

考試科目	統計學	所(組)別	統計學系	考試時間	100年10月29日 星期六 10:00-11:40
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注意事項：

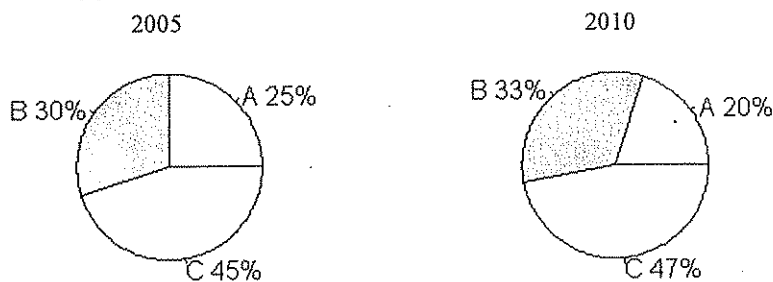
本科目有五份試題，第一份試題之答題請寫在第一卷上，餘類推。

第一份試題(答題請寫在第一卷上)

1. Nina Liu, Chief Financial Officer of Fortune Inc., suspects irregularities in the payroll system, and orders an inspection of "each and every payroll voucher issued since January 1, 2001." Nina is ordering a _____ . (2%)

- a) statistic from the payroll vouchers
- b) census of the payroll vouchers
- c) sample of the payroll vouchers
- d) sorting of the payroll vouchers
- e) parameter of the payroll vouchers

2. The 2005 and 2010 market share data of the three competitors (A, B, and C) in a cell phone industry are presented in the following pie charts.



2-1. Which of the following is true? (2%)

- a) Only company C gained market share.
- b) Only company A lost market share.
- c) Company B lost market share.
- d) Company C lost market share.
- e) All companies lost market share

2-2. Which of the following may be a false statement? (2%)

- a) Sales revenues declined at company A.
- b) Only company A lost market share.
- c) Company B gained market share.
- d) Company C gained market share.
- e) Both Company B and Company C gained market share

3. Ann, the marketing director of KK Electrical Company is leading a study to assess the relative importance of product features. A survey questionnaire was distributed to 100 of KK's customers and asked them to rate the importance of "ease of maintenance" and "efficiency of operation" on a scale of 1 to 10 (with 1 meaning "not important" and 10 meaning "highly important"). Her staff assembled the following statistics on these variables.

	Ease of Maintenance	Efficiency of Operation
Mean	8.00	6.00
Median	8.50	5.50
Mode	9.00	5.00
Standard Deviation	1.60	1.38

3-1. What can Ann conclude from these statistics? (2%)

- a) The Ease of Maintenance distribution is skewed to the right.
- b) The Ease of Maintenance distribution is not skewed.
- c) The Efficiency of Operation distribution is skewed to the left.
- d) The Efficiency of Operation distribution is positively skewed.
- e) Both are symmetrically distributed.

3-2. Which variable has a smaller variation? Why? (3%)

(下接第一份試題第 2 頁)

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第一份試題第 2 頁(答題請寫在第一卷上)

4. A market research firm is investigating the preference of three package designs. The table below gives information obtained through a sample of 200 consumers. The three package designs are labeled I, II, and III. The consumers are classified according to age and package design preference.

	I	II	III	Total
Under 30 years	20	30	40	90
30 or older	60	20	30	110
Total	80	50	70	200

If one of these consumers is randomly selected and prefers design II, what is the probability that the person is 30 or older? (2%)

- a) 0.10 b) 0.25 c) 0.45 d) 0.60 e) 0.40

5. A market research firm conducts studies regarding the success/failure of new products. The company is not always perfect in predicting the success. Suppose that there is a 60% chance that any new product would be successful (and a 40% chance that it would fail). In the past, for all new products that ultimately were successful, 80% were predicted to be successful. Also, for all new products that were ultimately failures, 70% were predicted to be failures. If the market research predicted that the product would be a success, what is the probability that it would actually be a success? (5%)

6. The mean life of a particular brand of light bulb is 800 hours and the standard deviation is 50 hours. It can be concluded that at least 89% of this brand of bulbs will last between _____ . (2%)

- a) 700 and 900 hours
b) 750 and 850 hours
c) 600 and 1000 hours
d) 650 and 950 hours
e) 550 and 1050 hours

(第一份試題結束)

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第二份試題(答題請寫在第二卷上)

1. 何謂抽樣分佈(Sampling Distribution)? (4分)
2. 假設樣本平均數 \bar{x} 為從具有平均數為 m 及標準差為 s 的母體中抽取大小為 n 之簡單隨機抽樣樣本之平均數，
則 \bar{x} 之抽樣分佈的平均數及標準差為何? (4分)
3. 試討論樣本平均數 \bar{x} 分佈的形狀。
 - (i) 若母體分佈為常態? (2分)
 - (ii) 若母體分佈不為常態? (6分)
4. 請寫出簡單隨機抽樣樣本大小為 n 之樣本比例 \hat{p} 的抽樣分佈。(4分)

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第三份試題(答題請寫在第三卷上)

1. Patients with AIDS frequently develop diarrhea (腹瀉) illness. Consider the randomized controlled trial in Huang and Zhou (2007). A total of 148 AIDS patients were enrolled, in which 75 patients were randomly assigned to the intensive handwashing intervention group, and 73 patients were assigned to the control group. For the intensive handwashing group, a weekly telephone call was made by the study nurse to educate the patients on the importance of handwashing. The study nurse made a weekly telephone call for 1 year and asked for the times of handwashing, and whether the patient had diarrhea in the preceding week. The following table gives the average and the standard deviation of the two samples on three related measurements: Baseline Handwashing, Handwashing and Diarrheal. The number of baseline handwashing episodes of a patient was collected prior to the experiment, while the other two measurements were collected during the trial.

