

考試科目	統計學	所(組)別	統計學系	考試時間	11月8日 星期日 10:00-11:40
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1. A nonparametric method for determining the differences between two populations based on two matched samples where only preference data is required is the
- Mann-Whitney-Wilcoxon test
 - Wilcoxon signed-rank test
 - sign test
 - Kruskal-Wallis Test
- (2%)

2. If a null hypothesis that states that two populations are identical is rejected using a nonparametric test, then it is safe to assume that
- neither the means nor the variances are equal.
 - the means of the populations are not the same.
 - the variances of the populations are not the same.
 - we cannot be sure of the way in which the populations differ from each other.
- (2%)

3. For a data set contains pairs of data, let d_i denote the difference between ranks for the i^{th} item, and $\sum_{i=1}^{20} d_i^2 = 50$ is obtained.

Then, Spearman rank-correlation coefficient is

- 0.8747
 - 0.8684
 - 0.9624
 - 0.9937
- (2%)

4. A research organization wishes to determine whether four brands of batteries for radios perform equally well. Three batteries of each type were randomly selected and installed in the three test radios. The number of hours of use for each battery together with marginal totals and sums of squares are given below.

	Brand 1	Brand 2	Brand 3	Brand 4	$\sum_{j=1}^4 y_{ij}$	$\sum_{j=1}^4 y_{ij}^2$
Radio A	25	27	20	28	100	2538
Radio B	29	38	24	37	128	4230
Radio C	21	28	16	19	84	1842
$\sum_{i=1}^3 y_{ij}$	75	93	60	84	$\sum_{i=1}^3 \sum_{j=1}^4 y_{ij} = 312$	
$\sum_{i=1}^3 y_{ij}^2$	1907	2957	1232	2514		

- Write the design for this experiment.
 - At $\alpha = 0.05$, test whether there exists any significant difference in means for the four types of batteries. Write down H_0 , H_a , compute the test statistic, find critical value, and draw conclusion.
- (12%)

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<p>貳：</p> <ol style="list-style-type: none"> 1. (6 points) Determine whether the following qualitative variables are nominal or ordinal. <ol style="list-style-type: none"> (a) Religious preference. (b) Phone numbers. (c) The rating of personal computers purchased by customers. 2. (6 points) A couple plans to have children. After some discussion, they decide to continue to have children until they have a girl or until they have three children, whichever comes first. We assume that each child has probability $1/2$ of being a boy and $1/2$ of being a girl, and that knowing the gender of a child does not influence the gender of any of the successive children. <ol style="list-style-type: none"> (a) Generate the sample space. (b) What is the probability that they will have a boy among their children ? 3. (8 points) Suppose you are on a game show and you are given the choice of three doors. Behind one door is a car; behind the others, goats. The car and the goats were placed randomly behind the doors before the show. The rules of the game show are as follows: "After you have chosen a door, the door remains closed for the time being. The game show host, who knows what is behind the doors, now opens one of the two remaining doors that has a goat behind it. (Note that, no matter which door you select, at least one of the remaining doors has a goat behind it.) If both remaining doors have goats behind them, he chooses one randomly. After the game host opens a door with a goat, he will ask you to decide whether you want to stay with your original choice or to switch to the other remaining closed door." <ol style="list-style-type: none"> (a) What is the probability of winning the car if you switch doors? (b) What is the probability of winning the car if you do not switch doors? 					

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參:

1. Find (a) $E(X)$, and (b) $\text{Var}(X)$, when X is a normal random variable with parameter μ and σ^2 . (8%)
2. Show that $P(X=n+k|X>n)=P(X=k)$, when X is a geometric random variable with parameter p . (5%)
3. The joint density of X and Y is given by

$$f(x, y) = \begin{cases} e^{-(x+y)} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$$

Find the density function of the random variable X/Y . (7%)

肆:

The manufacture manager in the Coca-Cola Company suspected that the new bottling process produces under-filled cans of Coca-Cola. Based on the most recent collected data of 100 cans of regular 12-oz Coca-Cola, the sample mean is 11.95 oz and the sample standard deviation is 0.1 oz. When testing $H_0: \mu = 12$ oz vs.

$H_1: \mu < 12$ oz, what is the minimum sample size needed to guarantee that the power of the test will be at least 90% in order to detect the true $\mu = 11.98$ at $\alpha = 0.05$?

(Note: You can make the necessary assumption if needed.)

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伍: The following table lists a sample of automatic teller machine (ATM) customers: time (seconds) to complete their transaction, age, and gender (1=male, 0=female).

Time	Age	Gender
76	47	0
70	42	1
76	46	0
42	35	1
66	26	1
57	30	1
53	33	1
67	66	0
81	45	0
76	64	0
70	47	1
75	27	0
73	46	0
72	49	1

The computer printouts are as follows.

	Estimate	Std. Error
Intercept	69.49	11.48
Age	0.11	0.23
Gender	-12.19	5.31

Residual standard error: 8.72, F -statistic: 4.27

- (1) Determine the regression equation and interpret the partial regression coefficients. (6%)
- (2) Please construct an analysis of variance table for this regression model and interpret the results. (7%)
- (3) Determine the values of R^2 and adjusted R^2 , and compare their difference. (7%)