

## 國立臺灣科技大學 109 學年度碩士班招生試題

系所組別：企業管理系碩士班

科目：統計學

(總分為 100 分)

## 1. Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

1.1. (3 points) Which of the following is correct?

- A. The probability of a type I error is  $\beta$ .
- B. The probability of a type II error is  $(1 - \beta)$ .
- C. The probability of a type II error is  $\alpha$ .
- D. none of the above

1.2. (3 points) According to the empirical rule, the bell or mound shaped distribution will have approximately 95% of the data within what number of standard deviations of the mean?

- A. one standard deviation
- B. two standard deviations
- C. three standard deviations
- D. four standard deviations

1.3. (3 points) A random sample of 5 chickens is sampled. The number of chickens carrying the Bird Flu in the sample is an example of which random variable?

- A. normal
- B. student's t
- C. binomial
- D. uniform

1.4. (3 points) The long-run average of a random variable is?

- A. the expected value
- B. the coefficient of determination
- C. the standard deviation
- D. the mode

1.5. (3 points) If population A has a larger standard deviation than population B, which of the following is NOT true?

- A. Population B has a smaller variance than population A.
- B. The mean of a sample of 20 from population A has a larger standard deviation than the mean of a sample of 20 from population B.
- C. A typical observation from population A will be farther from the mean of population A than a typical observation from B will be from the mean of population B.
- D. The mean of a sample from population A will on average be larger than the mean of a sample from population B.

1.6. (3 points) A researcher is studying students in college in Taiwan. He takes a sample of 500 students from 5 colleges. The average age of all college students in Taiwan is

- A. a statistic.



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B. a parameter.

C. the median.

D. a population.

1.7. (3 points) The standard deviation of a normal population is 10. You take a sample of 50 items from this population and compute a 95% confidence interval. In order to compute the confidence interval, you will use?

A. the t table because the degrees of freedom will be 49.

B. the t table because you have estimated the standard deviation from the sample.

C. the z table because the population standard deviation is known.

D. the z table because the sample size is small.

1.8. (3 points) IQ tests are standardized so that the mean score is 100 for the entire group of people.

However, if you select a group of 50 who takes the test, you probably would not get 100. What statistical concept explains the difference between the two means?

A. Statistical error

B. Inferential error

C. Residual error

D. Sampling error

1.9. (3 points) A set of scores is presented in a histogram. The histogram shows a series of bars that tend to decrease in height from left to right. What is the shape of the distribution?

A. Leptokurtic

B. Positively skewed

C. Negativity skewed

D. Normal

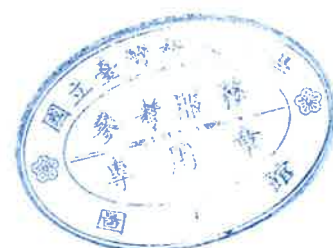
1.10. (3 points)  $R^2$  is the notation for:

A. The coefficient of correlation.

B. The coefficient of determination.

C. The coefficient of variation.

D. The coefficient of regression.



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**Open-ended questions.**

2. Selena argues that IQ scores can influence employees' work performance in a particular month (Time\_1: March; Time\_2: October). She designs an experiment to test her question. Answer the questions for Selena with the following informative tables.

2.1.(5 points) What is this experimental design?

2.2.(5 points) What are independent and dependent variables in this design?

2.3.(5 points) Make a plot with the interaction effect. (Take IQ variable as your horizontal axis.

2.4.(5 points) Interpret the meaning of the interaction effect with mean scores on the four conditions (High/Low IQ x Time\_1/\_2).

**Descriptive Statistics**

	IQ	Mean	Std. Deviation	N
Time_1	Low IQ	2.38	1.323	50
	High IQ	1.98	1.082	48
	Total	2.18	1.221	98
Time_2	Low IQ	2.65	1.354	50
	High IQ	3.09	.890	48
	Total	2.86	1.166	98

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Linear	23.260	1	23.260	15.736	.000
Time * IQ	Linear	8.670	1	8.670	5.865	.017
Error(Time)	Linear	141.898	96	1.478		

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1248.253	1	1248.253	951.375	.000
IQ	.019	1	.019	.015	.904
Error	125.957	96	1.312		



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## IQ \* Time

Time	(I) IQ	(J) IQ	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
1	Low IQ	High IQ	.401	.245	.105	-.085	.887
	High IQ	Low IQ	-.401	.245	.105	-.887	.085
2	Low IQ	High IQ	-.441	.233	.061	-.902	.021
	High IQ	Low IQ	.441	.233	.061	-.021	.902

IQ	(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Low IQ	1	2	-.268	.243	.272	-.751	.214
	2	1	.268	.243	.272	-.214	.751
High IQ	1	2	-1.110 <sup>*</sup>	.248	.000	-1.602	-.617
	2	1	1.110 <sup>*</sup>	.248	.000	.617	1.602

## 3. Multiple Choice Questions

I. (5 points) Distance is an example of a variable that uses

- the interval scale.
- the ratio scale.
- the ordinal scale.
- either the ratio or the ordinal scale.

