國立中山大學114學年度
碩士班考試入學招生考試試題

科目名稱：統計學【國資所碩士班乙組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以2B鉛筆劃記，不可使用修正液（帶）塗改，未使用2B鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

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※本科目依簡章規定「不可以」使用計算機(混合題)　　

PART I: Answer each question by selecting one of options from A-E (60%, Each question 3%)

1. A fair coin is tossed three times. What is the probability of getting exactly two heads?
   (A) 1/8
   (B) 3/8
   (C) 1/2
   (D) 3/4
   (E) 7/8

2. Standard deviation measures which of the following?
   (A) Central Tendency
   (B) Dispersion
   (C) Skewness
   (D) Kurtosis
   (E) Sample Correlation

3. When data is normally distributed, which of the following is correct?
   (A) Mean > Median
   (B) Mean < Median
   (C) Mean = Median = Mode
   (D) Skewness Coefficient is Positive
   (E) Kurtosis is Negative

4. What does a 95% confidence interval represent?
   (A) 95% of the data lies within this range
   (B) The population parameter has a 95% chance of falling in this range
   (C) The sample parameter has a 95% chance of falling in this range
   (D) The data in this range has a 95% chance of being normally distributed
   (E) The data in this range has a mean equal to the population mean

5. In linear regression, what does R^2 signify?
   (A) Absolute Value of Variance
   (B) Model's Average Error
   (C) Proportion of Variance Explained by Independent Variables
   (D) Standardized Sample Size
   (E) Sum of Residuals

6. As sample size increases, how does the standard error of the sampling distribution change?
   (A) Increases
   (B) Decreases
   (C) Remains Unchanged
   (D) Cannot Be Determined

(E) Matches the Population Distribution

7. The expected value of a random variable is a measure of what?
(A) Central Tendency
(B) Dispersion
(C) Skewness
(D) Kurtosis
(E) Sample Size

8. When the p-value is less than the significance level (α), what should be the decision?
(A) Accept the Null Hypothesis
(B) Reject the Null Hypothesis
(C) Increase the Sample Size for Retesting
(D) Lower the Significance Level
(E) Revise the Data Model

9. Which method is used to detect relationships between multiple variables?
(A) t-test
(B) Chi-Square Test
(C) Correlation Analysis
(D) F-Test
(E) One-Way ANOVA

10. Which of the following distributions is continuous?
(A) Binomial Distribution
(B) Poisson Distribution
(C) Normal Distribution
(D) Geometric Distribution
(E) Hypergeometric Distribution

11. In hypothesis testing, what is a Type I error?
(A) Accepting the Null Hypothesis When It Is True
(B) Rejecting the Null Hypothesis When It Is False
(C) Rejecting the Null Hypothesis When It Is True
(D) Accepting the Null Hypothesis When It Is False
(E) Unable to Test Data Accuracy

12. The Central Limit Theorem applies in which of the following scenarios?
(A) The population distribution must be normal.
(B) The population sample size must be less than 30.
(C) Regardless of the shape of the population distribution, the distribution of sample means will approach a normal distribution when the sample size is sufficiently large.
(D) The sample mean will approach a normal distribution only if the population distribution is

uniform.
(E) The population mean and variance must be equal.

13. A study with a large sample (sample size = 100) finds a sample mean of 50 and a population standard deviation of 10. If the confidence level is 95%, what is the range of the confidence interval for the population mean?
(A) 50 ± 1.96
(B) $50 \pm 1.96 \times 1$
(C) $50 \pm 1.96 \times (10/\sqrt{100})$
(D) $50 \pm 1.96 \times 10$
(E) $50 \pm 1.96 \times (1/\sqrt{100})$

14. When estimating the confidence interval for population variance, assuming the population follows a normal distribution, which distribution is used?
(A) t distribution
(B) Chi-square distribution
(C) F distribution
(D) Standard normal distribution
(E) Poisson distribution

15. In hypothesis testing, what does the p-value represent?
(A) The probability of observing the test statistic or more extreme values under the null hypothesis
(B) The probability that the null hypothesis is false
(C) The probability that the alternative hypothesis is true
(D) The value of the test statistic
(E) The probability that the null hypothesis is true

16. Which of the following scenarios can be modeled using a binomial distribution?
(A) Rolling a die and recording the outcome
(B) Drawing cards from a deck and recording the suits
(C) Inspecting a batch of products to count how many are defective (pass/fail)
(D) Measuring continuous temperature changes
(E) Students' height in the school

17. If a random variable X follows a uniform distribution U(a, b), what is the probability density function f(x)?
(A) $f(x) = 1 / (b - a)$ for $a \leq x \leq b$, otherwise 0
(B) $f(x) = b - a$ for $a \leq x \leq b$, otherwise 0
(C) $f(x) = x$ for $a \leq x \leq b$, otherwise 0
(D) $f(x) = 0$
(E) $f(x) = 1$

18. What is the primary purpose of a boxplot?
(A) To display the central tendency and spread of data

(B) To test the significance of differences between two groups
(C) To compare the correlation between data
(D) To calculate the standard deviation of data
(E) To calculate the mean of data

19. For a random variable X, the F(.) indicates the cumulative density function of X. If F(a)=0.3 and F(b)=0.7, with a<b, what is P(a<X≤b)?
(A) F(b)−F(a)
(B) F(a)+F(b)
(C) F(a)×F(b)
(D) F(a)/F(b)
(E) F(b)

20. Bayes' Theorem is applied in which of the following scenarios?
(A) Ensuring the sample mean approaches a normal distribution as the sample size increases
(B) Testing the correlation between two variables
(C) Calculating the average of all possible outcomes
(D) Constructing a probability density function
(E) Updating probabilities based on observed evidence

PART II: Short Answer Question (40%, Each question 5%)

Q1. The library wants to determine the relationship between the daily number of visitors to the library (in hundreds) (X) and the number of books borrowed (in hundreds) (Y). It is known that the library was open for 25 days last month, and the following data were collected:

$\Sigma X = 200$, $\Sigma Y = 300$, $\Sigma X^2 = 1{,}660$, $\Sigma Y^2 = 3{,}696$, $\Sigma XY = 2{,}436$。

21. Find the value of $\widehat{\beta_0}$ in the regression line $\hat{Y} = \widehat{\beta_0} + \widehat{\beta_1}X$.

22. Find the value of $\widehat{\beta_1}$ in the regression line $\hat{Y} = \widehat{\beta_0} + \widehat{\beta_1}X$.

Q2. The probability distribution of the number of passengers per bus on Route 85 in Kaohsiung is as follows:

X (numbr of passengers)	20	30	40	50	60	70	80	90
$f(X)$	0.05	0.1	0.1	0.1	0.25	0.3	0.1	0.00

23. Calculate the expected value *E(X)* of the number of passengers per bus.
24. Calculate the variance *V(X)* of the number of passengers per bus.

25. If each passenger pays 15 NTD and Y represents the revenue from passengers per bus, find expected revenue *E(Y)*
26. If each passenger pays 15 NTD and Y represents the revenue from passengers per bus, find the variance *V(Y)*

Q3. Assume A and B are independent events, and P(.) is the probability of an event. If $P(A)= 0.9$, $P(B) = 0.3$, find the following:

27. $P(A|B)$=?

28. $P(A \cap B)$=?