國立中正大學
109 學年度碩士班招生考試
試 題

[第 1 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。

國立中正大學109學年度碩士班招生考試試題

科目名稱：統計學　　本科目共 8 頁　第 1 頁

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一、選擇題 (每題3分) 單選

1. Which of the following is **true** about the sampling distribution of the sample mean?
   (A) The mean of the sampling distribution is always μ .
   (B) The standard deviation of the sampling distribution is always σ.
   (C) The shape of the sampling distribution is always approximately normal.
   (D) All of the above are true.

2. Sales prices of baseball cards from the 1960s are known to possess a skewed-right distribution with a mean sale price of \$5.25 and a standard deviation of \$2.80. Suppose a random sample of 100 cards from the 1960s is selected. Describe the sampling distribution for the sample mean sale price of the selected cards.
   (A) Skewed-right with a mean of \$5.25 and a standard error of \$2.80
   (B) Normal with a mean of \$5.25 and a standard error of \$0.28
   (C) Skewed-right with a mean of \$5.25 and a standard error of \$0.28
   (D) Normal with a mean of \$5.25 and a standard error of \$2.80

3. The width of a confidence interval estimate for a proportion will be
   (A) narrower for 99% confidence than for 95% confidence.
   (B) wider for a sample size of 100 than for a sample size of 50.
   (C) narrower for 90% confidence than for 95% confidence.
   (D) narrower when the sample proportion is 0.50 than when the sample proportion is 0.20.

4. A major department store chain is interested in estimating the average amount its credit card customers spent on their first visit to the chain's new store in the mall. Fifteen credit card accounts were randomly sampled and analyzed with the following results: $\overline{X} = \$50.50$ and $s^2 = 400$. Construct a 95% confidence interval for the average amount its credit card customers spent on their first visit to the chain's new store in the mall assuming that the amount spent follows a normal distribution.
   (A) \$50.50 ± \$9.09
   (B) \$50.50 ± \$10.12
   (C) \$50.50 ± \$11.00
   (D) \$50.50 ± \$11.08

5. We have created a 95% confidence interval for μ with the result (10, 15). What decision will we make if we test $H_0 : \mu = 16$ versus $H_1 : \mu \neq 16$ at $\alpha = 0.10$?
   (A) Reject H_0 in favor of H_1.
   (B) Accept H_0 in favor of H_1.
   (C) Fail to reject H_0 in favor of H_1.
   (D) We cannot tell what our decision will be from the information given.

6. Suppose we want to test $H_0 : \mu \geq 30$ versus $H_1 : \mu < 30$. Which of the following possible sample results based on a sample of size 36 gives the strongest evidence to reject H_0 in favor of H_1?
   (A) $\overline{X} = 28, s = 6$
   (B) $\overline{X} = 27, s = 4$

(C) $\bar{X} = 32, s = 2$

(D) $\bar{X} = 26, s = 9$

7. *The Wall Street Journal* recently ran an article indicating differences in perception of sexual harassment on the job between men and women. The article claimed that women perceived the problem to be much more prevalent than did men. One question asked to both men and women was: "Do you think sexual harassment is a major problem in the American workplace?" Some 24% of the men compared to 62% of the women responded "Yes." Suppose that 150 women and 200 men were interviewed. What conclusion should be reached?

(A) Using a 0.01 level of significance, there is sufficient evidence to conclude that women perceive the problem of sexual harassment on the job as much more prevalent than do men.

(B) There is insufficient evidence to conclude with at least 99% confidence that women perceive the problem of sexual harassment on the job as much more prevalent than do men.

(C) There is no evidence of a significant difference between the men and women in their perception.

(D) More information is needed to draw any conclusions from the data set.

8. If we are testing for the difference between the means of 2 independent populations with samples of $n_1 = 20$ and $n_2 = 20$, the number of degrees of freedom is equal to

(A) 39.

(B) 38.

(C) 19.

(D) 18.

9. Which of the following components in an ANOVA table are not additive?

(A) Sum of squares.

(B) Degrees of freedom.

(C) Mean squares.

(D) It is not possible to tell.

