

第一部分：單選題，共 38 題，每題 2 分，共 76 分，請於試卷上「選擇題作答區」內依序作答。

David, Richard, and Peter are the judges for the performance of 陶喆, 吳克群, 孫楠, and 胡彥斌 in a competition. The judges are asked to evaluate four singers on a scale of 0 to 10. Please answer the following 7 questions (1-7).

1. No matter how four singers perform, David's rating is always one point greater than the rating of Richard. If the ratings of Richard on four singers are 9, 7, 6, and 8 respectively, which of the following is correct?
 - (A) The correlation coefficient between David's ratings and Peter's ratings is different from the correlation coefficient between Richard's ratings and Peter's ratings.
 - (B) The correlation coefficient between David's ratings and Peter's ratings must be the same as the correlation coefficient between Richard's ratings and Peter's ratings.
 - (C) Peter's ratings have to be observed first to determine whether the correlation coefficient between David's ratings and Peter's ratings is the same as the correlation coefficient between Richard's ratings and Peter's ratings.
 - (D) Only when Peter's ratings on four singers are exactly identical can the correlation coefficients between David's ratings and Peter's ratings be the same as the correlation coefficients between Richard's ratings and Peter's ratings.
 - (E) Only when Peter's ratings on four singers are a function of either David's ratings or Richard's rating can the correlation coefficients between David's ratings and Peter's ratings be the same as the correlation coefficients between Richard's ratings and Peter's ratings.

2. After standardizing each judge's ratings on 4 singers, which of the following is correct?
 - (A) The correlation coefficient between David's ratings and Peter's ratings is less than the covariance between Richard's ratings and Peter's ratings.
 - (B) The correlation coefficient between David's ratings and Peter's ratings must be the same as the covariance between Richard's ratings and Peter's ratings.
 - (C) Peter's ratings have to be observed first to determine whether the correlation coefficient between David's ratings and Peter's ratings is the same as the covariance between Richard's ratings and Peter's ratings.
 - (D) Only when Peter's ratings on four singers are exactly identical can the correlation coefficients between David's ratings and Peter's ratings be the same as the covariance between Richard's ratings and Peter's ratings.
 - (E) Only when Peter's ratings on four singers are a function of either David's ratings or Richard's rating can the correlation coefficients between David's ratings and Peter's ratings be the same as the covariance between Richard's ratings and Peter's ratings.

3. Following the above questions, after standardization, which of the following is correct?
 - (A) The mean of David's ratings is one point greater than the mean of Richard's ratings.
 - (B) David's ratings can be all positive.

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- (C) Peter's ratings can be all negative.
- (D) When some of Peter's ratings are positive, the magnitude of summed negative ratings must be identical to the magnitude of summed positive ratings.
- (E) When some of Peter's ratings are positive, the number of negative ratings must be identical to the number of positive ratings.
4. Peter is aware that David would like to rate singers one point above Richard's rating. And therefore Peter decides to rate singers two points below Richard's ratings. Which of the following is correct?
- (A) The standardized ratings of David, Richard, and Peter on each singer are exactly identical.
- (B) The covariance between David's ratings and Peter's rating can be greater than 1.
- (C) The covariance between Richard's ratings and Peter's rating can be less than 1.
- (D) The correlation coefficient between David's ratings and Peter's ratings can be positive but less than 1.
- (E) The correlation coefficient between David's ratings and Peter's ratings can be less than the mean of either David's or Peter's standardized ratings.
5. Assume that the covariance between David's ratings and Peter's ratings is negative. Which of the following is correct?
- (A) The valence of David's standardized rating on a given singer should be opposite to the valence of Peter's rating on the same singer.
- (B) The valence of David's standardized rating on a given singer should be identical to the valence of Peter's rating on the same singer.
- (C) The valence of David's standardized rating on a given singer should be either opposite or identical to the valence of Peter's rating on the same singer.
- (D) The number of negative standardized ratings judged by David should be identical to the number of positive standardized ratings judged by Peter.
- (E) The number of negative standardized rating judged by David should not be identical to the number of negative standardized ratings judged by Peter.
6. Following the above questions, John is the big fan of 吳克群, and he loves to watch the competition show broadcast on TV. John notices that Peter's rating on 吳克群 at a competition is always identical to the number of times John is bitten by mosquitos on that day. For example, when Peter's rating on 吳克群 is 4, John gets bitten 4 times by mosquitos on that day; when Peter's ratings on 吳克群 is 7, John gets bitten 7 times by mosquitos on that day, and so on. No exception has been identified. Which of the following is correct?
- (A) In order to make sure that 吳克群 is able to get the high rating, John should try to get bitten by mosquitos as many times as possible.
- (B) Number of times John is bitten by mosquitos and Peter's rating on 吳克群 are positively correlated.
- (C) The covariance between Peter's rating on 吳克群 and number of times John is bitten by mosquitos can be any real number.
- (D) Since the two variables are positively correlated, John can apply regression analysis, and

