國立成功大學 108 學年度碩士班招生考試試題

系　　所：土木工程學系

考試科目：工程統計

考試日期：0223，節次：3

※ 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. A mail-order computer business has six telephone lines. Let X denote the number of lines in use at a specified time. Suppose the pmf of X is as given in the accompanying table. Calculate the probability of each of the following events. (5 points each)

x	0	1	2	3	4	5	6
P(x)	0.1	0.15	0.2	0.25	0.2	0.06	0.04

(1) {at least three lines are in use}.

(2) {between two and five lines, inclusive, are in use}.

(3) {between two and four lines, inclusive, are not in use}.

(4) {at least four lines are not in use}.

2. The actual tracking weight of a stereo cartridge that is set to track at 3 g on a particular changer can be regarded as a continuous rv X with pdf. (5 points each)

$$f(x) = \begin{cases} k[1-(x-3)^2] & 2 \le x \le 4 \\ 0 & otherwise \end{cases}$$

(1) Find the value of k.

(2) What is the probability that the actual tracking weight is greater than the prescribed weight?

(3) What is the probability that the actual weight is within .25 g of the prescribed weight?

3. A CI is desired for the true average stray-load loss μ (watts) for a certain type of induction motor when the line current is held at 10 amps for a speed of 1500 rpm. Assume that stray load loss is normally distributed with σ=3. (5 points each)

(1) Compute a 95% CI for μ when n=25 and $\bar{x} = 58.3$.

(2) Compute a 99% CI for μ when n=100 and $\bar{x} = 58.3$.

(3) How large must *n* be if the width of the 99% interval for μ is to be 1.0?

Values Provided for Your Calculations

z	1.64	1.96	2.58	$t_{0.05,\,16}$	$t_{0.05,\,15}$	$t_{0.025,\,16}$	$t_{0.025,\,15}$	$F_{0.05,\,1,\,7}$	$F_{0.05,\,1,\,8}$	$F_{0.05,\,1,\,9}$	$F_{0.05,\,2,\,7}$	$F_{0.05,\,2,\,8}$	$F_{0.05,\,2,\,9}$
Φ(z)	0.95	0.975	0.995	1.746	1.753	2.120	2.131	6.61	5.32	5.12	9.55	8.65	8.02

4. One method for straightening wire before coiling it to make a spring is called "roller straightening." That is related to the tensile properties of wire. Suppose a sample of 16 wires is selected and each is tested to determine tensile strength (N/mm^2). The resulting sample mean and standard deviation are 2160 and 30, respectively. (5 points each)

(1) The mean tensile strength for springs made using spinner straightening is 2150 N/mm^2. What hypotheses should be tested to determine whether the mean tensile strength for the roller method exceeds 2150?.

(2) Assuming that the tensile strength distribution is approximately normal, what test statistic would you use to test

the hypotheses in part (1)?

(3) What is the value of the test statistic for this data?

(4) For a level .05 test, what conclusion would you reach?

5. Several numbers are missing in the ANOVA table listed below. The data were obtained in a regression experiment with 16 observations. The regression line is expressed as follows: $y = \beta_0+\beta_1 x$.

(1) Please fill in the seven missing numbers as shown below. (2 points each)

(2) What does the statement "Prob. > F, 0.001" mean? (6 points)

Source	SS	DF	MS	F	Prob. > F
Model	2059.78	(a)	(d)	(f)	0.0001
Error	974.65	(b)	(e)		
Total	3034.43	(c)			

R^2 = (g)

6. Find the best answer for each question. (5 points each)

(1) A certain population follows a normal distribution with mean μ and standard deviation $\sigma = 2.5$. You collect data and test the hypotheses H_0: $\mu = 1$ vs. H_a: $\mu \neq 1$. You obtain a p-value of 0.022. Which of the following is true? (a) A 95% confidence interval for μ will include the value 1. (b) A 95% confidence interval for μ will include the value 0. (c) A 99% confidence interval for μ will include the value 1. (d) A 99% confidence interval for μ will include the value 0. (e) none of the above.

(2) A civil engineer believes that the mean porosity μ of sandstone from a certain area in Taiwan exceeds 18. To find statistical evidence to test his theory, he does porosity measurements on ten core samples taken from random positions in the sandstone deposit. State the null and alternative hypotheses required to evaluate his theory. (a) H_0: $\mu = 18$, H_a: $\mu > 18$ (b) H_0: $\mu = 18$, H_a: $\mu \geq 18$ (c) H_0: $\mu < 18$, H_a: $\mu \geq 18$ (d) H_0: $\mu \geq 18$, H_a: $\mu < 18$ (e) H_0: $\mu = 18$, H_a: $\mu \neq 18$.