10. A campus researcher wanted to investigate the factors that affect visitor travel time in a complex, multilevel building on campus. Specifically, he wanted to determine whether different building signs (building maps versus wall signage) affect the total amount of time visitors require to reach their destination and whether that time depends on whether the starting location is inside or outside the building. Three subjects were assigned to each of the combinations of signs and starting locations, and travel time in seconds from beginning to destination was recorded. An Excel output of the appropriate analysis is given below:

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Signs	14008.33		14008.33		0.11267	5.317645
Starting Location	12288			2.784395	0.13374	5.317645
Interaction	48		48		0.919506	5.317645
Within	35305.33		4413.167			

Total	61649.67	11

The F test statistic for testing the interaction effect between the types of signs and the starting location is

(A) 0.0109

(B) 2.7844

(C) 3.1742

(D) 5.3176

11. A study published in the *American Journal of Public Health* was conducted to determine whether the use of seat belts in motor vehicles depends on ethnic status in San Diego County. A sample of 792 children treated for injuries sustained from motor vehicle accidents was obtained, and each child was classified according to (1) ethnic status (Hispanic or non-Hispanic) and (2) seat belt usage (worn or not worn) during the accident. The number of children in each category is given in the table below.

	Hispanic	Non-Hispanic
Seat belts worn	31	148
Seat belts not worn	283	330

Which test would be used to properly analyze the data in this experiment?

(A) χ^2 test for independence

(B) χ^2 test for differences among more than two proportions

(C) Wilcoxon rank sum test for independent population

(D) Wilcoxon signed ranks test for two related populations

12. According to an article in *Marketing News*, fewer checks are being written at grocery store checkout stands than in the past. To determine whether there is a difference in the proportion of shoppers who pay by check among three consecutive years at a 0.05 level of significance, the results of a survey of 500 shoppers in three consecutive years are obtained and presented below.

	Year		
Check Written	Year 1	Year 2	Year 3
Yes	225	175	125
No	275	325	375

What is the correct conclusion?

(A) There is enough evidence that the proportions are all different in the 3 years.

(B) There is not enough evidence that the proportions are all different in the 3 years.

(C) There is enough evidence that at least two of the proportions are not equal.

(D) There is not enough evidence that at least two of the proportions are not equal.

13. For estimating linear regression model, the least squares method minimizes which of the following?

(A) SSR

(B) SSE

(C) SST

(D) All of the above

14. In a multiple regression problem involving two independent variables, if b_1 is computed to be +2.0, it means that
    (A) the relationship between X_1 and Y is significant.
    (B) the estimated average of Y increases by 2 units for each increase of 1 unit of X_1, holding X_2 constant.
    (C) the estimated average of Y increases by 2 units for each increase of 1 unit of X_1, without regard to X_2.
    (D) the estimated average of Y is 2 when X_1 equals zero.
15. In a multiple regression model, which of the following is correct regarding the value of the adjusted r^2?
    (A) It can be negative.
    (B) It has to be positive.
    (C) It has to be larger than the coefficient of multiple determination.
    (D) It can be larger than 1.
16. A real estate builder wishes to determine how house size (House) is influenced by family income (Income), family size (Size), and education of the head of household (School). House size is measured in hundreds of square feet, income is measured in thousands of dollars, and education is in years. The builder randomly selected 50 families and ran the multiple regression. Microsoft Excel output is provided below:

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.865
R Square	0.748
Adjusted R Square	0.726
Standard Error	5.195
Observations	50

ANOVA

	df	SS	MS	*F*	*Signif F*
Regression		3605.7736	901.4434		0.0001
Residual		1214.2264	26.9828		
Total	49	4820.0000			

	Coeff	StdError	*t Stat*	*P-value*
Intercept	−1.6335	5.8078	−0.281	0.7798
Income	0.4485	0.1137	3.9545	0.0003
Size	4.2615	0.8062	5.286	0.0001
School	−0.6517	0.4319	−1.509	0.1383

Which of the independent variables in the model are significant at the 2% level?
    (A) Income, Size, School

(B) Income, Size

(C) Size, School

(D) Income, School

17. A survey was conducted to determine how people rated the quality of programming available on television. Respondents were asked to rate the overall quality from 0 (no quality at all) to 100 (extremely good quality). The stem-and-leaf display of the data is shown below.

Stem	Leaves
3	24
4	03478999
5	0112345
6	12566
7	01
8	
9	2

What percentage of the respondents rated overall television quality with a rating of 50 or below?

(A) 11

(B) 40

(C) 44

(D) 56

18. Most analysts focus on the cost of tuition as the way to measure the cost of a college education. But incidentals, such as textbook costs, are rarely considered. A researcher at Drummand University wishes to estimate the textbook costs of first-year students at Drummand. To do so, she monitored the textbook cost of 250 first-year students and found that their average textbook cost was $300 per semester. Identify the population of interest to the researcher.

(A) All Drummand University students.

(B) All college students.

(C) All first-year Drummand University students.

(D) The 250 students that were monitored.

