單選題(共 50 題，每題 2 分)：請按照題號順序作答

For your references: $Z_{0.10} = 1.28$, $Z_{0.05} = 1.65$, $Z_{0.025} = 1.96$, $Z_{0.01} = 2.33$, $Z_{0.005} = 2.58$, $Z_{0.001} = 3.1$, $Z_{0.0001} = 3.7$

1. Which of the following statements is false?
   A. The width of a confidence interval estimate of the population mean narrows when the sample size increases
   B. The width of a confidence interval estimate of the population mean narrows when the value of the sample mean increases
   C. The width of a confidence interval estimate of the population mean widens when the variance increases
   D. The width of a confidence interval estimate of the population mean widens when the confidence level increases
   E. All of the above statements are true
2. A population that consists of 500 observations has a mean of 40 and a standard deviation of 15. A sample of size 100 is taken at random from this population. The standard error of the sample mean equals:
   A. 2.50 B. 12.50 C. 1.343 D. 1.50 E. None of the above
3. In testing whether the means of two normal populations are equal, summary statistics computed for two independent samples are as follows: $\{ n_1 = 25,\ \bar{x}_1 = 7.30,\ s_1 = 1.05 \}$ and $\{ n_2 = 25,\ \bar{x}_2 = 6.80,\ s_2 = 1.20 \}$. Assume that the population variances are equal. Then, the standard error of the sampling distribution of the sample mean difference $\bar{x}_1 - \bar{x}_2$ equals to:
   A. 0.1017 B. 1.2713 C. 0.3189 D. 1.1275 E. None of the above
4. The ratio of two independent chi-squared variables divided by their degrees of freedom is:
   A. normally distributed B. Student *t* distributed
   C. chi-squared distributed D. Exponential distributed E. None of the above
5. Which statistical technique is appropriate when we describe a single population of qualitative data with exactly two categories?
   A. z-test of a population proportion
   B. The chi-squared test of a multinomial experiment
   C. The chi-squared test of a contingency table
   D. Both a and b
   E. Both b and c
6. The number of degrees of freedom for a contingency table with 4 rows and 8 columns is
   A. 32 B. 28 C. 24 D. 12 E. None of the above
7. The chi-squared distribution is Not used:
   A. in a goodness-of-fit test B. in a test of a contingency table
   C. in making inferences about a single population variance
   D. in analysis of variance E. in multinomial test
8. Which of the following statements is not correct?
   A. The chi-squared distribution is symmetrical
   B. The chi-squared distribution is skewed to the right
   C. All values of the chi-squared distribution are positive
   D. The critical region for a goodness-of-fit test with *k* categories is $\chi^2 > \chi^2_{\alpha,k-1}$
   E. All of above are correct
9. The nonparametric counterpart of the parametric *t*-test of μ_D for matched pairs is the:
   A. Friedman test B. Kruskal-Wallis test
   C. Wilcoxon sign rank test D. Wilcoxon rank sum test E. Run test
10. Consider the following data set: {1.2, 1.3, 1.3, 1.5, 1.6, 1.7, 1.8, 1.8, 1.8, 1.9, 2.1, 2.2, 2.5}. The rank assigned to the three observations of value 1.8 is:
    A. 5 B. 6 C. 7 D. 8 E. 9
11. Consider the following two samples: A = {12, 14, 15} and B = {11, 13, 16, 16, 17, 19, 20}. The value of the test statistic for a right-tail Wilcoxon rank sum test is:

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A. 7　B. 11　C.22　D. 33　E.44

12. A matched pairs experiment yielded the following paired differences: Sample 1 = {3, -2, 2, 2, 2, -2, 0, 1, 0} and Sample 2 = {3, 0, -1, 2, -1, 3, 2, 1, 2}. The value of the standardized sign test statistic z^* is:
A. 1.807　B. 11.0　C.3.873　D. –5.939　E. None of the above

13. A nonparametric method to compare two populations, when the samples are independent and the data are ordinal, is the:
A. Wilcoxon sign rank test　B. sign test
C. Friedman test　D. Run test　E. None of the above

14. A nonparametric method to compare two or more populations, when the samples are independent and the data are either ordinal or interval but not normal, is the:
A. Kruskal-Wallis test　B. Friedman test　C. Wilcoxon rank sum test
D. Wilcoxon signed rank sum test　E. None of the above

