

國立中正大學

112 學年度碩士班招生考試

試題

[第 2 節]

科目名稱	統計學
系所組別	財務金融學系

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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I. Multiple Choice (單選題) : (Find the BEST answer, 60%, 3 points each)

1. If the following data represents cumulative relative frequency, what must be the order of the classes?

Class	A	B	C	D	E
Relative frequency	1.00	0.15	0.3	0.8	0.15

- A) CBDEA B) ADBEC C) ADCBE D) EBCDA E) none of the above
2. An advertising firm is trying to determine how effective their TV ad for a product is. The results of a survey are that 20% of the people surveyed purchase the product and have seen the ad. Thirty-five percent of the people who purchase the product have never seen the TV ad. Sixty percent of the people surveyed have seen the TV ad. What is the probability that a randomly chosen person from the survey does not buy the product given that he has seen the TV ad? A) 0.6364 B) 0.3333 C) 0.875 D) 0.6667 E) 0.3636
3. Fifteen students in an accounting class receive the following scores:
56 59 60 65 70 75 78 80 80 87 89 92 95 99 100
A 16th student, who was absent the day of the exam, takes the same exam the next day. What score of this sixteenth student would not change the median score of the exam? A) 80 B) 79 C) 81 D) A and B
E) A and C
4. If a distribution is skewed to the right, then this distribution has
A) positive skewness coefficient.
B) negative skewness coefficient.
C) a mean smaller than the mode.
D) a mean equal to the median.
E) B and C.
5. Which of the following statements is invalid?
A) The geometric mean is smaller than the arithmetic mean.
B) The geometric mean is more sensitive to extreme values than the arithmetic mean.
C) The geometric mean cannot be calculated for data containing either zero or negative values.
D) The geometric average is frequently used to calculate average stock rates of return.
E) A and C
6. An investor has a portfolio of stocks. The returns of the stock are 15%, 12.5%, 5%, -3.2%, and -6.9%. What is the geometric mean for the rates of return of her portfolio? A) 8.52% B) 4.48% C) 4.13%
D) 7.30% E) The geometric mean cannot be calculated for data containing negative values.
7. Which of the following statements is correct?
A) The Central Limit Theory tells us that as population size grows, its distribution approaches normal.
B) As the sample size increases, the sampling distribution of the mean approaches normal, regardless of

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the population distribution.

- C) More estimated parameters in a model results in a higher degree of freedom.
- D) The degree of freedom in a t distribution of a random variable is equal to the sample size.
- E) A and B

8. Which of the following results in a smaller confidence interval width?

- A) Larger sample mean.
- B) Larger sample variance.
- C) Larger sample size.
- D) Larger degree of confidence.
- E) Larger population mean.

9. Consider an increase in the significance level used to examine a hypothesis from 5% to 10%. Which of the following would NOT be an implication?

- A) The probability of a Type I error is increased.
- B) The rejection criterion has become more strict.
- C) The null hypothesis will be rejected less often.
- D) There is no impacts on the p-value.
- E) B and D.

10. Which of the following statements is correct?

- A) Whenever possible, in establishing the null and alternative hypotheses, the research hypothesis should be made the alternative hypothesis.
- B) Hypothesis testing and confidence interval estimation are essentially two totally different statistical procedures and share little in common with each other.
- C) A conclusion to "not reject" the null hypothesis is the same as the decision to "accept the null hypothesis".
- D) In a hypothesis test, the p-value measures the probability that the alternative hypothesis is true.
- E) In conducting a hypothesis test where the conclusion is to reject the null hypothesis, then either a correct decision has been made or else a Type II error.

11. Which of the following statements is NOT true?

- A) The test statistic for comparing two population variance follows the F distribution.
- B) The shape of the F distribution is positively skewed.
- C) The F statistic is computed as the ratio of two chi-square random variables.
- D) Analysis of Variance (ANOVA) is used to compare two or more means.
- E) All of the above statements are true.

12. Two samples with sizes $n_x = 12$ and $n_y = 15$ are taken from two independent populations with standard deviation $s_x = 6$ and $s_y = 7$. Sample means for x and y are 5 and 4 respectively. Which of the following is

true in testing the difference between the two means when the population variances are unknown? The null hypothesis

- A) can be rejected at alpha $\alpha = 0.1$
- B) cannot be rejected at alpha $\alpha = 0.05$
- C) cannot be rejected at alpha $\alpha = 0.01$
- D) A and B
- E) B and C.

