

本份統計考題總分為 100 分。

一、單選題(共 50 題，每題 2 分)：請按照題號順序作答

1. The eight employees of the Tuning Department and their "years of experience" are listed in the following table. If a sample of two employees is selected without replacement, which of the following is not a possible value of the sample mean years of experience?

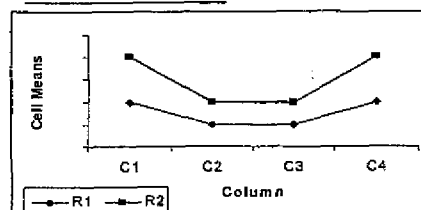
Employee	A	B	C	D	E	F	G	H
Experience (years)	10	2	1	1	15	7	4	8

- A. 9      B. 12.5      C. 4      D. 2      E. None of the above
2. Suppose 40% of all college students have a computer at home and a sample of 64 is taken. What is the probability that more than 30 of those in the sample have a computer at home?  
A. 0.3686      B. 0.1314      C. 0.8686      D. 0.6314      E. None of the above
3. 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
4. The width of a confidence interval estimate of the population mean widens when the:  
A. level of confidence decreases  
B. sample size decreases  
C. value of the population standard deviation decreases  
D. All of the above statements are correct  
E. All of the above.
5. A random sample of 64 items is selected from a population of 400 items. The sample mean is 200 and the sample standard deviation is 48. From this data, a 95% confidence interval to estimate the population mean can be computed as:  
A. 189.21 to 210.79      B. 188.24 to 211.76  
C. 190.13 to 209.87      D. 190.94 to 209.06      E. None of the above
6. When a null hypothesis is rejected, the probability of committing a Type II error is:  
A.  $\alpha$       B.  $\beta$       C.  $1-\alpha$       D.  $1-\beta$       E. None of the above
7. Power of test is equal to:  
A.  $1-\alpha$ , if the null hypothesis is true      B.  $\alpha$ , if the null hypothesis is false  
C.  $1-\beta$ , if the null hypothesis is false      D.  $\beta$ , if the null hypothesis is true  
E. None of above
8. Suppose a researcher is testing a null hypothesis that  $\mu = 61$ . A random sample of  $n = 36$  is taken resulting in a sample mean of 63 and  $S=9$ . The calculated Z value is:  
A. -0.22      B. 0.22      C. 8      D. 6      E. None of the above
9. Suppose the sum of squares for treatment in a one-way ANOVA are 73.2 and the mean squares for error are 9.8. There were four treatments and 7 subjects received each treatment (for a total of 28). The calculated value of F is:  
A. 9.8      B. 34.2      C. 14.6      D. 2.49      E. None of the above
10. For the following ANOVA table, the calculated F value is:

Source of Variation	SS	df	MS	F
Treatment		4		
Error	360			
Total	440	16		

- A. 0.67      B. 1.50      C. 6.00      D. 5.00      E. None of the above

11. The following graph indicates a \_\_\_\_\_.



- A.  $2 \times 4$  factorial design with interaction  
 C.  $4 \times 2$  factorial design with interaction  
 E. In the range of  $[0.800, 1.000)$
- B.  $4 \times 2$  factorial design with no interaction  
 D.  $3 \times 3$  factorial design with interaction
12. A chi-square goodness-of-fit test is to be used to determine if a distribution is normally distributed. The data will be divided into "k" categories. Both the mean and standard deviation must be estimated. The degrees of freedom would be :  
 A.  $k-1$       B.  $k-2$       C.  $k-3$       D.  $k-4$       E. None of the above
13. A variable contains five categories. It is expected that data are uniformly distributed across these five categories. To test this, a sample of observed data is gathered on this variable resulting in frequencies of 27, 30, 29, 21, 24. Using  $\alpha = .01$ , the calculated value of chi-square is :  
 A. 2.09      B. 9.82      C. 1.62      D. 17.81      E. None of the above
14. Calculate the Spearman rank correlation coefficient for the following set of data:
- |   |    |    |    |    |    |
|---|----|----|----|----|----|
| X | 21 | 22 | 35 | 32 | 33 |
| Y | 18 | 24 | 28 | 22 | 35 |
- A. -0.2      B. 1.00      C. 0.20      D. 0.80      E. None of the above
15. Consider the following data set: {11, 11, 12, 13, 15, 16, 16, 17, 18, 19, 20, 22, 22, 22, 22, 25}. The rank assigned to the four observations of value 22 is:  
 A. 12      B. 12.5      C. 13      D. 14      E. None of the above
16. Consider the following two samples:  $A = \{14, 15, 17, 20, 45\}$  and  $B = \{25, 29, 32, 35, 38\}$ . The value of the test statistic for a left-tail Wilcoxon rank sum test is:  
 A. 6      B. 20      C. 35      D. 55      E. None of the above
17. The nonparametric counterpart of the parametric  $t$ -test of  $\mu_D$  for matched pairs is the:  
 A. Friedman test      B. Kruskal-Wallis test  
 C. Wilcoxon signed rank sum test      D. Wilcoxon rank sum test  
 E. None of the above
18. A nonparametric method that is equivalent to the Wilcoxon rank sum test is the:  
 A. Wilcoxon signed rank sum test      B. Mann-Whitney test  
 C. Kruskal-Wallis test      D. Friedman test  
 E. None of the above
19. A nonparametric method to compare two populations, when the samples are matched pairs and the data are ordinal, is the:  
 A. Sign test      B. Wilcoxon signed rank sum test  
 C. Wilcoxon rank sum test      D. matched pairs  $t$ -test  
 E. None of the above
20. If there are two unbiased estimators of a population parameter, the one whose variance is smaller is said to be:  
 A. the better estimator      B. relatively efficient  
 C. consistent      D. relatively unbiased      E. None of the above
21. 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
22. One-way ANOVA is applied to independent samples taken from three normally distributed populations with equal variances. The following summary statistics were calculated:  $\{n_1 = 10, \bar{x}_1 = 40, s_1 = 5\}$ ,  $\{n_2 = 10, \bar{x}_2 = 48, s_2 = 6\}$ , and  $\{n_3 = 10, \bar{x}_3 = 50, s_3 = 4\}$ . The between-treatments variation equals  
 A. 460      B. 688      C. 560      D. 183      E. None of the above
23. The randomized block design with exactly two treatments is equivalent to a two-tail:  
 A. independent samples  $z$ -test  
 B. independent samples equal-variances  $t$ -test  
 C. independent samples unequal-variances  $t$ -test  
 D. matched pairs  $t$ -test  
 E. None of the above.

24. In the two-way ANOVA where  $a$  is the number of factor A levels,  $b$  is the number of factor B levels, and  $r$  in the number of replicates, the degrees of freedom for error is given by:  
 A.  $(a-1)(b-1)$  B.  $abr - 1$  C.  $ab(r-1)$  D.  $(a-1)(r-1)$  E. None of the above
25. The  $F$ -test of the randomized block design of the analysis of variance requires that the random variable of interest must be normally distributed and the population variances must be equal. When the random variable is not normally distributed, we can use  
 A. Kruskal-Wallis test B. two-way ANOVA  
 C. Chi-square test D. Friedman test  
 E. Non of the above.
26. Which one of the following statements is true?  
 A. Some hotels ask their guests to rate the hotel's services as excellent, very good, good, and poor. This is an example of the interval scale.  
 B. The scale of measurement that is simply a label for the purpose of identifying the attribute of an element is the ordinal scale.  
 C. In a questionnaire, respondents are asked to mark their gender as male or female. Gender is an example of the nominal scale.  
 D. The scale of measurement that has an inherent zero value defined is the interval scale.  
 E. None of the above
27. A tabular method that can be used to summarize the data on two variables simultaneously is called  
 A. simultaneous equations B. crosstabulation  
 C. a histogram D. an ogive E. None of the above
28. The hourly wages of a sample of 130 system analysts are {mean = 60, range = 20, mode = 73, variance = 324, median = 74}. The coefficient of variation equals  
 A. 5.4% B. 54% C. 0.38% D. 38% E. None of the above
29. The interquartile range is used as a measure of variability to overcome what difficulty of the range?  
 A. The range is influenced too much by extreme values.  
 B. The range is difficult to compute.  
 C. The sum of the range variances is zero.  
 D. The range is negative.  
 E. None of the above
30. Assume you have applied for two scholarships, a Merit scholarship (M) and an Athletic scholarship (A) The probability that you receive an Athletic scholarship is 0.18. The probability of receiving both scholarships is 0.11. The probability of getting at least one of the scholarships is 0.3. What is the probability of receiving the Athletic scholarship given that you have been awarded the Merit scholarship?  
 A. 0.6111 B. 0.23 C. 0.3827 D. 0.4783 E. None of the above
31. A survey of a group of 115 tourists was taken in St. Louis. The survey showed the following: 64 of the tourists plan to visit Gateway Arch; 48 plan to visit the zoo; 11 plan to visit the Art Museum and the zoo, but not the Gateway Arch; 13 plan to visit the Art Museum and the Gateway Arch, but not the zoo; 19 plan to visit the Gateway Arch and the zoo, but not the Art Museum; 7 plan to visit the Art Museum, the zoo and the Gateway Arch; 16 plan to visit none of the three places. What is the probability for the tourist to visit the Art Museum only?  
 A. 13/115 B. 99/115 C. 62/115 D. 37/115 E. None of the above
32. Twenty-five percent of all resumes received by a corporation for a management position are from females. Fifteen resumes will be received tomorrow. What is the probability that fewer than 3 of the resumes will be from females?  
 A. 0.1651 B. 0.2361 C. 0.2251 D. 0.5468 E. None of the above
33. The Globe Fishery packs shrimp that weigh more than 1.91 ounces each in packages marked "large" and shrimp that weigh less than 0.47 ounces each into packages marked "small"; the remainder are packed in "medium" size packages. Assume that the shrimps' weights are normally distributed. If a day's catch showed that 19.77 percent of the shrimp were large and 6.06 percent were small, what are the mean and the standard deviation for the shrimp weights.  
 A.  $(\mu=1.2, \sigma=1)$  B.  $(\mu=1.4, \sigma=0.9)$  C.  $(\mu=1.2, \sigma=0.6)$  D.  $(\mu=1, \sigma=1.2)$  E. None of the above
34. The management of a company has recorded data on yearly sales (units in thousands of dollars) and advertising (units in hundreds of dollars) for the past five years. From the existing data, the following information has been compiled:  $\{\sum X = 132, \sum X^2 = 3502, \sum Y = 96, \sum Y^2 = 1870, \sum XY = 2553\}$ . Using the