- the regression coefficient, β , would also be positive
- (E) It is not likely that on the next day when John wins the lottery, the number of times John is bitten by mosquitos is not identical to Peter's rating on 吳克群 any more.
7. In the first competition show, if Peter's rating on 胡彥斌 was 5, it could be because ____.
- (A) Peter believed that the performance of 胡彥斌 on each of the evaluative criteria was neutral
- (B) Peter believed that the performance of 胡彥斌 on half evaluative criteria was above average, but below average performance (with the same magnitude) was perceived on the remaining evaluative criteria which were weighted equally important as positive evaluative criteria.
- (C) Peter never heard of 胡彥斌 before the show, and happened to be seriously distracted during the performance of 胡彥斌 such that no evaluative information of 胡彥斌 was available when making the assessment.
- (D) Peter always rated everything neutrally.
- (E) All of the above
8. A survey reported that 70% of audiences who participated in a speech propogandizing the benefits of vegetarianism were in favor of the vegetarian diet. In contrast, only 38% of people who did not participate in such a speech were in favor of the vegetarian diet. A subsequent analysis showed that 70% is significantly greater than 38%. The survey, therefore, concluded that the speech would successfully and significantly enhance the speech participants' favorability toward the vegetarian diet. Which of the following is correct?
- (A) The survey conclusion made a lot of sense in that after listening to the speech a lot more proportion of people became favorable toward the vegetarian diet.
- (B) The survey conclusion made a lot of sense in that 70% was significantly greater than 38% in the statistical test.
- (C) The survey conclusion might not make any sense in that the speech was usually free and open to the public.
- (D) The survey conclusion might not make any sense in that the speech could primarily attract people who had been in favor of the vegetarian diet, but not those who had been unfavorable toward the vegetarian diet.
- (E) All of the above
9. A hypothesis
- (A) does not test causality relationship between variables, but only tests descriptive or explanatory relationship between variables.
- (B) is a vague and broad problem statement.
- (C) cannot be discovered during research.
- (D) does not have clear implications for testing the relationship between variables.
- (E) is a conjectural statement about the relationship between two variables that are measurable or potentially measurable.
10. The general idea of correlation has been largely used in the research. For example, in Grant's

research, the index of a new set of scales is identified to represent the construct, Service Quality. Grant attempts to confirm his finding by examining the correlation coefficient of this newly found index with another existent index of Service Quality, and the correlation coefficient is 0.70. However, Grant's colleague, Steve, is not fully convinced by Grant's findings. Steve therefore examines the correlation relationship between the newly found index and the index of another construct, Customer Satisfaction. The result shows that the correlation coefficients between the newly found index and the index of Customer Satisfaction is as high as 0.90. Which of the following statements can best characterize such a scenario of how a newly found index is categorized?

- (A) “故從事於道者同於道，德者同於德，失者同於失。” 老子 二十三章
- (B) “無我相、無人相、無眾生相，無壽者相。應無所住而生其心。” 金剛經
- (C) “以指喻指之非指，不若以非指喻指之非指。” 莊子 齊物論
- (D) “信者吾信之，不信者吾亦信之，德信。” 老子 四十九章
- (E) “自其異者視之，肝膽楚越也，自其同者視之，萬物皆一也。” 莊子 德充符

The winning percentage of Yankee in the last season was 0.568. The assistant manager of Yankee, John, believes that the winning percentage will be increased by recruiting 田中將大 as Yankee's starting pitchers. John estimates that the improved winning percentage by additional 15% would pay for the cost of such a recruitment. Any further increase in winning percentage would create an extra profit gain. John would like to test his belief that recruiting 田中將大 would lead to a positive effect on profit. Please answer the following 11 questions (11-21).

11. To examine John's belief, the null hypothesis is

- (A) $H_0: p = 0.568$
- (B) $H_0: p \leq 0.568$
- (C) $H_0: p > 0.568$
- (D) $H_0: p = 0.718$
- (E) $H_0: p \leq 0.50$

12. If the winning percentage of the first season with 田中將大 serving as the starting pitcher approaches 0.680, then which alternative hypothesis should John use to test his belief?

- (A) $H_a: p > 0.680$
- (B) $H_a: p \neq 0.680$
- (C) $H_a: p > 0.718$
- (D) $H_a: p \neq 0.718$
- (E) $H_a: p \neq 0.568$

13. Let $\text{Prob}(x)$ be the probability of x , and \hat{p} be the sampled winning percentage. If $\text{Prob}(\hat{p} > 0.680) = .60$, the power of the test is

- (A) Unknown
- (B) 0.05
- (C) 0.25
- (D) 0.40

- (E) 0.60
14. The power of a statistical test can be _____.
(A) increased by increasing sample size
(B) reduced by increasing sample size
(C) independent of sample size
(D) increased by increasing the level of significance
(E) independent of the level of significance
15. If the Type I error to test John's belief is 0.10, then the Type II error is _____.
(A) 0.90
(B) 0.10
(C) 0.60
(D) 0.40
(E) unknown
16. Continued from the above question, if the Type II error to test John's belief is 0.30, then the probability that the null hypothesis of John is rejected when in fact it is true is _____.
(A) 0.30
(B) 0.70
(C) 0.10
(D) 0.90
(E) 0.05
17. Continued from the above question, the probability that the null hypothesis of John is rejected when in fact it is false is _____.
(A) 0.30
(B) 0.70
(C) 0.10
(D) 0.90
(E) 0.05
18. Continued from the above question, the probability that the null hypothesis of John is not rejected when in fact it is false is _____.
(A) 0.30
(B) 0.70
(C) 0.10
(D) 0.90
(E) 0.05
19. Continued from the above question, the probability that the null hypothesis of John is not rejected when in fact it is true is _____.
(A) 0.30