13. In a multiple regression model, which of the following is TRUE?

- A) The coefficient of determination will be equal to the square of the highest correlation in the correlation matrix.
- B) Adding variables that have a low correlation with the dependent variable will cause the R-square value to decline.
- C) The sum of the residuals computed for the least squares regression equation will be zero.
- D) The adjusted R-square might be higher or lower than the value of the R-square.
- E) None of the above

14. Which of the following statements is TRUE?

- A) If the confidence interval estimate for the regression slope coefficient crosses over zero, the true population regression slope coefficient could be zero.
- B) R-square will tend to be smaller than the adjusted R-squared values when insignificant independent variables are included in the model.
- C) The y-intercept will usually be negative in a multiple regression model when the regression slope coefficients are predominately positive.
- D) None of the above.
- E) All of the above.

15. In a regression model with 4 independent variables, what is the null hypothesis for testing the overall explanatory power of the model?

- A) $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
- B) $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
- C) $\beta_1 = \beta_2 = \beta_3 = \beta_4$
- D) $\beta_1 = 0$ or $\beta_2 = 0$ or $\beta_3 = 0$ or $\beta_4 = 0$
- E) $\beta_1 \neq 0$ or $\beta_2 \neq 0$ or $\beta_3 \neq 0$ or $\beta_4 \neq 0$

16. A decision maker is considering including two additional variables into a regression model that has Total Sales as the dependent variable. The first additional variable is the region of the country (North, South, East, or West) in which the company is located. The second variable is the type of business (Manufacturing, Financial, Information Services, or Other). Given this, how many additional variables will be incorporated into the model? A) 2 B) 6 C) 8 D) 9 E) 16.

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17. Interaction exists in a multiple regression model when
- A) one independent variable affects the relationship between another independent variable and the dependent variable.
 - B) two independent variables are closed related.
 - C) multicollinearity is present in a regression model.
 - D) the regression model is overall insignificant.
 - E) a polynomial model is used.
18. Which of the following statements is correct?
- A) An annual time series can exhibit a seasonal component.
 - B) In a recent meeting, a manager indicated that sales tend to be higher during October, November, and December and lower in the spring. In making this statement, she is indicating that sales for the company are cyclical.
 - C) The time-series component that implies a long-term upward or downward pattern is called the trend component.
 - D) From an annual time series of a company's employee income, the linear trend model, $Income_t = 165 - 54 \times Year_t$ has been developed. This means that on average income has been increasing by 165 per year.
 - E) If the forecast errors are autocorrelated, this is a good indication that the model has been specified correctly.
19. Which of the following problem(s) (or concerns) in regression analysis may be alleviated by enlarging the sample size?
- A) Perfect multicollinearity
 - B) Heteroscedasticity
 - C) Endogeneity
 - D) OLS estimates are not significant
 - E) None of the above.
20. Which one of the following is NOT an assumption of the classical linear regression model?
- I. The explanatory variables are uncorrelated with the error terms.
 - II. The dependent variable is not correlated with the disturbance terms.
 - III. The disturbance terms are independent of one another.
 - IV. The regressors are independent of one another.
 - V. The assumption of normality is required for BLUE.
- A) I, III, V B) II, IV C) I, III D) II, IV, V E) None of the A~D is correct.

II. Essay Questions (問答計算題，請詳列計算過程) : (40%)

1. Toss a fair coin 10 times. Calculate the probability of 3 or fewer heads using both the *binominal* distribution and the *normal* approximation. What is the difference between the probability calculations using the two methods? (10 points)
2. The R-squared of a regression (R^2) is the proportion of the sample variation in the dependent variable of a regression explained by the independent variables and serves as a goodness-of-fit measure. Show that R^2 is also equal to the squared *correlation coefficient* between the actual y_i and the fitted value \hat{y}_i . (10 points)
3. A consumer group plans to test whether a new passenger car that is advertised to have a mean highway miles per gallon (mpg) of at least 33 actually meets this level. They plan to test the hypothesis using a significance level of 0.05 and a sample size of $n = 100$ cars. It is believed that the population standard deviation is 3 mpg. Based upon this information,
 - i. what is the critical value in terms of mpg that would be needed prior to finding beta? (5 points)
 - ii. if the "true" population mean is 32.0 mpg, what is the probability that the test will lead the consumer group to "accept" the claimed mileage for this car? (5 points)
4. To test the mileage efficiency of four new car models, random samples of size 8 were selected from each of the four cars and the mean and variance mpg (miles per gallon) data obtained are shown below. Undertake an appropriate hypothesis testing using 1% significance level to investigate if there is an overall difference in their performance. (10 points)

	Mean	Standard deviation
Model A	41	3.5
Model B	38	4.6
Model C	14	3.8
Model D	37	4.9