above information, develop the least squares estimated regression line. Using the regression line, develop a 95% confidence interval for estimating the mean sale for those years when advertising was \$3,000.

- A. [\$16,373.23, \$29,112.77]    B. [\$16,373.23, \$27,731.46]  
 C. [\$18,454.85, \$29,112.77]    D. [\$18,454.85, \$27,731.46]    E. None of the above
35. Which one of the following statements is true?
- A. The numerical value of the coefficient of determination is always larger than the coefficient of correlation.  
 B. The numerical value of the coefficient of determination is always smaller than the coefficient of correlation.  
 C. The numerical value of the coefficient of determination can be larger or smaller than the coefficient of correlation.  
 D. The numerical value of the coefficient of determination is negative if the coefficient of determination is negative.  
 E. None of the above.
36. The following estimated regression model was developed relating yearly income ( $Y$  in \$1,000s) of 30 individuals with their age ( $X_1$ ) and their gender ( $X_2$ ) (0 if male and 1 if female).  $Y = 30 + 0.7X_1 + 3X_2$ . Also provided are  $SST = 1,200$  and  $SSE = 384$ . From the above function, it can be said that the expected yearly income of
- A. The expected yearly income of males is \$3 more than females.  
 B. The expected yearly income of females is \$3 more than males.  
 C. The expected yearly income of males is \$3,000 more than females.  
 D. The expected yearly income of females is \$3,000 more than males.  
 E. None of the above.
37. A stratified simple random sample has been taken with the following results. Develop an approximate 95% confidence interval for the population proportion.

Stratum ( $h$ )	$p_h$	$N_h$	$n_h$
1	0.25	400	30
2	0.30	350	45
3	0.35	250	40

- A. [0.2083, 0.3767]    B. [0.2083, 0.3346]  
 C. [0.2232, 0.3767]    D. [0.2232, 0.3346]    E. None of the above
38. The quality control department of a company has decided to select a sample of 10 items from the shipments received; and if the sample contains no defective parts, the entire shipment will be accepted. If there are 40 defective items in a shipment, what is the probability that the entire lot will be accepted?
- A. 0.5987    B. 0.3487    C. 0.1696    D. 0.1074    E. None of the above
39. The following data show the quarterly sales of a major auto manufacturer for the years 8 through 10. Use the four-quarter moving average values and compute the seasonal factors for the four quarters.

