

臺灣綜合大學系統 115 學年度學士班轉學生聯合招生考試試題

科目名稱	心理與教育統計學	類組代碼	A17
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※本項考試依簡章規定所有考科均「不可」使用計算機。本科試題共計 5 頁			
Questions 1 to 25 are multiple-choice questions, worth 4 points each, with no penalty for incorrect answers. Choose the best answer for each question. 1. A researcher is conducting a study on physical health and records the weight of each participant. Which scale of measurement does it represent? A) Nominal scale B) Ordinal scale C) Interval scale D) Ratio scale E) Qualitative scale 2. An experimenter is conducting a study to see if a new teaching method affects students' test performance. The researcher records the number of problems correct on a test for each student. What type of variable is this? A) Discrete and qualitative B) Continuous and qualitative C) Discrete and quantitative D) Continuous and quantitative E) Independent and continuous 3. A researcher performs a linear transformation on a dataset using the formula $X_{\text{new}} = a * X_{\text{old}} + b$, where a and b are constants. Which of the following statements regarding the new dataset's properties is correct? A) The shape of the distribution will be significantly altered. B) The new mean will be equal to (old mean + b). C) The new variance will be equal to (old variance * b). D) The new standard deviation will be equal to (old SD * a). E) The linear transformation acts exactly like a non-linear transformation. 4. When evaluating the properties of statistical estimators, "Unbiasedness" is highly desirable. Which of the following is considered an unbiased estimate of its corresponding population parameter? A) Sample variance calculated by dividing the sum of squared deviations by n. B) Sample mean as an estimate of the population mean. C) The range of a sample as an estimate of the population range. D) The mode of a sample as an estimate of the population median. E) Mode, median, and mean are all equally unbiased regardless of distribution shape. 5. When constructing a boxplot, how are the "whiskers" and potential outliers defined? A) The whiskers always extend to exactly 1.5 times the Interquartile Range from the median. B) The whiskers extend to the lowest and highest values within the fences (1.5 times the Interquartile Range from the quartiles), with points outside these fences labeled as outliers. C) The whiskers represent the top and bottom 10% points of the distribution. D) The whiskers extend to the 10th and 90th percentiles, and any scores beyond them are trimmed. E) The box represents the total range, and the whiskers show the standard deviation.			

6. According to the definitions of event relationships, if the occurrence of one event completely prevents or precludes the occurrence of another event, these two events are said to be:
- A) Independent events
 - B) Mutually exclusive events
 - C) Exhaustive outcomes
 - D) Joint probabilities
 - E) Empirical approaches
7. In statistical hypothesis testing, researchers must navigate the possibility of making incorrect decisions. If a researcher rejects the null hypothesis when it is actually correct, what type of error has been committed?
- A) Type I error
 - B) Type II error
 - C) Sampling error
 - D) Standard error
 - E) Directional error
8. According to the principles of hypothesis testing, if a sample score (test statistic) fails to reach the critical cutoff value, what is the appropriate formal conclusion regarding the null hypothesis?
- A) The null hypothesis is proven to be completely true.
 - B) The alternative hypothesis is accepted as true.
 - C) The null hypothesis cannot be rejected, and the results are inconclusive.
 - D) A Type I error has definitely occurred.
 - E) The experiment has had a highly significant effect.
9. Why can't we simply substitute the sample variance for the population variance in a standard normal distribution when the population standard deviation is unknown, particularly for small samples?
- A) The sample variance is always equal to zero.
 - B) The sample variance is a biased estimate that cannot be corrected by changing degrees of freedom.
 - C) The sample variance follows a perfectly symmetrical normal distribution.
 - D) The sample size automatically decreases when calculating variance.
 - E) The sampling distribution of the variance is positively skewed, meaning most sample variances underestimate the true population variance.
10. The t statistic is a "robust" statistic under certain conditions. What does this mean regarding the assumptions underlying the t test for a single mean?
- A) The t statistic is quite tolerable to departures from a normal distribution, though it loses validity for extremely non-normal distributions combined with very small samples.
 - B) The t test requires the sample to be drawn non-randomly.
 - C) The t statistic completely loses validity if the sample size is larger than 30.
 - D) The t statistic always requires a known population variance.
 - E) Robustness means the t value never changes regardless of the sample size.
11. In statistical hypothesis testing, "Power" is a crucial concept when evaluating a study's design. Which of the following best provides the definition of Power?
- A) The probability of retaining a true null hypothesis.
 - B) The probability of committing a Type I error.
 - C) The absolute difference between the sample variance and the population variance.
 - D) The probability that the alternative hypothesis is true before sampling.
 - E) The probability of correctly rejecting a false null hypothesis.

12. A psychological researcher is planning a future study and wishes to maximize its statistical power. Which of the following adjustments would successfully increase the study's power?

- A) Decreasing the sample size.
- B) Lowering the significance level α , e.g., from .05 to .01.
- C) Decreasing the true difference between the null and alternative hypotheses.
- D) Increasing the sample size or choosing a design with a larger effect size.
- E) Doubling the population variance while keeping everything else constant.

13. When dealing with research containing two independent groups where the sample sizes are unequal, what statistical method must be used to adjust the sample sizes when calculating the noncentrality parameter?

- A) The arithmetic mean of the two sample sizes.
- B) The median value of the combined datasets.
- C) The geometric mean of the population variances.
- D) The maximum value between two sample sizes.
- E) The harmonic mean of the sample sizes.