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Normal Distribution Table

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9924	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9958	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986

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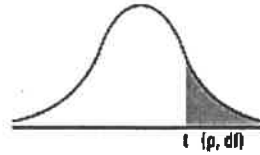
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Student's *t* Distribution Table

Numbers in each row of the table are values on a *t*-distribution with (*df*) degrees of freedom for selected right-tail (greater-than) probabilities (*p*).



df/p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	4.3178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
<i>z</i>	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905
CI	————	————	80%	90%	95%	98%	99%	99.9%

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F Distribution Table

F - Distribution ($\alpha = 0.01$ in the Right Tail)

df ₂	df ₁	Numerator Degrees of Freedom								
		1	2	3	4	5	6	7	8	9
1		4052.2	4999.5	5403.4	5624.6	5763.6	5859.0	5928.4	5981.1	6022.5
2		98.503	99.000	99.166	99.249	99.299	99.333	99.356	99.374	99.388
3		34.116	30.817	29.457	28.710	28.237	27.911	27.672	27.489	27.345
4		21.198	18.000	16.694	15.977	15.522	15.207	14.976	14.799	14.659
5		16.258	13.274	12.060	11.392	10.967	10.672	10.456	10.289	10.158
6		13.745	10.925	9.7795	9.1483	8.7459	8.4661	8.2600	8.1017	7.9761
7		12.246	9.5466	8.4513	7.8466	7.4604	7.1914	6.9928	6.8400	6.7188
8		11.259	8.6491	7.5910	7.0061	6.6318	6.3707	6.1776	6.0289	5.9106
9		10.561	8.0215	6.9919	6.4221	6.0569	5.8018	5.6129	5.4671	5.3511
10		10.044	7.5594	6.5523	5.9943	5.6363	5.3858	5.2001	5.0567	4.9424
11		9.6460	7.2057	6.2167	5.6683	5.3160	5.0692	4.8861	4.7445	4.6315
12		9.3302	6.9266	5.9525	5.4120	5.0643	4.8206	4.6395	4.4994	4.3875
13		9.0738	6.7010	5.7394	5.2053	4.8616	4.6204	4.4410	4.3021	4.1911
14		8.8616	6.5149	5.5639	5.0354	4.6950	4.4558	4.2779	4.1399	4.0297
15		8.6831	6.3589	5.4170	4.8932	4.5556	4.3183	4.1415	4.0045	3.8948
16		8.5310	6.2262	5.2922	4.7726	4.4374	4.2016	4.0259	3.8896	3.7804
17		8.3997	6.1121	5.1850	4.6690	4.3359	4.1015	3.9267	3.7910	3.6822
18		8.2854	6.0129	5.0919	4.5790	4.2479	4.0146	3.8406	3.7054	3.5971
19		8.1849	5.9259	5.0103	4.5003	4.1708	3.9386	3.7653	3.6305	3.5225
20		8.0960	5.8489	4.9382	4.4307	4.1027	3.8714	3.6987	3.5644	3.4567
21		8.0166	5.7804	4.8740	4.3688	4.0421	3.8117	3.6396	3.5056	3.3981
22		7.9454	5.7190	4.8166	4.3134	3.9880	3.7583	3.5867	3.4530	3.3458
23		7.8811	5.6637	4.7649	4.2636	3.9392	3.7102	3.5390	3.4057	3.2986
24		7.8229	5.6136	4.7181	4.2184	3.8951	3.6667	3.4959	3.3629	3.2560
25		7.7698	5.5680	4.6755	4.1774	3.8550	3.6272	3.4568	3.3239	3.2172
26		7.7213	5.5263	4.6366	4.1400	3.8183	3.5911	3.4210	3.2884	3.1818
27		7.6767	5.4881	4.6009	4.1056	3.7848	3.5580	3.3882	3.2558	3.1494
28		7.6356	5.4529	4.5681	4.0740	3.7539	3.5276	3.3581	3.2259	3.1195
29		7.5977	5.4204	4.5378	4.0449	3.7254	3.4995	3.3303	3.1982	3.0920
30		7.5625	5.3903	4.5097	4.0179	3.6990	3.4735	3.3045	3.1726	3.0665
40		7.3141	5.1785	4.3126	3.8283	3.5138	3.2910	3.1238	2.9930	2.8876
60		7.0771	4.9774	4.1259	3.6490	3.3389	3.1187	2.9530	2.8233	2.7185
120		6.8509	4.7865	3.9491	3.4795	3.1735	2.9559	2.7918	2.6629	2.5586
∞		6.6349	4.6052	3.7816	3.3192	3.0173	2.8020	2.6393	2.5113	2.4073