19. In a right-skewed distribution

(A) the median equals the arithmetic mean.

(B) the median is less than the arithmetic mean.

(C) the median is larger than the arithmetic mean.

(D) none of the above.

20. The probability that a new advertising campaign will increase sales is assessed as being 0.80. The probability that the cost of developing the new ad campaign can be kept within the original budget allocation is 0.40. Assuming that the two events are independent, the probability that the cost is kept within budget and the campaign will increase sales is:

(A) 0.20

(B) 0.32

(C) 0.40

(D) 0.88

二. 計算題 It is necessary to show the detail solution process. (需詳列計算過程)

1. (12 points) A bank has determined that 5% of its customers pay their credit card payments after the due date. What is the probability that in a random sample of 120 customers,

a. (6 points) 8 will be late on their payments?

b. (6 points) at least 10 will be late on their payments?

2. (28 points) Given below are five observations collected for a regression study on two variables x (independent variable) and y (dependent variable).

x	3	12	6	20	14
y	55	40	55	10	15

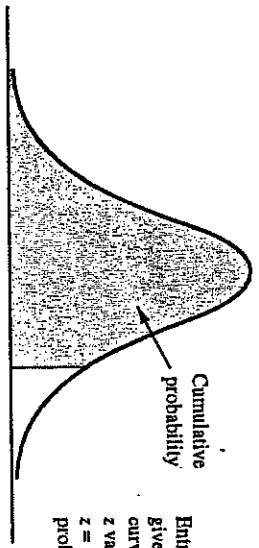
a. (7 points) Develop the least squares estimated regression equation.

b. (7 points) At 95% confidence, perform a t test and determine whether or not the slope is significantly different from zero.

c. (7 points) Compute the coefficient of determination and the coefficient of correlation.

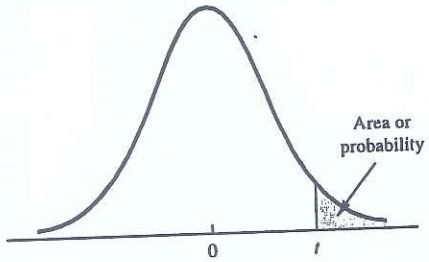
d. (7 points) Develop a 95% prediction interval for y when x=8.

TABLE 1 CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION (*Continued*)



z	.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

TABLE 2 *t* DISTRIBUTION



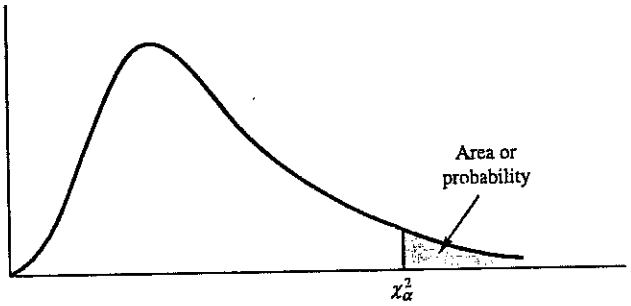
Entries in the table give t values for an area or probability in the upper tail of the t distribution. For example, with 10 degrees of freedom and a .05 area in the upper tail, $t_{.05} = 1.812$.

Degrees of Freedom	Area in Upper Tail					
	.20	.10	.05	.025	.01	.005
1	1.376	3.078	6.314	12.706	31.821	63.656
2	1.061	1.886	2.920	4.303	6.965	9.925
3	.978	1.638	2.353	3.182	4.541	5.841
4	.941	1.533	2.132	2.776	3.747	4.604
5	.920	1.476	2.015	2.571	3.365	4.032
6	.906	1.440	1.943	2.447	3.143	3.707
7	.896	1.415	1.895	2.365	2.998	3.499
8	.889	1.397	1.860	2.306	2.896	3.355
9	.883	1.383	1.833	2.262	2.821	3.250
10	.879	1.372	1.812	2.228	2.764	3.169
11	.876	1.363	1.796	2.201	2.718	3.106
12	.873	1.356	1.782	2.179	2.681	3.055
13	.870	1.350	1.771	2.160	2.650	3.012
14	.868	1.345	1.761	2.145	2.624	2.977
15	.866	1.341	1.753	2.131	2.602	2.947
16	.865	1.337	1.746	2.120	2.583	2.921
17	.863	1.333	1.740	2.110	2.567	2.898
18	.862	1.330	1.734	2.101	2.552	2.878
19	.861	1.328	1.729	2.093	2.539	2.861
20	.860	1.325	1.725	2.086	2.528	2.845
21	.859	1.323	1.721	2.080	2.518	2.831
22	.858	1.321	1.717	2.074	2.508	2.819
23	.858	1.319	1.714	2.069	2.500	2.807
24	.857	1.318	1.711	2.064	2.492	2.797
25	.856	1.316	1.708	2.060	2.485	2.787
26	.856	1.315	1.706	2.056	2.479	2.779
27	.855	1.314	1.703	2.052	2.473	2.771
28	.855	1.313	1.701	2.048	2.467	2.763
29	.854	1.311	1.699	2.045	2.462	2.756
30	.854	1.310	1.697	2.042	2.457	2.750
31	.853	1.309	1.696	2.040	2.453	2.744
32	.853	1.309	1.694	2.037	2.449	2.738
33	.853	1.308	1.692	2.035	2.445	2.733
34	.852	1.307	1.691	2.032	2.441	2.728