- (B) 0.70
(C) 0.10
(D) 0.90
(E) 0.05
20. Which of the following is correct?
(A) A 95% confidence interval for Yankee's average winning percentage of all seasons will be equal to a 95% prediction interval for Yankee's winning probability of a given game.
(B) A 95% confidence interval for Yankee's average winning percentage of all seasons will be wider than a 95% prediction interval for Yankee's winning probability of a given game.
(C) A 95% confidence interval for Yankee's average winning percentage of all seasons will be narrower than a 95% prediction interval for Yankee's winning probability of a given game.
(D) A 95% confidence interval for Yankee's average winning percentage of all seasons may be either wider or narrower than a 95% prediction interval for Yankee's winning probability of a given game.
(E) None of the above.
21. If the 95% confidence interval for Yankee's average winning percentage in the last 50 seasons was (0.34, 0.78). Which of the following is correct?
(A) We are 95% confident that the average winning percentage of all seasons are in the interval between 0.34 and 0.78.
(B) We are 95% confident that the average winning percentage of the last 50 seasons are in the interval between 0.34 and 0.78.
(C) We are 95% confident that the winning probability of a given game is in the interval between 0.34 and 0.78.
(D) 95% of the 50 sampled winning percentages were between 0.34 and 0.78.
(E) There is a 0.95 probability that the winning probability of a given game is between 0.34 and 0.78.
22. Let X be a random variable with the normal distribution, $N(2000, 0.0001)$. That is, the mean of the corresponding normal distribution is 2000, and the variance is 0.0001. Which of the following statements is correct?
(A) X is positive.
(B) X is negative.
(C) X can be -2000.0001.
(D) X can not be 0.
(E) There is a 0.05 probability that the sample mean of X can be greater than 2000.0001.
23. A p value of 0.001 means _____.
(A) there is a 0.1% probability that the test result is incorrect.
(B) there is a 0.1% probability that the test result is correct.
(C) the odds are only 1 in 1000 of getting the test result by chance.
(D) the odds are 1 in 1000 of getting Type I error

- (E) there is a probability of 1 in 1000 that the test result would occur if the null hypotheses were true.
24. Tesla's VP in marketing would like to find out how satisfied Tesla's drivers are. In one survey, 300 Tesla's drivers report their satisfaction at a mean of 6.8 on a scale of 0 to 10. Another survey of 200 Tesla's drivers report their satisfaction at a mean of 7.3 on the same scale. Which of the following is correct?
- (A) The mean satisfaction score of all Tesla's drivers should be close to 6.8 rather than to 7.3.
(B) The mean satisfaction score of all Tesla's drivers should be close to 7.3 rather than to 6.8.
(C) The mean satisfaction score of all Tesla's drivers should be less than 6.8.
(D) The mean satisfaction score of all Tesla's drivers should be between 6.8 and 7.3.
(E) The mean satisfaction score of all Tesla's drivers can be only 2.5.
25. Genekam is a company developing the medical diagnostic test of H7N9. Assume that the probability of a person getting H7N9 is 0.05. If a person really gets H7N9, there is a probability of 0.95 that the medical diagnostic test indicates the presence of H7N9. If a person does not get H7N9, there is a probability of 0.15 that the medical diagnostic test indicates the presence of H7N9. What is the probability that a person actually gets H7N9 when the medical diagnostic test indicates the presence of H7N9?
- (A) 0.25
(B) 0.33
(C) 0.5
(D) 0.67
(E) 0.95
26. Which of the following statements is correct regarding the F -distribution?
- (A) $F_{0.05,10,20} = 1/F_{0.95,10,20}$
(B) $F_{0.05,10,20} = 1/F_{0.05,20,10}$
(C) $F_{0.95,10,20} = 1/F_{0.05,20,10}$
(D) $F_{0.95,10,20} = 1/F_{0.95,20,10}$
(E) none of these choices
27. When one tests $H_0: \mu_1 - \mu_2 = 0$ vs. $H_1: \mu_1 - \mu_2 \neq 0$, the observed value of the z-score was found to be -2.15. Then, the corresponding p -value for this test is
- (A) .0158
(B) .0316
(C) .9842
(D) .9684
(E) none of these choices
28. Fisher's least significant difference (LSD) multiple comparison method is flawed because
- (A) it will increase β ; the probability of committing a Type II error
(B) it will increase α ; the probability of committing a Type I error

