

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。

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一、選擇題（共 40 分，每題 2 分）

1. If more scores are clustered toward the low end of a frequency distribution and only a few scores are at the high end, then the distribution is _____.
A) negatively skewed B) positively skewed C) multimodal D) unimodal
2. Which of the following regression diagnostic tools is used to study the possible presence of multicollinearity?
A) Scatter diagram B) Residual plot C) The correlation matrix D) Durbin-Watson test
3. Interaction exists in a multiple regression model when:
A) one independent variable affects the relationship between another independent variable and the dependent variable.
B) the regression model is overall insignificant.
C) multicollinearity is present in a regression model.
D) a polynomial model used.
4. In one city, 20% of adults smoke. In groups of size 100 of adults, what is the variance of the number that smoke?
A) 8 B) 16 C) 20 D) 36
5. If the results of an experiment using one-way ANOVA were summarized as $F(2, 28) = 2.79$, $p\text{-value} > \alpha = 0.05$, then you would know that H_0 was _____ and was _____.
A) $\mu_1 = \mu_2$; not rejected B) $\mu_1 = \mu_2$; rejected C) $\mu_1 = \mu_2 = \mu_3$; rejected
D) $\mu_1 = \mu_2 = \mu_3$; not rejected
6. The sum of the residuals when using a least-squares regression line is _____.
A) equal to the variance of the Y variable B) normally distributed around the mean of X
C) equal to zero D) normally distributed around the mean of Y
7. If scores are measured on a nominal scale, then the best measure of central tendency for the scores is the _____.
A) median B) mean C) mode D) correlation coefficient
8. A standard error of the mean is a standard deviation of a _____.
A) population mean B) sampling distribution of the mean C) population
D) sample

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9. In a normal distribution, what proportion of scores fall within the interval between the mean to one standard deviation above the mean?
- A) 0.8413 B) 0.1359 C) 0.6826 D) 0.3413
10. The probability function for random variable X is specified as: $f(X) = X/10$ for $X = 1, 2, 3$ or 4 . The expected value of X is
- A) 2.000 B) 2.333 C) 3.000 D) 3.500
11. After a linear forecasting model is found for a time series, if the Durbin-Watson statistic is 1.98, this means that:
- A) no positive autocorrelation exists, a nonlinear model should be tried.
B) positive autocorrelation exists, a nonlinear model should be tried.
C) positive autocorrelation exists, the linear model is adequate.
D) no positive autocorrelation exists, the linear model is adequate.
12. A bar graph is used to present _____ data, whereas a histogram is used to present _____ data.
- A) qualitative; quantitative B) statistical; population C) continuous; discrete
D) quantitative; qualitative
13. If the correlation coefficient for variables X and Y is zero, then the _____.
- A) regression equation will predict Y exactly B) mean of X will be higher than the mean of Y
C) Y -intercept is equal to 1.0 D) best prediction of Y is the mean of Y
14. The student t distribution varies with the _____.
- A) range of values in the sample B) value of the sample variance
C) value of the sample mean D) size of the sample
15. If cars arrive to a service center randomly and independently at a rate of 1 car per hour on average, what is the probability of 0 cars arriving in a given hour? ($e = 2.7183$)
- A) 0.0067 B) 0.1755 C) 0.3679 D) 0.5000
16. Which of the following statements is correct?
- A) The lower the confidence level, the smaller the confidence interval.
B) The greater the population variance, the smaller the confidence interval.
C) The higher the confidence level, the smaller the confidence interval.
D) None of the above.

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17. A percentile is _____.
- A) always the midpoint of a class interval
 - B) a score at or above which a specified percentage of the scores in a distribution fall
 - C) a score at or below which a specified percentage of the scores in a distribution fall
 - D) the percentage of scores in a distribution equal to or greater than a particular score
18. If we are testing for the difference between the means of two paired populations with samples of $n_1 = 20$ and $n_2 = 20$, the number of degrees of freedom is equal to:
- A) 19
 - B) 39
 - C) 38
 - D) 18
19. Representativeness of a sample is principally determined by the _____.
- A) symmetry of the population distribution
 - B) method of sampling used
 - C) standard error of the mean
 - D) size of the sample
20. A and B are mutually exclusive outcomes in a probability distribution. The $p(A) = 0.24$ and the $p(B) = 0.13$. The $p(A \text{ or } B)$ then equals _____.
- A) 0.03
 - B) 0.37
 - C) 1.85
 - D) 0.11

二、解釋名詞（共 30 分，每題 5 分）

以下是六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. Significant Level α
2. Population Parameter
3. Variance Inflationary Factor
4. Sum of Square for Error
5. Treatment Effect
6. Best Linear Unbiased Estimator

三、簡答計算題（共 30 分）

1. (6 分) 試說明古典機率(classical probability)與實證機率(empirical probability)的差異之處。
2. (共 16 分) 擁有稀有珠寶通常是身份地位的象徵。根據需求理論，產品的價格愈低，需求量會愈高，故珠寶價格若提高，則其購買量應會隨之降低。然而，珠寶的象徵價值正是來自於其昂貴的價位；當珠寶價格高到一個地步之後，其購買量反而會隨著單位價格的提高而提升，成為炫耀財。為探討稀有珠寶是否遵循需求理論或屬於炫耀財，專家建立一個二次迴歸模型，如下所示：

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \varepsilon$$

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其中，Y=珠寶銷售額，X=每克拉珠寶的零售價格 (Price)。此一模型的樣本資料是 12 種稀有珠寶的銷售資料，統計分析報表如下所示，試回答下列問題。

Regression Statistics		ANOVA					
Multiple R	0.994		df	SS	MS	F	Sig.
R Square	0.988	Regression	1	115145	57573	373	0.0001
Standard Error	12.42	Residual	9	1388	154		
Observations	12	Total	11	116533			
	Coeff	StdError	t Stat	P-value			
Intercept	286.42	9.66	29.64	0.0001			
Price	-0.31	0.06	-5.14	0.0006			
Price Square	0.000067	0.00007	0.95	0.3647			

- (1) (4 分) 此一迴歸模型是線性模型 (Linear Model) 還是非線性模型 (Nonlinear Model)？請說明理由。
- (2) (4 分) 試根據研究目的，請分別使用迴歸係數與文字陳述兩種方式，開列對立假說 (H_1)。
- (3) (4 分) 試根據統計分析報表，說明題 (2) 的檢定結果，令 $\alpha=0.1$ 。
- (4) (4 分) 試根據統計分析報表，說明專家選取的珠寶是否為炫耀財，令 $\alpha=0.1$ 。

3. (共 8 分) 某一調查對 250 人進行訪問，詢問其是否快樂，以及最近 2 個月內從事戶外活動的程度，訪問結果如下表所示。表中，每一方格代表實際勾選人數，括弧內是期望人數。試回答以下問題。

戶外活動程度 \ 快樂與否	戶外活動天數為 2 天以內	戶外活動天數為 3 天以上	Chi-Square Test
快樂	60 (80)	140 (120)	$\chi^2 = 41.6667$
不快樂	40 (20)	10 (30)	p-value = 1.08239E-10
			df = 1

- (1) (2 分) 根據調查內容，試以文字陳述的方式，開列對立假說 (H_1)。
- (2) (2 分) 根據統計分析報表，說明題 (1) 的檢定結果，令 $\alpha=0.1$ 。
- (3) (4 分) 根據統計分析報表，是否可以提出有助提升快樂程度的策略建議？請說明你的建議與支持的數據。