No. of Printed Pages : 7

1921

MST-004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination, 2019

MST-004 : STATISTICAL INFERENCE

Time : 3 Hours] **[Maximum Marks : 50**

Note : Question **No. 1** is **compulsory**. Attempt **any four** questions from the remaining questions. Use of scientific (non-programmable) calculator is allowed. Use of Formulae and statistical tables booklet for PGDAST is allowed. Symbols have their usual meanings.

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

   (a) If sample size of a survey has increased 4 times, then standard error will be increased 2 times.

   (b) Kruskal-Wallis test is non-parametric version of Two Way analysis of variance (ANOVA).

(c) A patient suffering from fever visits to a doctor and suppose the doctor formulate hypotheses as:
H_0 : The patient is suffering from Chikunguniya
H_1 : The patient is not suffering from Chikunguniya
If the doctor rejects H_0 when the patient is actually suffering from Chikunguniya patient, then the doctor commits type II error.

(d) The moment estimators are generally more efficient than maximum likelihood estimators.

(e) If variance of a normal population is known then for testing the hypothesis about population mean, we apply t-test.

2. (a) The marks of 5 learners of MST-004 in Term-end-Exam are as follows : 48 , 42 , 36 , 44 , 28.

(i) Write all possible samples of size 2 without replacement.

(ii) Compute mean of all the samples in case (i) and construct sampling distribution of the sample mean. [2+4]

(b) A random sample of 50 households was selected for a 4G mobile phone survey. The question asked was, "Do you or any member of your household have a 4G mobile phone ?" of the 50 respondents, 28 said "Yes" and 22 said "No".

(i) Determine standard error of sampling distribution of the proportion, if the population proportion of 4G mobile phones of householders is 0.40.

(ii) What is the probability that more than 50% householders have 4G mobile phones ?

[1+3]

3. (a) A sample of 500 voters is chosen randomly from all the voters of Delhi. It is found that 75% of them were in favour of a particular candidate (Mr. X). If large number of voters cast their votes, calculate 95% confidence interval for the proportion of voters of Delhi in favour of Mr. X. [6]

(b) A researcher wants to estimate the average mileage of cars of a company. How large a sample of cars should be taken such that he is

95% confident that the estimate average mileage is within the range of $\pm$ 5 km/litre ? Assume that a reasonable estimate of the population standard deviation of mileage is 6 km/litre. [4]

4. A physical fitness test was conducted to see that village boys, in general, are physically more fits than the town boys. The scores of the six randomly chosen village boys (V) and six town boys (T) are as follows :

Village Boy (V)	15.7	8.2	6.5	7.2	9.0	8.5
Town Boy (T)	11.7	3.2	8.8	7.9	5.6	6.7

If the test scores follows normal distributions with equal variances, test whether the village boys are more fit than the town boys at 5% level of significance. [10]

5. The Vice President (Sales) of a garment company wants to determine whether sales of the company's brand of jeans is dependent of age group. He has appointed a marketing researcher for this purpose. The marketing researcher has conducted a survey on three brands of the company's jeans on 570 consumers of three categories of age group. The observations are given below :

Brand Brand 1 Brand 2 Brand 3 Total

Brand → / Age Group ↓	Brand 1	Brand 2	Brand 3	Total
15 to 25	65	75	85	225
26 to 40	60	40	65	165
41 to 60	55	65	60	180
Total	180	180	210	570

Test whether brand preference is independent of age group at 5% level of significance. [10]

6. (a) Two different types of drugs A and B were tried on some patients for increasing their weights. Drug A was given to 6 patients and drug B to other 7 patients. The gain in weight (in pounds) are given below :

Drug A	5	8	7	10	9	6	
Drug B	9	10	15	12	14	7	12

If distributions of increase in the weights due to both the drugs are unknown, do both the drugs differ significantly with regard to their average increased weights at 1% level of significance ?[6]

(b) The course coordinator of MST-004 course wants to fest the hypothesis that the standard deviation

of the final examination marks in MST-004 of the learners enrolled in Delhi lesser than enrolled in Pune. The Coordinator collects the data from both cities as given below :

City	Delhi	Pune
Sample Size	20	15
Sample SD	4.3	4.6

If the marks of the learners in both cities follow normal distributions, are there enough evidence that SD of marks of learners in Delhi less than that of Pune at $\alpha = 0.01$. [4]

7. (a) The pdf of Chi-square distribution is

$$f(\chi^2) = \frac{1}{96} e^{-\chi^2/2} (\chi^2)^3 ; \chi^2 > 0$$

(i) Obtain degrees of freedom of the distribution. Also find mean and variance of the given distribution.

(ii) Write any three applications of t-distribution. [2+2]

(b) The magnitude of earthquake (on the Richter Scale) recorded in a region as follows :

6.5, 7.7, 5.6, 7.3, 6.7, 7.8, 6.7, 6.2, 5.2, 6.6, 6.0, 7.0, 7.2, 6.8, 7.2.

It is observed that earthquake follows an exponential distribution with parameter θ whose pdf is given by :

$f(x) = \frac{1}{\theta} e^{-x/\theta}$; $x \geq 0$, $\theta > 0$ Find :

(i) maximum likelihood estimator of the parameter θ,

(ii) the maximum likelihood estimate of θ on the basis of the above data. [4+2]

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