- (C) it will increase both α and β , the probabilities of committing Type I and Type II errors, respectively
- (D) it will increase α ; the probability of committing a Type II error
- (E) none of these choices
29. In the randomized block design for ANOVA, where k is the number of treatments and b is the number of blocks, the number of degrees of freedom for error is
- (A) $k - b$
- (B) $kb - 1$
- (C) $n - k - b + 1$
- (D) $n - k - b$
- (E) none of these choices
30. An educational researcher is analyzing the test scores for physics students taught using two different methods - a traditional method, and a web-based self-paced method. Can he conclude, at $\alpha = .05$, that the test scores in the web-based self-paced method are lower?
- | | Traditional | Web-based Self-paced |
|---------------------|-------------|----------------------|
| Sample size | 60 | 50 |
| Mean test score | 84 | 80 |
| Population variance | 26 | 38 |
- (A) the data supports the claim because the test value 1.68 is greater than the critical value 1.65
- (B) the data supports the claim because the test value 1.68 is less than the critical value 1.96
- (C) the data supports the claim because the test value 3.66 is greater than the critical value 1.96
- (D) the data supports the claim because the test value 3.66 is greater than the critical value 1.65
- (E) none of these choices
31. In a goodness-of-fit test, the null hypothesis states that the data came from a normally distributed population. One researcher estimated the population mean and population standard deviation from a sample of 500 observations. In addition, the researcher used 6 standardized intervals to test for normality. Using a 5% level of significance, the critical value for this test is
- (A) 11.1433
- (B) 9.3484
- (C) 7.8147
- (D) 9.4877
- (E) none of these choices
32. As a researcher collects more and more data, the 95% prediction intervals in general
- (A) become narrower and narrower, with the widths getting closer and closer to 0
- (B) become narrower and narrower, but the widths are always more than approximately 2 times the standard error of the estimate
- (C) become narrower and narrower, but the widths are always more than approximately 4 times the standard error of the estimate

- (D) become narrower and narrower, but the widths are always more than approximately 4 times the slope
(E) none of these choices
33. Given the least squares regression line $\hat{y} = 2.48 - 1.63x$, and a coefficient of determination of 0.81, the coefficient of correlation is
(A) 0.66
(B) -0.81
(C) -0.90
(D) 0.90
(E) none of these choices
34. The standard error of estimate is a measure of the
(A) variation of y around the regression line
(B) variation of x around the regression line
(C) variation of y around the mean \bar{y}
(D) variation of x around the mean \bar{x}
(E) none of these choices
35. Suppose a multiple regression analysis involving 25 data points has standard error of estimate = 1.34 and $SSE = 36$. Then, the number of the independent variables must be
(A) 3
(B) 4
(C) 5
(D) 6
(E) none of these choices
36. A multiple regression analysis involving three independent variables and 25 data points results in a value of 0.769 for the unadjusted coefficient of determination. Then, the adjusted coefficient of determination is
(A) 0.385
(B) 0.877
(C) 0.591
(D) 0.736
(E) none of these choices
37. Consider in the Kruskal-Wallis test, there are four samples and the value of the test statistic is calculated as $H = 8.79$. The most accurate statement that can be made about the p -value is that:
(A) it is greater than 0.10.
(B) it is greater than 0.05 but smaller than 0.10.
(C) it is greater than 0.05.
(D) it is greater than 0.025 but smaller than 0.05.
(E) none of these choices

38. Mark is performing the Wilcoxon rank-sum test. The 13th through 15th values in an ordered array of pooled sample data all equal \$180 (while the 12th value is less and the 16th value is more). The appropriate ranks for the three \$180 values are
- (A) 14, 14, 14
 - (B) 13, 14, 15
 - (C) 12.5, 13, 14.5
 - (D) 12.5, 13, 15
 - (E) none of these choices

第二部分：計算與簡答題，共 8 題，每題 3 分，共 24 分，請於試卷內之「非選擇題作答區」依序作答，並應註明作答之題號。

39. Below shows an ANOVA table in a randomized block design. In the table, the treatments represent different drugs, and the blocks represent different groups of men.

Source of Variation	SS	df	MS	F
Treatments	A	4	D	F
Blocks	3,200	8	E	G
Error	B	C	125	
Total	13,500	34		

Then, A is equal to?

40. From Question 39, D is equal to?
41. From Question 39, F is equal to?
42. From Question 39, G is equal to?
43. The general manager of a frozen TV dinner maker must decide which one of four new dinners to introduce to the market. He decides to perform an experiment to help make a decision. Each dinner is sampled by ten people who then rate the product on a 7-point scale, where 1 = poor, and 7 = excellent. The results are shown below.

Taste Ratings

Respondent	Dinner 1	Dinner 2	Dinner 3	Dinner 4
1	6	6	4	5
2	5	5	2	4
3	7	7	3	4
4	6	6	5	4
5	7	6	4	3
6	7	5	3	5
7	6	4	3	4
8	5	6	4	6
9	4	4	3	5
10	7	5	6	4

Which statistical technique can the general manager use to help him make a decision?

44. A statistician investigating the relationship between the amount of precipitation (in inches) and the number of automobile accidents gathered data for 10 randomly selected days. The results are shown below. (We cannot assume these variables have normal distributions.)

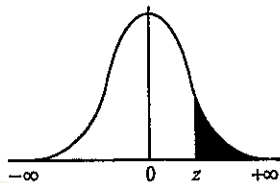
Day	Precipitation	Number of Accidents
1	0.05	5
2	0.12	6
3	0.05	2
4	0.08	4
5	0.10	8
6	0.35	14
7	0.15	7
8	0.30	13
9	0.10	7
10	0.20	10

Calculate the Spearman rank correlation coefficient test statistic if we want to determine at the 5% significance level whether we can infer that a linear relationship exists between the number of accidents and the amount of precipitation.