Year	Quarter	Sales	Year	Quarter	Sales	Year	Quarter	Sales
8	1	160	9	1	200	10	1	210
	2	180		2	210		2	240
	3	190		3	260		3	290
	4	170		4	230		4	260

- A. (0.9807, 0.9469, 1.1144, 0.9580)    B. (0.9367, 0.9701, 1.1024, 0.9476)  
 C. (0.9469, 0.9807, 1.1144, 0.9580)    D. (0.9476, 0.9367, 1.1024, 0.9701)  
 E. None of above
40. 15. Given the number of units sold during 5 years at a boat dealership, the seasonal factors for all four quarters are (1.1132, 0.9954, 0.9056, 0.9858) and the linear trend from the deseasonalized sales is  $Y = 216.2993 + 17.35763t$ . Forecast the number of units sold in each quarter of year 6.
- A. (580.81, 598.17, 615.52, 632.88)    B. (646.56, 595.42, 557.42, 623.90)  
 C. (521.75, 600.93, 679.69, 642.00)    D. (623.90, 557.42, 595.42, 646.56)  
 E. None of above
41. Consider the following information. Compute the Laspeyres index.

Item	1989		2001	
	Price	Quantity	Price	Quantity

A	\$ .25	210	\$ .37	210
B	.87	2	1.15	2
C	10.00	4	15.00	4
D	.35	35	.60	35

- A. 149.259      B. 132.184      C. 150      D. 171.429      E. None of the above
42. A variable such as  $Z$ , whose value is  $Z = X_1X_2$  is added to a general linear model in order to account for potential effects of two variables  $X_1$  and  $X_2$  acting together. This type of effect is  
 A. impossible to occur      B. called interaction  
 C. called multicollinearity effect      D. called transformation effect  
 E. None of the above
43. In a laboratory experiment, data were gathered on the life span ( $Y$  in months) of 33 rats, units of daily protein intake ( $X_1$ ), and whether or not agent  $X_2$  (a proposed life extending agent) was added to the rats diet ( $X_2 = 0$  if agent  $X_2$  was not added, and  $X_2 = 1$  if agent was added.) From the results of the experiment, the following regression model was developed.  $Y = 36 + 0.8X_1 - 1.7X_2$ . Also provided are  $SSR = 60$  and  $SST = 180$ . The life expectancy of a rat that was given 2 units of agent  $X_2$  daily, but was not given any protein is  
 A. 32.6      B. 36      C. 34.3      D. 38      E. None of the above
44. Refer to problem 18. The multiple coefficient of determination is  
 A. 0.25      B. 0.3333      C. 0.20      D. 0.50      E. None of the above
45. When dealing with the problem of non-constant variance, the reciprocal transformation means using  
 A.  $1/Y$  as the dependent variable instead of  $Y$ .  
 B.  $1/X$  as the independent variable instead of  $X$ .  
 C.  $X^2$  as the independent variable instead of  $X$ .  
 D.  $Y^2$  as the dependent variable instead of  $Y$ .  
 E. None of the above.
46. A soft drink filling machine is set up to fill bottles with 12 ounces of soft drink. The standard deviation  $s$  is known to be 0.4 ounces. The quality control department periodically selects samples of 16 bottles and measures their contents. Assume the distribution of filling volumes is normal. The means of six samples were 11.8, 12.2, 11.9, 11.9, 12.1, and 11.8 ounces. Construct an  $\bar{X}$  bar chart and indicate whether or not the process is in control.  
 A. The process is not in control through constructing an  $\bar{X}$  bar chart.  
 B. The process is in control through constructing an  $\bar{X}$  bar chart.  
 C. The process is not in control through constructing a  $P$  chart.  
 D. The process is in control through constructing a  $P$  chart.  
 E. None of the above.
47. We are interested in selecting a sample from a population of size 4,000 in order to develop an approximate 95% confidence interval estimate of the population mean. A pilot study has resulted in a standard deviation of 600. What should be the sample size if we do not want the sampling error to exceed 200?  
 A. 32      B. 25      C. 24      D. 36      E. None of the above
48. The probability function for the number of insurance policies John will sell to a customer is given by  $f(X) = .5 - (X/6)$  for  $X = 0, 1$ , or  $2$ . What is the probability that John will sell at least 2 policies to a customer?  
 A. 0.167      B. 0.333      C. 0.556      D. 0.667      E. None of the above
49. The advertised weight on a can of soup is 10 ounces. The actual weight in the cans follows a uniform distribution with mean = 9.8 ounces and standard deviation =  $1/12$  ounces. What is the probability that a can of soup will have between 9.8 and 10.0 ounces?  
 A. 0.08      B. 0.12      C. 0.24      D. 0.35      E. None of the above
50. What value of Durbin-Watson statistic indicates no autocorrelation is present?  
 A. 0      B. -2      C. 2      D. 1      E. None of the above