TABLE 2 *t* DISTRIBUTION (*Continued*)

Degrees of Freedom	Area in Upper Tail					
	.20	.10	.05	.025	.01	.005
35	.852	1.306	1.690	2.030	2.438	2.724
36	.852	1.306	1.688	2.028	2.434	2.719
37	.851	1.305	1.687	2.026	2.431	2.715
38	.851	1.304	1.686	2.024	2.429	2.712
39	.851	1.304	1.685	2.023	2.426	2.708
40	.851	1.303	1.684	2.021	2.423	2.704
41	.850	1.303	1.683	2.020	2.421	2.701
42	.850	1.302	1.682	2.018	2.418	2.698
43	.850	1.302	1.681	2.017	2.416	2.695
44	.850	1.301	1.680	2.015	2.414	2.692
45	.850	1.301	1.679	2.014	2.412	2.690
46	.850	1.300	1.679	2.013	2.410	2.687
47	.849	1.300	1.678	2.012	2.408	2.685
48	.849	1.299	1.677	2.011	2.407	2.682
49	.849	1.299	1.677	2.010	2.405	2.680
50	.849	1.299	1.676	2.009	2.403	2.678
51	.849	1.298	1.675	2.008	2.402	2.676
52	.849	1.298	1.675	2.007	2.400	2.674
53	.848	1.298	1.674	2.006	2.399	2.672
54	.848	1.297	1.674	2.005	2.397	2.670
55	.848	1.297	1.673	2.004	2.396	2.668
56	.848	1.297	1.673	2.003	2.395	2.667
57	.848	1.297	1.672	2.002	2.394	2.665
58	.848	1.296	1.672	2.002	2.392	2.663
59	.848	1.296	1.671	2.001	2.391	2.662
60	.848	1.296	1.671	2.000	2.390	2.660
61	.848	1.296	1.670	2.000	2.389	2.659
62	.847	1.295	1.670	1.999	2.388	2.657
63	.847	1.295	1.669	1.998	2.387	2.656
64	.847	1.295	1.669	1.998	2.386	2.655
65	.847	1.295	1.669	1.997	2.385	2.654
66	.847	1.295	1.668	1.997	2.384	2.652
67	.847	1.294	1.668	1.996	2.383	2.651
68	.847	1.294	1.668	1.995	2.382	2.650
69	.847	1.294	1.667	1.995	2.382	2.649
70	.847	1.294	1.667	1.994	2.381	2.648
71	.847	1.294	1.667	1.994	2.380	2.647
72	.847	1.293	1.666	1.993	2.379	2.646
73	.847	1.293	1.666	1.993	2.379	2.645
74	.847	1.293	1.666	1.993	2.378	2.644
75	.846	1.293	1.665	1.992	2.377	2.643
76	.846	1.293	1.665	1.992	2.376	2.642
77	.846	1.293	1.665	1.991	2.376	2.641
78	.846	1.292	1.665	1.991	2.375	2.640
79	.846	1.292	1.664	1.990	2.374	2.639

TABLE 3 CHI-SQUARE DISTRIBUTION



Entries in the table give χ^2_α values, where α is the area or probability in the upper tail of the chi-square distribution. For example, with 10 degrees of freedom and a .01 area in the upper tail, $\chi^2_{.01} = 23.209$.

Degrees of Freedom	Area in Upper Tail									
	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	.000	.000	.001	.004	.016	2.706	3.841	5.024	6.635	7.879
2	.010	.020	.051	.103	.211	4.605	5.991	7.378	9.210	10.597
3	.072	.115	.216	.352	.584	6.251	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	1.064	7.779	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	1.610	9.236	11.070	12.832	15.086	16.750
6	.676	.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.647	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	7.041	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	45.558
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	12.878	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	50.994
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.335