45. In a random sample of 20 patients who visited a clinic at Medical Center 1, a researcher found that the variance of the waiting time (in minutes) was 128.0. In a random sample of 15 patients in the clinic of Medical Center 2, the researcher found the variance to be 178.8. Develop the 95% confidence interval estimate of the ratio of the two population variances. Then the upper confidence limit (UCL) is ?
46. From the previous question, the rejection region for testing the equality of the two population variances at $\alpha = 0.05$ is when the test statistic $F < x$ or $F > y$. Then x is equal to?

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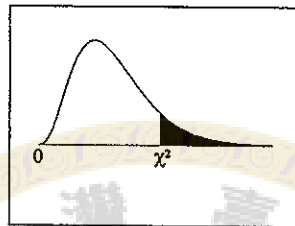
NORMAL DISTRIBUTION TABLE



	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

接次頁

Chi-Square Distribution Table



The shaded area is equal to α for $\chi^2 = \chi^2_{\alpha}$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

見背面

The F Distribution: Value of F ($\alpha=0.025$)



1	647.7931	799.4822	864.1509	899.9594	921.8347	937.1142	948.2028	956.6429	963.2786	968.6337	973.0284	976.7246	979.8387	982.3451	984.3736	986.9109	988.9109	990.3451	991.8003	993.0809
2	38.50619	39.00004	39.16557	39.24833	39.29836	39.3311	39.35565	39.37294	39.38638	39.39984	39.41477	39.42114	39.42666	39.43144	39.43569	39.43933	39.44206	39.44475	39.44751	39.45026
3	17.44343	16.04417	15.43913	15.10102	14.88479	14.73472	14.62445	14.53986	14.47302	14.41889	14.37411	14.33659	14.30453	14.27679	14.25269	14.23155	14.21267	14.19608	14.18084	14.16743
4	12.21792	10.64905	9.979203	9.60491	9.384499	9.197265	9.074142	8.979555	8.906635	8.84926	8.79583	8.74518	8.69706	8.65132	8.60784	8.56651	8.52733	8.49028	8.45538	8.42254
5	8.81317	7.25381	7.76356	7.38782	7.146355	6.977	6.83043	6.797205	6.681034	6.619189	6.567802	6.524544	6.487596	6.45593	6.42774	6.403184	6.381356	6.361915	6.344408	6.328548
6	8.072675	6.541541	5.889831	5.522594	5.285244	5.118579	4.994888	4.899634	4.823221	4.761119	4.709477	4.665822	4.628475	4.596075	4.567795	4.542812	4.520643	4.500777	4.482899	4.466756
7	7.570861	6.059452	5.415984	5.052641	4.817281	4.651696	4.528545	4.433275	4.357219	4.295117	4.243418	4.199577	4.16216	4.130375	4.103751	4.081913	4.062832	4.045105	4.028632	4.013353
8	7.20928	5.714686	5.078107	4.718061	4.484406	4.31973	4.197034	4.109653	4.042592	3.985822	3.938593	3.899823	3.868223	3.843054	3.824112	3.810183	3.800048	3.793538	3.790473	3.789416
9	6.936716	5.4564	4.825608	4.463347	4.236085	4.07212	3.949822	3.854893	3.77895	3.716792	3.664923	3.620654	3.583162	3.550412	3.522167	3.498298	3.478668	3.462988	3.451033	3.441510
10	6.724122	5.255685	4.63001	4.27508	4.040111	3.880643	3.786628	3.718634	3.665814	3.627981	3.594969	3.566492	3.542265	3.522167	3.506112	3.493882	3.485294	3.480048	3.477833	3.477162
11	6.544266	4.965273	4.347186	3.998993	3.766672	3.604256	3.482668	3.387981	3.312039	3.249667	3.197499	3.155375	3.123265	3.20621	3.172706	3.149152	3.128633	3.110811	3.095882	3.07777
12	6.414266	4.835702	4.217173	3.86927	3.636416	3.501356	3.379338	3.285294	3.209294	3.146882	3.094684	3.052519	3.020379	3.003821	2.991851	2.983921	2.979692	2.977892	2.977221	2.977672
13	6.29791	4.765042	4.14651	3.80004	3.567417	3.432356	3.310338	3.216294	3.140294	3.077882	3.025684	3.000379	2.983821	2.976892	2.972663	2.970834	2.970163	2.970533	2.970903	2.971273
14	6.195514	4.765042	4.14651	3.80004	3.567417	3.432356	3.310338	3.216294	3.140294	3.077882	3.025684	3.000379	2.983821	2.976892	2.972663	2.970834	2.970163	2.970533	2.970903	2.971273
15	6.115101	4.686683	4.07881	3.729411	3.502723	3.340653	3.219441	3.124825	3.048754	2.981555	2.933703	2.899053	2.850555	2.817018	2.787516	2.761354	2.738005	2.717907	2.700335	2.755897
16	6.042001	4.618869	4.011156	3.664752	3.437947	3.276682	3.155471	3.060975	2.984862	2.927192	2.889641	2.842891	2.796294	2.750834	2.723027	2.699653	2.679922	2.663329	2.649759	2.638005
17	5.978052	4.559666	3.953858	3.608335	3.38197	3.220919	3.099871	3.005269	2.92913	2.866372	2.813735	2.768866	2.730789	2.696424	2.666724	2.640348	2.617678	2.598598	2.582028	2.568005
18	5.921606	4.507513	3.903438	3.558771	3.332715	3.171949	3.050872	2.956266	2.880057	2.817245	2.764523	2.719574	2.680776	2.646928	2.617114	2.590653	2.566992	2.545704	2.526426	2.509941
19	5.87147	4.461242	3.863407	3.518741	3.292715	3.131949	3.010872	2.916266	2.839057	2.776245	2.721296	2.676347	2.637549	2.602694	2.571880	2.544419	2.519958	2.497270	2.476292	2.456909