15. The Wilcoxon rank sum test (like most of the nonparametric tests presented in your book) actually tests to determine whether the population distributions have identical:
A. Locations　B. Spreads (variances)　C. Shapes
D. All of the above are correct answers　E. None of the above

16. The nonparametric counterpart of the randomized block model of the analysis of variance is the:
A. Kruskal-Wallis test　B. Friedman test　C. Wilcoxon rank sum test
D. Wilcoxon signed rank sum test　E. None of the above

17. In a Wilcoxon signed rank sum test for matched pairs with n = 32, the rank sums of the positive and negative differences are 367.5 and 160.5, respectively. The value of the standardized test statistic z *is*:
A. 3.764　B. 1.882　C.1.391　D. 1.935　E. None of the above

18. The following sum of squares are produced:
$\sum (y_i - \bar{y})^2 = 200$, $\sum (y_i - \hat{y}_i)^2 = 50$, $\sum (\hat{y}_i - \bar{y})^2 = 150$
The percentage of the variation in y that is explained by the variation in x is:
A. 25%　B. 75%　C.33%　D. 50%　E. None of the above

19. The regression line $\hat{y} = 3 + 2x$ has been fitted to the data points (4,8), (2,5), and (1,2). The sum of the squared residuals will be:
A. 7　B. 15　C.8　D. 30　E. None of the above

20. A regression line using 25 observations produced SSR = 118.68 and SSE = 56.32. The standard error of estimate was:
A. 2.1788　B. 1.5648　C.1.5009　D. 2.2716　E. None of the above

21. In testing the hypotheses: $H_0 : \beta_1 = 0$ and $H_1 : \beta_1 \neq 0$ with the following statistics are available: n = 10, $b_0 = -1.8$, $b_1 = 2.45$, $s_{b_1} = 1.20$, $\hat{y} = 6$. The value of the test statistic is:
A. 2.042　B. 0.306　C.–1.50　D. –0.300　E. None of the above

22. In a multiple regression analysis involving 6 independent variables, the sum of squares are calculated as: Total variation in Y = SSY = 900, SSR = 600 and SSE = 300. The value of the F-test statistic for this model is:
A. 150　B. 100　C.50　D. 200　E. None of the above

23. In order to test the validity of a multiple regression model involving 5 independent variables and 30 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of F are:
A. 5 and 30　B. 6 and 29　C.5 and 24　D. 6 and 25　E. None of the above

24. In a multiple regression analysis involving 20 observations and 5 independent variables, Total variation in Y = SSY = 250 and SSE = 35. The multiple coefficient of determination adjusted for degrees of freedom is:
A. 0.880　B. 0.860　C.0.835　D. 0.831　E. None of the above

25. In a regression model involving 50 observations, the following estimated regression model was obtained: $\hat{y} = 10.5 + 3.2x_1 + 5.8x_2 + 6.5x_3$. For this model, SSR = 450 and SSE = 175. The value of MSR is:
A. 12.50　B. 275　C.150　D. 3.804　E. None of the above

26. Random samples of size 49 are taken from an infinite population whose mean is 300 and standard deviation is 21. The mean and standard error of the sample mean, respectively, are:
A. 300 and 21　B. 300 and 3　C.70 and 230　D. 49 and 21　E. None of the above

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27. A normally distributed population with 200 elements has a mean of 60 and a standard deviation of 10. The probability that the mean of a sample of 25 elements taken from this population will be smaller than 56 is
A. 0.0166 B. 0.0228 C. 0.3708 D. 0.0394 E. 0.0450

28. A sample of size 25 is selected at random from a finite population. If the finite population correction factor is 0.6325, then the population size is:
A. 10 B. 41 C. 15 D. 35 E. None of the above

29. The multiple coefficient of determination is defined as:
A. SSE/SST B. MSE/MSR C. 1- (SSE/SST)
D. 1- (MSE/MSR) E. None of the above

30. In testing the difference between two population means, the samples are matched pairs. Which of the following tests is appropriate?
A. z-test B. Equal-variances *t*-test
C. Randomized block design ANOVA
D. Spearman test E. None of the above

31. You asked five of your classmates about their height. On the basis of this information, you stated that the average height of all students in your university or college is 67 inches. This is an example of:
A. Descriptive statistics B. Inferential statistics C. Parameter
D. Population E. None of above

32. For the example, "the size of fries (small, medium, large) ordered by a sample of McDonald customers", identify the data type and the appropriate measurement scale.
A. Ranked data, Ordinal scale B. Quantitative data, Interval scale
C. Quantitative data, Interval scale D. Ranked data, Ordinal scale
E. None of above

33. Which of the following statements about the arithmetic mean is not always correct?
A. Half of the observations are on either side of the mean.
B. The sum of the deviations from the mean is zero.
C. The mean is a measure of the middle (center) of a distribution.
D. The value of the mean times the number of observations equals the sum of all of the observations.
E. All of the above.

