No. of Printed Pages : 7

MST-004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

02642

June, 2017

MST-004 : STATISTICAL INFERENCE

Time : 3 hours *Maximum Marks : 50*

Note :

(i) *Attempt **all** questions. Questions no. 2 to 5 have internal choices.*

(ii) *Use of scientific calculator is allowed.*

(iii) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(iv) *Symbols have their usual meaning.*

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1. State whether the following statements are *True* or *False*. Give reasons in support of your answers. *5×2=10*

(a) If probability density function of a χ^2-distribution is $f(\chi^2) = \frac{1}{2} e^{-\chi^2/2}$, $0 < \chi^2 < \infty$, then the degrees of freedom of the distribution will be 2.

(b) If θ represents the average marks of the students in MST-004 course of the PGDAST programme and 20 marks are the passing marks for this course, then the parameter space of θ will be $(H) = \{\theta : 20 \leq \theta \leq 50\}$.

(c) For testing $H_0 : \theta = 1$ against $H_1 : \theta = 2$, the pdf of the variable is given by

$$f(x, \theta) = \frac{1}{\theta}; 0 \leq x \leq \theta.$$

If the critical region is $x \geq 0{\cdot}4$, the size of the test is 0·6.

(d) If a random sample of the marks of 5 students is 30, 24, 38, 42 and 26, then the sum of the positive ranks will be 6 for applying Wilcoxon Signed-Rank test.

(e) A sample of size 3 is drawn randomly (x_1, x_2 and x_3) from a normal population with unknown mean μ, then $\frac{2x_1 + x_2 + 3x_3}{5}$ is an unbiased estimator of μ.

2. The lifespans (in '000 hours) of five LED bulbs of 10-watts are as follows :

46, 40, 48, 50, 42

(i) How many samples of size 3 are possible without replacement ? Write them.

(ii) Compute the mean of all samples of size 3 and set up the sampling distribution of the sample mean.

(iii) Compute the expected value and standard error of the sample mean. *3+4+3*

OR

In a medical survey, it is found that 60% people of city A and 40% people of city B are having vitamin D deficiency. A random sample of 150 and 120 people are drawn independently from city A and B, respectively.

Obtain

(i) the mean and standard error of the sampling distribution of the difference in the proportions of people having vitamin D deficiency.

(ii) the probability that difference in the sample proportions is less than or equal to 0·08. *4+6*

3. It is known that the yearly rise in the price of a particular product follows geometric distribution with parameter θ. If 11·1, 11·3, 11·8, 12·2, 12·5, 12·7, 13·3, 13·7, 13·8 and 14·6 are 10 observations of the yearly rise in price, then show that $\overline{X}$ is a consistent estimator of $\frac{1}{\theta}$. Also compute the consistent estimate of $e^{V\theta}$. *10*

OR

A market researcher, for a consumer electronic company, wants to study the television viewing habits of residents of a particular area. For standard deviation 3·8 viewing hours per week :

(i) How large a sample of residents should be taken to be 95% confident that the sample average viewing hours per week is correct to within 0·6 hours ?

(ii) Construct a 95% confidence estimate for mean amount of television watched per week if sample average viewing time per week is 15·3 hours for a sample of 100 respondents. *4+6*

4. The results of a study conducted on quality improvement effort at a semiconductor manufacturing facility provided data for a sample of 500 wafers, with and without particles, in the following table :

Particle	Quality of Wafer		Total
	Good	Bad	
With	40	60	100
Without	260	140	400
Total	300	200	500

Is there any evidence of a significant difference between the proportion of good and bad wafers with particles at the 5% level of significance ? *10*

OR

A company that manufactures chocolate bars is concerned about the mean and variability of the weight of the chocolate bars. A sample of 25 chocolate bars is selected and the sample mean and the sample standard deviation are found to be 10·2 grams and 0·02 grams respectively.

(i) Is there any evidence that the population mean weight of the chocolate bars is greater than 10 grams at 1% level of significance ?

(ii) Is it justifiable to conclude that the variability in the weights is less than 0·05 at 1% level of significance ? *5+5*

5. A marketing manager wants to test whether the sales (in thousands) of different products are about the same in four different stores. Seven products are selected. The sales of each product (in order) from each store are given below :

Store A	Store B	Store C	Store D
65	81	42	85
62	64	58	92
45	72	48	69
70	55	59	82
48	90	61	94
57	68	60	64
50	75	64	73

Test whether there is a significant difference in the sales of the four stores by Kruskal-Wallis test at 1% level of significance ? *10*

OR

The waiting time (in minutes) of 60 patients waiting for a doctor, in a particular hospital, to be examined is recorded. The results are as follows :

Waiting time (in minutes)	Frequency
0 or 1	5
2	8
3	10
4	11
5	10
6	9
7 or more	7

Does the number of patients waiting for the doctor follow Poisson distribution with mean 4 minutes at 5% level of significance ? *10*
