

考試科目	統計學	所(組)別	統計學系	考試時間	109 年 11 月 7 日 星期六 10: 00 - 11: 40
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注意: 本科目有四份試題, 第一份試題答案請寫在第一卷答案本上, 依此類推。每份試題配分為 25 分, 合計 100 分。

第一份試題 (答案請寫在第一卷答案本上)

1. (5 points) The data below shows the monthly income (in thousand) from a sample of 10 junior manager at X Company. Construct a stem-and-leaf plot for this data.

42 37 36 38 15 31 18 24 20 45

2. (5 points) Consider the experiment of rolling a fair die. The possible outcomes are $\{1, 2, 3, 4, 5, 6\}$. Consider the events $A = \{1, 2, 4, 5\}$ and $B = \{4, 5, 6\}$. Are events A and B independent? Explain.
3. (5 points) Mary found that the probability that a diner will returning to her restaurant is 0.8. Among 100 randomly selected diners, find the probability that the number of returns is within the range $[70, 75]$. Approximate this by the normal approximation to the binomial.
4. (10 points) The road traffic fatality rate is approximately 12.5 deaths per 100,000 inhabitants each year. Among 20,000 inhabitants, what is the probability that there will be two or less road traffic deaths within next year? Use Poisson probability distribution to calculate this probability.

第二份試題 (答案請寫在第二卷答案本上)

1. (12 points) Let θ be the probability of obtaining a head when a coin is tossed. To test the hypotheses $H_0: \theta \leq \theta_0$ vs. $H_1: \theta > \theta_0$, suppose that the coin is tossed repeatedly, and we let X be the number of tosses required to obtain the first head.
- (a) (5 points) Please find a rejection region based on X and give a reason to support your answer (ps. 先提出一個直觀的理由, 然後理論推導結果)
- (b) (4 points) Let $\beta(\theta)$ be the power function of the test in (a). Show that $\max_{\theta \leq \theta_0} \beta(\theta) = \beta(\theta_0)$.
- (c) (3 points) Assume that $\theta_0 = 0.01$. Please find the critical value of the test in (a) so that it becomes a size α test, where $\alpha = (1 - 0.99^{10})$.
2. (13 points) Let X be a single observation from the pdf $f(x) = e^{-(x-\theta)}, x > \theta$.
- (a) (3 points) Let the rejection region be $\{X \geq c\}$ for testing $H_0: \theta = 0$ vs. $H_1: \theta = 2$.
If the alternative hypothesis is changed to $H_1: \theta = 5$. The value c will become larger, smaller or the same? Why?
- (b) (10 points) Based on X , find the $100(1 - \alpha)\%$ confidence interval for θ with the form $[X + a, X + b]$, which has the minimum length.

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第三份試題 (答案請寫在第三卷答案本上)

1. (25 points) The following table shows the estimation output of a regression analysis, for which data are randomly taken from 30 suburb commercial properties by a real estate company in order to provide clients with quantitative information upon which to make rental decision.

	Coefficient Estimate	Standard error
<i>Constant</i>	12.45	0.76
X_1	-0.19	0.02
X_2	0.27	0.07
X_3	-2.31	1.43
$X_4/100$	0.08	0.01

$$SSTotal=102 \quad R^2=80\%$$

Here are the variables: age (X_1), operating expenses and taxes (X_2), vacancy rate (X_3), total square footage (X_4), and rental rate (Y) is the response. Answer the following questions and use the level of significance 0.05 if a hypothesis test is needed.

- (a) (8 points) Examine which variables in X_1, \dots, X_4 could be omitted based on the regression output.
(b) (10 points) Construct the ANOVA table for the regression analysis and comment on the resulting test.
(c) (7 points) What will the values of estimates in the table, $SSTotal$, and R^2 change if you divide X_4 by 10?

第四份試題 (答案請寫在第四卷答案本上)

1. (25 points) The Employee Benefit Research Institute reports that 26% of males anticipate having enough money to live comfortably in retirement, but only 18% of females express that confidence. If these results were based on a random sample of 100 people of each gender, would you consider this strong evidence that men and women have different outlooks?
- (a) (6 points) Can you perform a chi-square test for this problem? If yes, which one is your choice? Goodness-of-fit, homogeneity, or independence? Explain. State the hypotheses.
(b) (10 points) Carry out the test you stated in (a). Find and interpret the p-value. What can you conclude?
(c) (6 points) Estimate the difference by constructing a 95% confidence interval and interpret your interval.
(d) (3 points) Will the power of the test in (b) be greater if the results were based on a random sample of 250 people of each gender? Why?