14. Which of the following is not as an advantage of using a related samples design (repeated measures)?

- A) It completely eliminates carry-over and practice effects.
- B) It eliminates subject-to-subject variability.
- C) It controls for extraneous variables.
- D) It requires fewer subjects.
- E) It increases statistical efficiency by utilizing data from the same participants.

15. When calculating Cohen's d for the therapy example, why or how is the difference scaled, and which standard deviation is preferred in the basic formula?

- A) Divided by the standard deviation of the Difference scores.
- B) Divided by the standard deviation of the Before scores.
- C) Divided by the standard error of the sampling distribution.
- D) Divided by the population mean.
- E) Multiplied by the number of sample pairs.

16. When the assumption of homogeneity of variance is violated and sample variances cannot be pooled, what is the standard solution?

- A) Use the standard pooled variance formula and keep ($df = n_1 + n_2 - 2$).
- B) Discard the smaller sample group and perform a one-sample t -test.
- C) Apply Welch's solution to obtain an adjusted test statistic and an adjusted degrees of freedom.
- D) Switch directly to a paired-samples z -test.
- E) Multiply the final p -value by the calculated F statistic.

17. Which of the following modifications would not increase the statistical power of an independent-samples t -test?

- A) Increasing the number of participants in each group.
- B) Decreasing the population variance.
- C) Changing the hypothesis test from a two-tailed test to a one-tailed test.
- D) Increasing the overall effect size.
- E) Decreasing the significance level from .05 to .01.

18. If there are k groups in the experiment, which of the following statements is true regarding the within-groups estimate of the population variance?
- A) It is directly affected by whether the treatment effect is present or not.
 - B) It is calculated by dividing the group sum of squares by $(k - 1)$.
 - C) It reflects both the treatment effect and random variation due to chance factors.
 - D) Under the assumption of homogeneity of variance, it is not affected by whether the null hypothesis is true or false.
 - E) It can be easily calculated even if the population variances are completely heterogeneous and cannot be pooled.
19. When an ANOVA yields a significant F result and a researcher needs to conduct multiple pairwise comparisons among 5 group means, how does the Bonferroni correction control the Familywise Type I error rate at .05?
- A) By increasing the alpha level for each individual comparison to .50.
 - B) By dividing the overall significance level by the number of comparisons, setting each individual comparison's alpha to .005.
 - C) By adjusting the degrees of freedom rather than changing the alpha level.
 - D) By combining all 10 comparisons into a single Chi-Square test.
 - E) By reducing the number of comparisons from 10 down to 5.
20. In a factorial design, how is a main effect defined and evaluated differently from an interaction effect?
- A) A main effect evaluates the effect of one factor at only one specific level of another factor.
 - B) A main effect is calculated using cell means, whereas an interaction effect relies strictly on grand means.
 - C) A main effect represents the effect of one factor ignoring or averaging across the other factor, while an interaction shows if the effect of one factor changes across the levels of another.
 - D) A main effect can only be analyzed if the sample sizes across all cells are unequal.
 - E) A main effect always produces nonparallel lines when plotted on a line chart.
21. When a researcher has unequal sample sizes in a factorial ANOVA design, what is the primary statistical issue?
- A) The calculation of the within-groups error sum of squares becomes completely impossible.
 - B) The total sum of squares cannot be perfectly partitioned, requiring different types of sums of squares adjustment (Type I, II, III).
 - C) The one-way ANOVA calculations become severely biased, while the factorial ANOVA remains totally unaffected.
 - D) The degrees of freedom for the interaction effect drops automatically to zero.
 - E) It guarantees that the statistical power of the test will instantly rise to 99%.
22. What is the primary statistical advantage of using a One-Way Repeated-Measures ANOVA over a standard One-Way Between-Subjects ANOVA?
- A) It expands the degrees of freedom for the error term.
 - B) It completely bypasses the assumption of normality for all variables.
 - C) It removes subject-to-subject variability from the error term, thereby increasing statistical power.
 - D) It eliminates the need to perform any post-hoc pairwise comparisons.
 - E) It ensures that sample covariance structures are completely uncorellated.

23. When a simple linear regression model includes exactly one predictor variable, what is the relationship between the standardized regression coefficient and the Pearson correlation coefficient?
- A) The standardized regression coefficient is equal to the square root of the correlation coefficient.
 - B) The standardized regression coefficient is always equal to 0, regardless of the correlation coefficient.
 - C) The standardized regression coefficient is equal to the correlation coefficient.
 - D) The standardized regression coefficient is calculated by dividing the correlation coefficient by the sample size.
 - E) The standardized regression coefficient is equal to the coefficient of determination.
24. Under the Least Squared Error Principle used to determine the single best regression line, which of the following statements is true regarding the prediction errors?
- A) The sum of the predicted errors is always equal to 0.
 - B) The sum of squared errors is maximized to increase accuracy.
 - C) The regression line is chosen to ensure that all individual residual values are exactly equal to 1.
 - D) The sum of the predicted errors is identical to the total sum of squares.
 - E) Prediction errors will only exist if the correlation coefficient is perfectly equal to +1.00 or -1.00.
25. What is multicollinearity, and what is its primary negative effect on a multiple regression analysis?
- A) It refers to having too many criterion variables, which makes the coefficient of determination drop to zero.
 - B) It occurs when predictor variables are highly correlated with each other, making the regression equation very unstable from one sample to another.
 - C) It occurs when a predictor variable has a perfect linear correlation of exactly 0 with the criterion variable.
 - D) It refers to a situation where the residuals are bimodal, which automatically inflates the statistical power.
 - E) It is a refinement procedure that guarantees theoretical constructs will match statistical manipulations.