Mean \pm SD	Group	
	Handwashing ($n_1=75$)	Control ($n_2=73$)
Baseline Handwashing (average times/per day,)	3.3 \pm 0.98	3.4 \pm 1.1
Handwashing (average times/per day,)	4 \pm 1.01	7 \pm 1.4
Diarrheal (times/year)	1.24 \pm 0.9	2.92 \pm 0.6

- (a) (5%) Can we conclude that patients assigned to the intensive handwashing intervention group washed their hands more frequently compared with the control group? Please explain it.
- (b) (10%) Can we conclude that intensive handwashing reduces diarrheal illness in patients with AIDS? Please explain it.
- (c) (5%) Please comment on the given statistical evidence.

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第四份試題(答題請寫在第四卷上)

- (3pts). Which one (only one) of the followings is not a consequence of the multicollinearity?
 - Inaccurate prediction for a new observation.
 - Inaccurate conclusion on which independent variables are statistically significant.
 - The standard error of estimate is distorted.

- (8pts). The personnel director for Electronics Associates want to develop a regression equation relating an employee's score on a job satisfaction to his or her length of service and wage rate. A multiple linear regression analysis is performed. Please complete the following output.

The regression equation is

$$\text{Satisfaction} = 14.448 - 8.690 \text{ Length} + 13.517 \text{ Wage}$$

Predictor	Coef	SE	T	P
Constant	14.448	8.191	1.7639	0.121
Length	(a)	1.555	-5.5884	0.001
Wage	13.517	2.085	(b)	0.000

S=3.7728 R-sq= (c) % R-sq(adj)=86.1614%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	648.83	324.425	22.7916	0.003
Error	5	71.17	14.234		
Total	(d)	720.00			

- Consider a study involving the Graduate Management Admissions Test (GMAT) In attempt to improve students' performance on the GMAT exam, Texas university is considering offering several GMAT preparation programs. Before selecting the preparation program to adopt, further study is conducted to determine how the proposed programs affect GMAT scores. Since the GMAT is usually taken by students from three colleges: the College of Business, the College of Engineering, and the College of Arts and Sciences, the factor of a student's college is also considered in the study to affect the GMAT score. A two-way ANOVA with interaction is used to make appropriate conclusions and the ANOVA table is in the following.

Source	DF	SS	MS	F	P
Program	2	6100	3050	1.3828	0.299
College	2	45300	22650	10.2693	0.005
Program*College	4	11200	2800	1.2695	0.350
Error	9	19850	2205.6		
Total	17	82450			

- (3pts). How many preparation programs are considered in this study?
- (3pts). What is the p-value for the test of hypothesis H_0 : there is no interaction effect between the preparation program and the college against H_1 : there is an interaction effect between the preparation program and the college?
- (3pts). How much variation in the GMAT scores is not explained by this interaction model?

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第五份試題(答題請寫在第五卷上)

(單選題: 12pts)

1. Suppose 15 students are randomly selected and their exam scores recorded before and after a new TA is assigned to this class. Which of the following tests is not suitable for proving that the new TA can help students improve their exam performance?
 (A) Paired t test (B) Sign test (C) Wilcoxon Signed-Rank test
 (D) Wilcoxon Rank-Sum test (E) None of the above
2. Which of the following tests does not use the chi-square value as the test statistic?
 (A) The goodness of fit test (B) Testing independence for the contingency table
 (C) Wilcoxon Rank-Sum test (D) The Kruskal-Wallis test (E) None of the above
3. Which of the following is a correct statement regarding the goodness-of-fit test?
 (A) Population must be normal (B) The number of categories must be at least five (C) All the expected frequencies must be equal
 (D) Small numbers of observations will tend to reject the null hypothesis (E) None of the above.
- 4) The Taipei city governor believes that the median of the annual income for the residents is about \$2,000,000. Which of the following is best suited for performing such a test?
 (A) Sign test (B) One-sample t test (C) Wilcoxon Rank-Sum test (D) Goodness of fit test (E) None of the above

(填充題: 8pts)

5. Four brands of light bulbs are being considered for the declaration of Xmas trees on NCCU campus. The director of purchasing asked for 100 samples from each manufacturer. The numbers of acceptable and unacceptable bulbs from each manufacturer are show below.

	Manufacturer			
	A	B	C	D
Unacceptable	12	8	5	11
Acceptable	88	92	95	89
Total	100	100	100	100

To see if the quality of bulbs related to manufacturer, we can perform a chi-square goodness-of-fit test. Fill in the following blanks.

- (a)(2pts) Given the significance level 0.05, the critical value for this test = _____.
- (b)(4pts) The chi-square test statistic = _____.
- (c)(2pts) Would you conclude the quality of bulbs related to manufacturer? (yes/no) _____.