20	5.826621	4.419917	3.822887	3.478221	3.252195	3.091429	2.970352	2.875746	2.798537	2.735725	2.680776	2.635827	2.597029	2.562174	2.530360	2.501416	2.474955	2.450494	2.427706	2.406428
21	5.786319	4.38277	3.785743	3.441077	3.215052	3.054286	2.933209	2.838603	2.761394	2.708582	2.653633	2.608684	2.570886	2.536031	2.504177	2.475233	2.449292	2.425351	2.403410	2.383478
22	5.748826	4.349204	3.752488	3.407822	3.181797	3.021031	2.900954	2.806348	2.729139	2.676327	2.621378	2.576429	2.538631	2.503776	2.471922	2.442978	2.416037	2.391096	2.367155	2.344214
23	5.716629	4.318736	3.721084	3.376420	3.150395	2.989629	2.869552	2.774946	2.707737	2.654925	2.600976	2.556027	2.518229	2.483374	2.451520	2.421576	2.393635	2.367694	2.343753	2.320812
24	5.689638	4.290933	3.694282	3.349618	3.123593	2.962827	2.842750	2.748144	2.680935	2.628123	2.574174	2.529225	2.491427	2.457572	2.426718	2.397774	2.370833	2.345892	2.321951	2.299010
25	5.658648	4.265473	3.669726	3.325062	3.099037	2.938271	2.818194	2.723588	2.656379	2.603567	2.549618	2.504669	2.466871	2.433016	2.402162	2.373218	2.346277	2.321336	2.297395	2.274454
26	5.633126	4.242082	3.647187	3.302513	3.076488	2.915722	2.795645	2.701039	2.633830	2.580918	2.526969	2.482020	2.444222	2.410367	2.379513	2.349569	2.321628	2.295687	2.271746	2.248805
27	5.609564	4.22051	3.626411	3.281747	3.055722	2.894956	2.774879	2.680273	2.613064	2.560152	2.505203	2.459254	2.421456	2.387601	2.356747	2.326793	2.298852	2.272911	2.248970	2.225029
28	5.593529	4.192056	3.599349	3.254685	3.028660	2.867894	2.747817	2.653211	2.586002	2.533090	2.478141	2.432192	2.394384	2.360529	2.329675	2.299721	2.271780	2.245839	2.221898	2.198957
29	5.579492	4.167501	3.574894	3.230230	2.994205	2.833439	2.713362	2.618756	2.551547	2.508635	2.453686	2.407737	2.370939	2.337084	2.306230	2.276276	2.248335	2.222394	2.198453	2.174512
30	5.567529	4.145056	3.553499	3.208835	2.972800	2.812034	2.691957	2.607351	2.540142	2.497230	2.442281	2.396332	2.359524	2.325669	2.294815	2.264861	2.236920	2.210979	2.187038	2.163097
31	5.557594	4.124501	3.533099	3.188380	2.952345	2.791579	2.671502	2.586896	2.519687	2.476775	2.421826	2.375877	2.339069	2.305214	2.274360	2.244406	2.216465	2.190524	2.166583	2.142642
32	5.549626	4.104946	3.513699	3.168965	2.932830	2.772014	2.651937	2.567331	2.500122	2.457210	2.402261	2.356312	2.319504	2.285649	2.254795	2.224841	2.196900	2.172959	2.149018	2.125077
33	5.542644	4.086391	3.494299	3.150550	2.914315	2.752449	2.632372	2.547766	2.480557	2.437645	2.382696	2.336747	2.299939	2.266084	2.235230	2.205276	2.177335	2.153394	2.129453	2.105512
34	5.537662	4.068836	3.475899	3.133195	2.895700	2.732868	2.612791	2.528185	2.460976	2.418064	2.363115	2.317166	2.280358	2.246503	2.215649	2.185695	2.157754	2.133813	2.109872	2.085931
35	5.534680	4.052281	3.458499	3.116790	2.877095	2.713280	2.593203	2.508597	2.441388	2.398476	2.343527	2.297578	2.260770	2.226915	2.196061	2.168120	2.144179	2.120238	2.096297	2.072356
36	5.532698	4.036726	3.442099	3.101285	2.858490	2.693699	2.573622	2.489016	2.421807	2.378895	2.323946	2.277997	2.241189	2.207334	2.176480	2.148539	2.124598	2.100657	2.076716	2.052775
37	5.531716	4.022171	3.426699	3.086780	2.840985	2.674208	2.554131	2.469525	2.402316	2.359404	2.304455	2.258506	2.221698	2.187843	2.156989	2.129048	2.105107	2.081166	2.057225	2.033284
38	5.531734	4.008616	3.412299	3.072275	2.823480	2.654713	2.534636	2.449030	2.381821	2.338909	2.283960	2.238011	2.192062	2.155207	2.123352	2.095411	2.071470	2.047529	2.023588	1.999647
39	5.532752	4.000061	3.400000	3.058770	2.806975	2.635206	2.515129	2.429523	2.362314	2.319402	2.264453	2.218504	2.172555	2.135700	2.103845	2.075904	2.051963	2.028022	2.004081	1.980140
40	5.534770	4.000000	3.400000	3.050000	2.800000	2.630000	2.510000	2.424400	2.357191	2.314280	2.259331	2.213382	2.167433	2.130578	2.098723	2.070782	2.046841	2.022900	1.998959	1.975018
41	5.537788	4.000000	3.400000	3.050000	2.800000	2.630000	2.510000	2.424400	2.357191	2.314280	2.259331	2.213382	2.167433	2.130578	2.098723	2.070782	2.046841	2.022900	1.998959	1.975018
42	5.542806	4.000000	3.400000	3.050000	2.800000	2.630000	2.510000	2.424400	2.357191	2.314280	2.259331	2.213382	2.167433	2.130578	2.098723	2.070782	2.046841	2.022900	1.998959	1.975018
43	5.549824	4.000000	3.400000	3.050000	2.800000	2.630000	2.510000	2.424400	2.357191	2.314280	2.259331	2.213382	2.167433	2.130578	2.098723	2.070782	2.046841	2.022900	1.998959	1.975018
44	5.558842	4.000000	3.400000	3.050000	2.800000	2.630000	2.510000	2.424400	2.357191	2.314280	2.259331	2.213382	2.167433	2.130578	2.098723	2.070782	2.046841	2		

