

考生注意: 1. 依次序作答, 只要標明題號, 不必抄題。
2. 答案必須寫在答案卷上, 否則不予計分, 並限以藍黑色筆作答。
3. 試題隨卷繳回。(餘詳詳閱試場規則)

Note: The following data may be useful in answering your questions:

$$\begin{array}{ll} F_{0.025}(10,12)=3.37 & F_{0.975}(10,12)=0.276 \\ t_{0.05}(22)=1.717 & t_{0.005}(22)=2.819 \\ z_{0.05}=1.64 & z_{0.025}=1.96 \\ \chi^2_{0.05}(2)=5.991 & \chi^2_{0.025}(2)=7.378 \end{array}$$

1. In the report on College Web Culture in Taiwan (CWCT) it is claimed that 22% of students spend less than one hour per week with Internet, 27% of students spend one to five hours per week with Internet, and 51% of students will spend more than five hours per week with Internet. The data of 40 college students selected from NCNU indicate that six students spend less than one hour per week with Internet, seven within five hours per week, and 27 more than five hours per week. Would the CWCT claim be rejected at the significance level of $\alpha=0.05$? (10 points)

2. Consider two random variables X and Y that have the joint p.m.f.

$$f(x,y) = \frac{x+2y}{18}, \quad x=1,2, \text{ and } y=1,2.$$

- (a) What is the probability $\text{Prob}(X=2|Y=2)$? (4 points)
(b) Are X and Y independent? (4 points)
(c) What is the covariance of X and Y ? (6 points)

3. Let X_1, X_2, \dots, X_n be the observations of a random sample of size n from a normal distribution $N(\mu, \sigma^2)$. Show that S^2 is an unbiased estimator of σ^2 , where

$$S^2 = \frac{1}{n-1} \sum_{i=1}^n (X_i - \frac{1}{n} \sum_{j=1}^n X_j)^2$$

(10 points)

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4. Please fill and complete the following ANOVA table.

Source	Sum of Squares	Degree of Freedom	Mean Square	F
Row	24	2	(d)	(e)
Column	30	(b)	10	(f)
Error	(a)	(c)	(g)	
Total	58	(h)		

(16 points)

5. Let X and Y denote the used disk spaces of user accounts in two file systems, respectively. For 11 observations of X , the sample mean is 1.21 and the sample variance 0.26. For 13 observations of Y , the sample mean is 1.68 and the sample variance 0.34.

(a) Please test whether the two means of X and Y are equal at an $\alpha=0.05$ significance level. (7 points)

(b) Please test whether the two variances of X and Y are equal at an $\alpha=0.05$ significance level. (8 points)

6. A proportion, p , that many public opinion polls estimate is the number of citizens who would say yes to the question, "Do you think that it is necessary for government to fund elementary computer courses in preschools?" In one such random sample of 300 people, 75 say yes.

(a) Find an approximate 95% confidence interval for p . (7 points)

(b) If a margin of error of ± 4 percent is required, how many people should be questioned? (8 points)

7. A bowl contains two red balls, two white balls, and two ball that are either red or white. Let p denote the probability of drawing a red ball from the bowl. We shall test the null hypothesis $H_0: p = 1/2$ against the alternative hypothesis $H_a: p \neq 1/2$. Draw four balls at random from the bowl one at a time and with replacement. Let X denote the number of red balls drawn.

(a) Define a critical region for this test in terms of X . (8 points)

(b) Find the corresponding values of α and β errors. (12 points)