sampling, 95% of the intervals constructed would contain the population mean.
- C) 95% of the observations in the sample fall in the given interval.
- D) In repeated sampling, the population parameter would fall in the given interval 95% of the time.

17. Choose the statement that best describes what is meant when we say that the sample mean is *unbiased* when estimating the population mean.

- A) The sample mean will always equal the population mean.
- B) The standard error of the sampling distribution and the population standard deviation are equal.
- C) The expected value of the sampling distribution is equal to the population mean.

18. A sample of people who have attended a college football game at your university has a mean = 3.2 members in their family. The mode number of family members is 5 and the median number is 5.0. Based on this information:

- A) the distribution is left-skewed.
- B) the distribution is bell-shaped.
- C) the population mean exceeds 3.2.
- D) the distribution is right-skewed

19. Which of the following is an appropriate null hypothesis for a Chi-Square test of independence?

- A) The means of populations A and B are equal.
- B) The relationship between A and B is linear.
- C) The row and column variables are independent in the population.
- D) The mean of the population is equal to the mean of the sample.

科目：統計學

適用：國企系

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 5 頁

第 5 頁

編號：233

20. The standard deviation of the sample data 20, 20, 20, and 20 equals:

- A) 20 B) 4 C) 0 D) 5

二、簡答題（共 30 分）

1. (5%) 請說明「抽樣分配」(Sampling Distribution) 的意義。
2. (5%) 在推導抽樣分配之前，通常會先假設構成樣本的 n 個隨機觀察值 (x_1, x_2, \dots, x_n) ，具有獨立同態 (i.i.d.) 的性質。請說明何謂「獨立同態」？
3. (5%) 承上題，在獨立同態的假設下，當樣本數符合中央極限定理的要求，則樣本平均數的抽樣分配為何？（須開列該分配的「參數」）
4. (5%) 承上題，請畫下樣本平均數的抽樣分配的型態，並標示「參數」在圖中的位置。
5. (10%) 就一個統計模型而言，假設 (Assumption) 與假說 (Hypothesis) 有何不同？試舉例說明之。

三、計算題（共 10 分）

為估計母體平均數，小明蒐集 50 個樣本觀察值，並根據資料建立的信賴區間為 $(L, U) = (24, 36)$ 。若小明繼續蒐集資料達到 450 個樣本觀察值，且樣本平均數、母體標準差與信賴水準皆維持不變，則根據此一資料建立的信賴區間為何？請完整寫出信賴區間的下限與上限，也就是以 (L, U) 的型式呈現答案。

為回答此一問題，請填空或計算以下 4 個小題：（最大誤差 = Margin of Error）

- (1) (2 分) 請問這兩組樣本的樣本平均數 (\bar{X}) 都是多少？ 答： $\bar{X} =$ _____
- (2) (2 分) 請問根據第一組樣本 ($n=50$) 建立的信賴區間，最大誤差 $E_1 =$? 答： $E_1 =$ _____
- (3) (4 分) 請問根據第二組樣本 ($n=450$) 建立的信賴區間，最大誤差 $E_2 =$? 答： $E_2 =$ _____

[請寫出計算過程]

- (4) (2 分) 請問根據第二組樣本 ($n=450$) 建立的信賴區間為何？ 答： $(L, U) = ($ _____ , _____)