MST-004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

□□728   **June, 2015**

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 Table Booklet for PGDAST is allowed.*

(iv) *Symbols have their usual meaning.*

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

(a) If X_1, X_2 and X_3 is a random sample of size 3 taken from a population with mean μ and variance σ^2, the estimator $T = \dfrac{X_1 + 2X_2 + 3X_3}{3}$ is an unbiased estimator of μ.

(b) The number of samples of size 3 with replacement from a population of size 6 is 20.

(c) When population is normal and population variance is known, we apply the t-test for testing the population mean.

(d) We apply the chi-square test for testing two population variances.

(e) The number of runs in the sequence AABBBABABB is 7.

2. (a) The monthly income (in thousands) of five workers in a small company is as follows :

25, 20, 30, 15, 10.

If we select a sample without replacement,

(i) How many samples of size 2 are possible ? Write them down.

(ii) Compute the mean of all samples and set up the sampling distribution of the sample mean. 7

(b) Obtain the tabulated value of t-variate for which the area on the right-tail is 0·01 and the degree of freedom is 10. Write any two applications of the t-distribution. 3

OR

The weight of a certain type of truck tyre is known to be normally distributed with mean 200 pounds and standard deviation 4 pounds. A random sample of 20 tyres is selected.

(i) What is the sampling distribution of the sample mean ?

(ii) Calculate the mean and variance of the sampling distribution of the sample mean.

(iii) Find the probability that the mean weight of the tyres is less than 198 pounds.   *1+2+7*

3. (a) A sample of 1000 voters is chosen randomly from all voters of Delhi. 75% of them were in favour of a particular candidate. If a large number of the voters cast their votes, calculate 95% confidence interval for the proportion of the voters of Delhi in favour of that particular candidate.   *6*

(b) A washing machine company chooses a random sample of 10 motors from the lot received from one of its suppliers. It determines the length of life of each of the motors. The results (in thousands of hours) are as follows :

4·5, 5·0, 4·2, 4·8, 4·2, 5·1, 4·0, 4·2, 4·2, 4·5.

Compute a point estimate of the mean length of life of the motors received from the supplier.   *4*

OR

(a) Differentiate between estimator and estimate. Write the properties of a good estimator. *4*

(b) A company manufactures two types of bulbs (A and B). The manager of the company tests a random sample of 50 bulbs of type A and 60 bulbs of type B. She obtains the following information :

	Mean Life (in hours)	Standard Deviation (in hours)
Type A	1300	50
Type B	1200	60

Obtain 99% confidence interval for the difference of the average life of two types of bulbs. *6*

4. (a) An instructor wishes to test the hypothesis that the standard deviation of the final examination grades of Statistics class is greater for male students than female students. The data from the final examination for the last semester are as follows :

Male	Female
$n_1 = 16$	$n_2 = 18$
$S_1 = 4.5$	$S_2 = 2.3$

Is there enough evidence to support the claim, using $\alpha = 0.01$? *5*

(b) A computer chip manufacturer claims that at most 2 percent of the chips it produces are defective. An electronic company, impressed by that claim, has purchased a large quantity of chips. To check the claim of the manufacturer, the company has decided to test a sample of 250 of these chips. If there are eight defective chips among these 250, does this disprove the manufacturer's claim at 5% level of significance ?   5

OR

A company, manufacturing cars, claims that its cars give an average mileage of 18 km/litre. For testing the claim of the company, an analyst takes 10 cars of that company randomly and records their mileages under the normal conditions. The data so obtained are given in the following table :

Mileages of the cars

S.No.	Mileage (km/litre)	S.No.	Mileage (km/litre)
1	14	6	12
2	16	7	16
3	15	8	13
4	18	9	12
5	20	10	14

Assuming that the mileage of the cars is normally distributed,

(a) formulate the null and alternative hypothesis. *1*

(b) use a suitable test for testing the claim of the company at 5% level of significance when the standard deviation of mileage of the cars is

(i) known to be 6 km/litre, and *4*

(ii) unknown. *5*

5. 1000 students at college level were graded according to their IQ level and the economic condition of their parents. The results are shown in the following table :

Economic condition	IQ Level		Total
	High	Low	
Rich	230	170	400
Poor	470	130	600
Total	700	300	1000

Test the hypothesis that the IQ levels are independent of the economic conditions at 1% level of significance. *10*

OR

A group of 6 children was tested to find out how many digits they would repeat from memory after hearing them once. They were given practice session for this test. Next week they were retested. The results obtained are as follows :

Child Number	1	2	3	4	5	6
Recall Before	3	4	5	7	5	4
Recall After	5	6	8	7	8	3

Assuming that the distribution of the differences of the scores before and after the practice sessions is symmetrical about its median, answer the following questions to ascertain whether the memory practice session improves the performance of the children :

(i)   Are the two samples of data paired or independent ?   1

(ii) State the null and alternative hypotheses.   2

(iii) Which test is used for testing the null hypothesis in this case and why ?   2

(iv) Conduct the test at 0·01 level of significance. What do you conclude ?   5

—————