34. Suppose that a firm's sales were $2,500,000 four years ago, and sales have grown annually by 25%, 15%, -5%, and 10% since that time. What was the geometric mean growth rate in sales over the past four years?
A. In the range of [0.480, 0.640] B. In the range of [0.360, 0.480)
C. In the range of [0.240, 0.360) D. In the range of [0.120, 0.240)
E. In the range of [-0.100, 0.120)

35. A politician wants to estimate the mean age of registered voters in her district. Unfortunately, she does not have a complete list of households. So she select a sample from each county in her district. What is this type of sampling called?
A. Simple random sampling B. Stratified random sampling
C. Cluster sampling D. Systematic Sampling
E. None of the above

36. In a histogram, what is the proportion of the total area that must be to the right of the mean?
A. Less than .50 if the distribution is skewed to the left.
B. Exactly equal to .50
C. More than .50 if the distribution is skewed to the right.
D. Exactly equal to 1.0 if the distribution is symmetric and bimodal.
E. Exactly equal to .50 if the distribution is symmetric and unimodal.

37. A standard admissions test was given at three locations. One thousand students took the test at location *A*, 600 students at location *B*, and 400 students at location *C*. The percentages of students from locations *A*, *B*, and *C*, who passed the test were 70%, 68%, and 77%, respectively. One student is selected at random from among those who took the test. If the selected student passed the test, what is the probability that the student took the test at location *B*?
A. In the range of [0.000, 0.200] B. In the range of [0.200, 0.400)
C. In the range of [0.400, 0.600) D. In the range of [0.600, 0.800)

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E. In the range of [0.800, 1.000)

38. Continued from question 37, what is the probability that the selected student took the test at location *C* and failed?
A. In the range of [0.000, 0.200] B. In the range of [0.200, 0.400)
C. In the range of [0.400, 0.600) D. In the range of [0.600, 0.800)
E. In the range of [0.800, 1.000)

39. A woman is expecting her second child. Her doctor has told her that she has a 50-50 chance of having another girl. If she has another girl, there is a 90% chance that she will be taller than the first. If she has a boy, however, there is only a 25% chance that he will be taller than the first child. Find the probability that the woman's second child will be taller than the first.
A. In the range of [0.000, 0.200] B. In the range of [0.200, 0.400)
C. In the range of [0.400, 0.600) D. In the range of [0.600, 0.800)
E. In the range of [0.800, 1.000)

40. An analysis of the stock market produces the following information about the returns of two stocks.

	Stock 1	Stock 2
Expected Returns	15%	18%
Standard Deviations	20	32

Assume that the returns are positively correlated with $\rho_{12} = .60$. What is the standard deviation of the return on a portfolio consisting of an equal investment in each of the two stocks?
A. In the range of [0%, 10%] B. In the range of [10%, 20%)
C. In the range of [20%, 40%) D. In the range of [40%, 80%)
E. In the range of [80%, 120%)

41. Continue from question 40, suppose that you wish to invest $1 million. Which of the following combination of stock 1 and stock 2 would you choose to minimize the level of risk (variance of return)?
A. 100% on stock 1 B. 100% on stock 2
C. 50% on stock 1, 50% on stock 2 D. 60% on stock 1, 40% on stock 2
E. 80% on stock 1, 20% on stock 2

42. The length of time patients must wait to see a doctor at an emergency room in a large hospital is uniformly distributed between 40 minutes and 3 hours. What is the probability that a patient would have to wait between 50 minutes and two hours?
A. In the range of [0.000, 0.200] B. In the range of [0.200, 0.400)
C. In the range of [0.400, 0.600) D. In the range of [0.600, 0.800)
E. In the range of [0.800, 1.000)

43. A used car salesman in a small town states that, on the average, it takes him 5 days to sell a car. Assume that the probability distribution of the length of time between sales is exponentially distributed. What is the probability that he will have to wait between 6 and 10 days before making another sale?
A. In the range of [0.000, 0.200] B. In the range of [0.200, 0.400)
C. In the range of [0.400, 0.600) D. In the range of [0.600, 0.800)
E. In the range of [0.800, 1.000)

44. Automobile insurance appraisers examine cars that have been involved in accidental collisions and estimate the cost of repairs. An insurance executive claims that there are significant differences in the estimates from different appraisers. To support his claim he takes a random sample of six cars that have recently been damaged in accidents. Three appraisers then estimate the repair costs of all six cars. From the result shown below, can we infer at the 5% significance level that the executive's claim is true?