The F Distribution: Value of F ($\alpha=0.05$)



1	161.462	199.4995	215.7067	224.5633	230.1604	233.9875	235.7669	238.8842	240.5432	241.8819	242.9906	243.9047	244.6905	245.3635	245.9492	246.4658	246.9169	247.3244	247.6881	248.0156	
2	18.51276	19.00003	19.16419	19.24673	19.29629	19.32949	19.35314	19.37087	19.38474	19.39588	19.40498	19.41248	19.41885	19.42431	19.42908	19.43370	19.43704	19.44022	19.44318	19.44588	
3	10.12796	9.522082	9.276619	9.11713	9.013434	8.940674	8.88673	8.845234	8.812322	8.785491	8.763323	8.746678	8.732648	8.720841	8.71098	8.702841	8.6962768	8.692289	8.674533	8.666973	8.660209
4	7.70865	6.944276	6.591392	6.388234	6.256073	6.163134	6.094211	6.041034	5.9988	5.964353	5.935817	5.911716	5.891338	5.873346	5.8578	5.844129	5.831954	5.821107	5.811359	5.802548	5.794548
5	6.607877	5.786148	5.409447	5.192453	5.050339	4.950294	4.875868	4.818332	4.77246	4.735057	4.703863	4.677702	4.65522	4.63578	4.618758	4.603477	4.590447	4.578538	4.567823	4.558132	4.549432
6	5.97374	5.143246	4.757055	4.533689	4.37374	4.283862	4.206569	4.146813	4.099007	4.059956	4.027441	3.99929	3.97668	3.95932	3.939055	3.922281	3.908269	3.895707	3.884409	3.874192	3.864526
7	5.59146	4.757416	4.36603	4.120309	3.971522	3.865978	3.787051	3.725717	3.676675	3.636529	3.603034	3.574684	3.55034	3.529237	3.510735	3.494407	3.479869	3.466866	3.455142	3.444526	3.434919
8	5.37645	4.549858	4.06618	3.837894	3.687504	3.600581	3.5046	3.438103	3.388724	3.347168	3.312948	3.283944	3.259101	3.237375	3.218403	3.201635	3.186599	3.172927	3.160247	3.148247	3.136819
9	5.177357	4.256492	3.862539	3.63309	3.481659	3.373756	3.29274	3.229587	3.178897	3.137274	3.102485	3.072941	3.047546	3.025477	3.005943	2.988462	2.972692	2.958046	2.944451	2.931856	2.920266
10	4.964591	4.028216	3.708266	3.47805	3.325837	3.217481	3.135469	3.071662	3.020382	2.97824	2.942954	2.912977	2.887177	2.864724	2.845043	2.827562	2.812008	2.798046	2.784641	2.771746	2.760166
11	4.844338	3.922208	3.587431	3.356689	3.20388	3.094613	3.012332	2.947385	2.896222	2.853625	2.81927	2.793753	2.767418	2.739645	2.716636	2.700915	2.686598	2.673092	2.660287	2.648084	2.636445
12	4.747221	3.82529	3.490529	3.259787	3.106975	2.997709	2.915428	2.850481	2.800316	2.757636	2.723389	2.717329	2.686633	2.66018	2.637123	2.616851	2.598881	2.582837	2.568427	2.554541	2.541387
13	4.667486	3.805567	3.470806	3.240064	3.087252	2.977986	2.895705	2.830758	2.780593	2.737913	2.703666	2.686633	2.66018	2.637123	2.616851	2.598881	2.582837	2.568427	2.554541	2.541387	2.528883
14	4.600111	3.73889	3.404128	3.173386	3.020574	2.911308	2.829027	2.764080	2.713915	2.671235	2.645988	2.628955	2.60322	2.579983	2.559146	2.540614	2.523387	2.507365	2.492447	2.478531	2.464615
15	4.543068	3.682317	3.347554	3.116812	2.964000	2.854734	2.772453	2.707506	2.657341	2.614661	2.589414	2.572381	2.546648	2.523401	2.503564	2.486032	2.469805	2.454887	2.440270	2.425954	2.411838
16	4.493998	3.633716	3.298953	3.068211	2.915400	2.806134	2.723853	2.658906	2.608741	2.566061	2.540814	2.523781	2.498048	2.474801	2.454964	2.438432	2.423205	2.408287	2.393670	2.379354	2.365238
17	4.451223	3.591538	3.256775	3.026033	2.873222	2.763956	2.681675	2.616728	2.566563	2.523883	2.508636	2.491603	2.465870	2.442623	2.422786	2.406254	2.391027	2.376109	2.361492	2.347176	2.333160
