

國立成功大學
110學年度碩士班招生考試試題

編 號：101

系 所：土木工程學系

科 目：工程統計

日 期：0202

節 次：第 3 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. An appliance dealer sells three different models of upright freezers having 12, 16, and 20 cubic feet of storage space, respectively. Let X = the amount of storage space purchased by the next customer to buy a freezer. Suppose that X has the probability mass function (pmf) as follows: (5 points each)

x	12	16	20
$p(x)$	0.2	0.5	0.3

- (1) Compute $E(X)$, $E(X^2)$, and $V(X)$.
 - (2) If the price of a freezer having capacity X cubic feet is $25X - 8.5$, what is the expected price paid by the next customer to buy a freezer?
 - (3) What is the variance of the price $25X - 8.5$ paid by the next customer?
 - (4) Suppose that although the rated capacity of a freezer is X , the actual capacity is $h(X) = X - 0.01X^2$. What is the expected actual capacity of the freezer purchased by the next customer?
2. Let X denote the amount of space occupied by an article placed in a 1-m^3 packing container. The probability density function (pdf) of X is as follows: (5 points each)

$$f(x) = \begin{cases} 90[(1-x)x^9] & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

- (1) What is the cumulative density function (cdf) of X ?
 - (2) What is $P(0.25 \leq X \leq 0.5)$?
 - (3) Compute $E(X)$.
 - (4) Compute $V(X)$.
3. A minor league baseball team asks you to be the statistical consultant on a study of home runs hit in their ball park. Denote by X , the number of home runs hit in a game. You take a sample of 100 games and get $\bar{X} = 2.45$. (Assume that $\sigma = 0.92$). (5 points each)
- (1) Compute a 95% confidence interval for μ , the mean number of home runs hit in their ball park
 - (2) The president of the team is not impressed with the accuracy of the confidence interval and wants the margin of error to be 0.1. What sample size do you need to get the margin of error to 0.1 with 95% confidence?
 - (3) Last year the mean number of home runs hit was 2.25. The president wants to know if the number of homeruns hit this season has increased. State the hypotheses of interest for testing his question.
 - (4) Find the z-test statistic to test your hypotheses. State your conclusions at $\alpha = 0.05$.

Values Provided for Your Calculations

z	1.64	1.96	2.58	$t_{0.05, 16}$	$t_{0.05, 15}$	$t_{0.025, 16}$	$F_{0.05, 4, 20}$	$F_{0.05, 4, 21}$	$F_{0.05, 4, 22}$	$F_{0.05, 3, 20}$	$F_{0.05, 3, 21}$	$F_{0.05, 3, 22}$
$\Phi(z)$	0.95	0.975	0.995	1.746	1.753	2.120	2.87	2.23	2.22	3.10	3.07	2.35

4. A marketing consultant conducted an experiment to compare four different package designs for a new breakfast cereal. Twenty-four stores with approximately similar sale volumes were selected and each store was required to carry only one of the package designs. Thus, each package was randomly assigned to six stores. Other relevant conditions such as price, amount and location of shelf space, and advertising were kept roughly similar for all stores participating in the experiment. Sales (y), in number of cases, were observed for the study period. The data were analyzed using the one-way classification model $y_{ij} = \mu_i + \epsilon_{ij}$ $i = 1, \dots, 4; j = 1, \dots, 6$. The data are as follows:

Package Design	Average No. of Cases Sold
1: 3 colors, with cartoons	16
2: 3 colors, without cartoons	18
3: 5 colors, with cartoons	12
4: 5 colors, without cartoons	25

- (1) Complete the ANOVA table by filling the blanks below. (2 points for each blank)

Source	SS	DF	MS	F
Design	420	(b)	(e)	(g)
Error	(a)	(c)	(f)	
Total	520	(d)		

- (2) Using the ANOVA table to make your conclusion. Make sure to include in your answer the null and alternative hypotheses. Using $\alpha = 0.05$ (6 points)

5. An experiment was conducted to determine the relationship between the strain (y) for a particular alloy and applied stress (x). A total of 24 pairs of values were measured. A simple linear regression model was fitted to the data: $y = b_0 + b_1x$. The following statistics have been computed from the data: $S_{xx} = 13,500$, $S_{yy} = 980$, $S_{xy} = 2,700$. Fill the blanks in the ANOVA table as shown below. (2 points each)

Source	SS	DF	MS	F
Regression	(a)	(d)	(g)	(i)
Error	(b)	(e)	(h)	
Total	(c)	(f)		

$R^2 = (j)$