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Treatments	52,877.78	2	26,438.889	7.457	.01042	4.103
Blocks	1,844,311.11	5	368,862.222	104.035	.00003	3.326
Error	35,455.56	10	3545.556			
Total	1,932,644.44	17				

A. Don't reject the null hypothesis. There are significant differences in the estimates.
B. Reject the null hypothesis. There are significant differences in the estimates.
C. Don't reject the null hypothesis. There are no significant differences in the estimates.
D. Reject the null hypothesis. There are no significant differences in the estimates.
E. None of the above.

45. Continued from question 44, can we infer at the 5% significance level that these cars are different?

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A. Don't reject the null hypothesis. There are no significant differences in these six cars.
B. Reject the null hypothesis. There are no significant differences in these six cars.
C. Don't reject the null hypothesis. There are significant differences in these six cars.
D. Reject the null hypothesis. There are significant differences in these six cars.
E. None of the above.

46. A recent college graduate is in the process of deciding which one of three graduate schools he should apply to. He decides to judge the quality of the schools on the basis of the Graduate Management Admission Test (GMAT) scores of those who are accepted into the school. A random sample of six GMAT scores from the students in each school was taken. Assuming that the data are normally distributed and from the result shown below, can we infer at the 5% significance level that the GMAT scores differ among the three schools?

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatments	28,511.11	2	14,755.56	5.1651	0.01967
Error	41,400.00	15	2,760.00		
Total	69,911.11	17			

A. There is evidence that the GMAT scores differ among the three schools at α=5%.
B. There is evidence that the GMAT scores differ among the three schools at α=1%.
C. There is evidence that the GMAT scores are the same among the three schools at α=1%.
D. There is evidence that the GMAT scores are the same among the three schools at α=5%.
E. None of the above.

47. Continued from question 46, use Tukey's method and obtain ω = 78.713 with $\alpha = 0.05$. $\bar{x}_1 = 646.67$, $\bar{x}_2 = 606.67$, and $\bar{x}_3 = 523.33$.

A. All three schools are different.
B. Schools 1 and 2 are different.
C. Schools 2 and 3 are the same.
D. Schools 2 and 3 are different.
E. Non of the above.

48. A professor of statistics is trying to determine which of four statistical software packages is the best for his students. He believes that the time (in hours) it takes a student to master particular software may be influenced by gender. A 4*2 factorial experiment with five replicates was designed. Is there sufficient evidence at α=5% to deter that differences exist among the types of software?

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Software	94.778	3	31.593	3.258	0.0409
Gender	53.389	1	53.389	5.506	0.0284
Interaction	76.778	3	25.593	2.639	0.0748
Error	213.333	22	9.697		
Total	438.278	29			

A. Don't reject the null hypothesis. There are differences exist among the types of software.
B. Reject the null hypothesis. There are differences exist among the types of software.
C. Don't reject the null hypothesis. There are no differences exist among the types of software.
D. Reject the null hypothesis. There are no differences exist among the types of software.
E. None of the above.

49. Continued from question 48, are the differences existing among male and female students?

A. There is no evidence that differences existing between male and female students at α=5%.
B. There is no evidence that differences existing between male and female students at α=10%.
C. There is evidence that no differences existing between male and female students α=10%.
D. There is evidence that no differences existing between male and female students at α=5%.
E. None of the above.

50. Continued from question 48, is there sufficient evidence to infer that the time it takes a student to master software and the gender of the student interact at α=5%?

A. Don't reject the null hypothesis. Interaction of software packages and genders exists.
B. Reject the null hypothesis. Interaction of software packages and genders exists.
C. Don't reject the null hypothesis. No interaction of software packages and genders exists.
D. Reject the null hypothesis. No interaction of software packages and genders exists.
E. None of the above.