18	4.413963	3.554561	3.159911	2.929169	2.776358	2.667092	2.584811	2.519864	2.469699	2.427019	2.411772	2.394739	2.369006	2.345759	2.324922	2.306394	2.289167	2.273249	2.258632	2.244316	2.230300
19	4.380752	3.52189	3.127238	2.896496	2.743685	2.634419	2.552138	2.487191	2.437026	2.394346	2.379099	2.362066	2.336333	2.313086	2.293249	2.275721	2.259494	2.244576	2.230059	2.215943	2.202227
20	4.35125	3.492829	3.098177	2.867435	2.714624	2.605358	2.523077	2.458130	2.407965	2.365285	2.349938	2.332905	2.307172	2.283925	2.263088	2.245560	2.229333	2.214415	2.200000	2.185984	2.172268
21	4.324789	3.467195	3.072543	2.841801	2.689000	2.579734	2.497453	2.432506	2.382341	2.339661	2.324314	2.307281	2.281548	2.258301	2.237464	2.219936	2.203709	2.188791	2.174174	2.159858	2.145842
22	4.300944	3.443361	3.048124	2.817272	2.664471	2.555205	2.472924	2.407977	2.357812	2.315132	2.299785	2.282752	2.257019	2.233772	2.212935	2.194407	2.177180	2.161262	2.146645	2.132329	2.118313
23	4.279343	3.42213	3.027999	2.795558	2.642747	2.533481	2.451200	2.386253	2.336088	2.293408	2.278061	2.261028	2.235295	2.212048	2.191211	2.172683	2.155456	2.139538	2.124921	2.110605	2.096589
24	4.259575	3.402832	3.009786	2.776289	2.623478	2.514212	2.431931	2.366984	2.316819	2.274139	2.258792	2.241759	2.216026	2.192779	2.171942	2.153414	2.136187	2.120269	2.105652	2.091336	2.077320
25	4.241699	3.385196	2.991243	2.758711	2.605900	2.496634	2.414353	2.349406	2.299241	2.256561	2.241214	2.224181	2.198448	2.175201	2.154364	2.135836	2.118609	2.102691	2.087074	2.072758	2.058742
26	4.2252	3.36901	2.975156	2.742595	2.589784	2.480518	2.398237	2.333290	2.283125	2.240445	2.225098	2.208065	2.182332	2.159085	2.138248	2.120720	2.104602	2.089785	2.075268	2.061052	2.047136
27	4.210008	3.354131	2.960348	2.727766	2.574955	2.465689	2.383408	2.318461	2.268296	2.225616	2.210269	2.193236	2.167503	2.144256	2.123419	2.104891	2.087664	2.071746	2.057129	2.042813	2.028797
28	4.195982	3.340389	2.946685	2.714074	2.561263	2.452000	2.369719	2.304772	2.254607	2.211927	2.196580	2.179547	2.153814	2.130567	2.109730	2.091202	2.074075	2.058258	2.043641	2.029225	2.015009
29	4.170886	3.327833	2.932278	2.699632	2.536851	2.427588	2.345307	2.280360	2.230195	2.187515	2.172168	2.155135	2.129402	2.106155	2.085318	2.068091	2.052274	2.037757	2.023441	2.009325	1.995409
30	4.149474	3.316431	2.919176	2.685479	2.512670	2.403407	2.321126	2.256179	2.206014	2.163334	2.147987	2.130954	2.105221	2.081974	2.059727	2.038400	2.021473	2.005956	1.990740	1.975724	1.960908
40	4.03243	3.182606	2.79001	2.567179	2.400412	2.281149	2.199882	2.134935	2.084770	2.042090	2.026743	2.010710	1.984977	1.960244	1.936511	1.913778	1.891945	1.870912	1.850579	1.830746	1.811313
50	4.001194	3.150441	2.758078	2.535242	2.368267	2.249004	2.167737	2.102790	2.052625	2.009945	1.994598	1.978565	1.952832	1.928100	1.904367	1.881634	1.859801	1.838868	1.818735	1.799302	1.780369
60	3.920121	3.077176	2.680167	2.457331	2.290356	2.171093	2.089826	2.024879	1.974714	1.932034	1.916687	1.900654	1.874921	1.850189	1.826456	1.803723	1.781990	1.761257	1.741424	1.722391	1.704058
100,000	3.841549	2.995819	2.604999	2.372019	2.214186	2.094919	2.013652	1.948705	1.908540	1.878375	1.858210	1.838045	1.817880	1.797715	1.777550	1.757385	1.737220	1.717055	1.696890	1.676725	1.656560