II. (5 points) For which of the following probability distribution, there is a lower limit but no upper limit for a random variable ( $x$ )?

- exponential probability distribution.
- normal probability distribution.
- uniform probability distribution.
- beta probability distribution.

III. (5 points) The measure of location which is the most likely to be influenced by extreme values in the data set is

- range.
- mode.
- interquartile range.
- mean.



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IV. (5 points) For two mutually exclusive events, which of the following is true?

- They have no sample points in common.
- Their intersection is 1.
- Their intersection is 0.5.
- Most of their sample points are in common.

4. There are forty thousand students in a local university, and 10% of the students live in the dormitories. A random sample of 100 students is selected from all the students in the university for a particular study.

## 第4題請查z表

- What is the probability that the sample proportion (the proportion living in the dormitories) is between 0.172 and 0.178? (5 points)
- What is the probability that the sample proportion (the proportion living in the dormitories) is greater than 0.175? (5 points)

5. The estimated regression equation based on 10 observations follows.

$$\hat{y} = 29.2351 + 5.324x_1 + 3.741x_2$$

Here  $SST = 7445.217$ ,  $SSR = 7363.147$ ,  $s_{b_1} = 0.2217$ , and  $s_{b_2} = 0.4125$

## 第5題請查F及t表

- Perform the appropriate  $F$  test. Use  $\alpha = 0.05$ . (5 points)
- Perform a  $t$  test for the significance of  $\beta_1$ . Use  $\alpha = 0.05$ . (5 points)
- Perform a  $t$  test for the significance of  $\beta_2$ . Use  $\alpha = 0.05$ . (5 points)
- Compute  $R^2$ . (5 points)

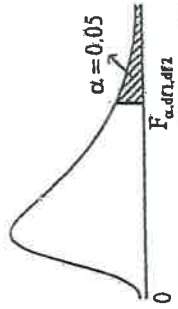


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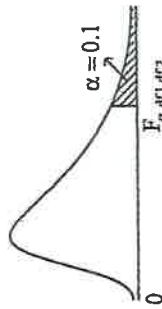
(總分為 100 分)



F 分配臨界值表 (續)

$P(F_{df1, df2} > F_{\alpha, df1, df2}) = \alpha = 0.05$

Table of F-distribution critical values for alpha=0.05. Columns represent degrees of freedom (df1) from 1 to infinity. Rows represent degrees of freedom (df2) from 1 to infinity.



F 分配臨界值表

$P(F_{df1, df2} > F_{\alpha, df1, df2}) = \alpha = 0.1$

Table of F-distribution critical values for alpha=0.1. Columns represent degrees of freedom (df1) from 1 to infinity. Rows represent degrees of freedom (df2) from 1 to infinity.



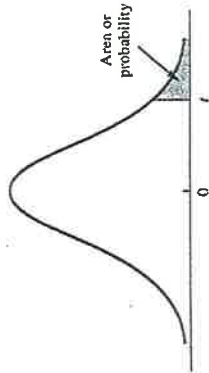
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t Distribution

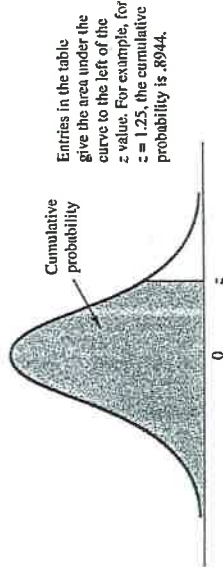


Entries in the table give  $t$  values for an area or probability in the upper tail of the  $t$  distribution. For example, with 10 degrees of freedom and a .05 area in the upper tail,  $t_{.05} = 1.812$ .

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

Cumulative Probabilities for The Standard Normal Distribution

表



Entries in the table give the area under the curve to the left of the  $z$  value. For example, for  $z = 1.25$ , the cumulative probability is .8944.

$z$	.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
10	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
11	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
12	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
13	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
14	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
15	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
16	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
17	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
18	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
19	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
20	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
21	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
22	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
23	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
24	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
25	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
26	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
27	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
28	.9974	.9975	.9976	.9977	.9978	.9979	.9980	.9981	.9982	.9983
29	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
30	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

