

**POST GRADUATE DIPLOMA IN  
APPLIED STATISTICS (PGDAST)**

**Term-End Examination**

00395

**June, 2018**

**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.*

1. State whether the following statements are *True* or *False*. Give reasons in support of your answers.

$5 \times 2 = 10$

- (a) If probability density function of a  $\chi^2$ -distribution is  $f(x^2) = \frac{1}{96} e^{-x^2/2} (x^2)^3$ ;  $0 < x < \infty$ , then the degrees of freedom of the distribution will be 8.

- (b) The number of all possible samples of size 3 with replacement from a population of size 6 is 20.
- (c) If  $X_1, X_2$  and  $X_3$  is a random sample of size 3 taken from a population with mean  $\mu$  and variance  $\sigma^2$ , then the estimator  $T = \frac{2X_1 + 3X_2 + X_3}{6}$  is an unbiased estimator for  $\mu$ .
- (d) If the probability of type-I error is 0.1, then the level of significance will be 0.05.
- (e) The number of runs in the sequence H H H T T H T T H T H T T T is 5.

2. The number of mobile phones in four families is as follows :

2, 4, 3, 1.

If we select a sample of size 2 with replacement,

- (a) How many samples are possible ? Write them down.

- (b) Compute the mean of all samples and set up the sampling distribution of the sample mean.
- (c) Compute the mean and standard error of the sampling distribution of the sample mean. 3+4+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.

- (a) What is the sampling distribution of the sample mean ?
- (b) Calculate the mean and variance of the sampling distribution of the sample mean.
- (c) Find the probability that mean weight of the tyres is less than 198 pounds. 1+2+7
3. (a) A random sample of 500 pineapples was selected from a large consignment and 65 were found to be bad. Construct the 95% confidence interval for the proportion of bad pineapples in the consignment. 4

- (b) If (4, 3, 6, 2, 5, 4, 3, 2, 5, 6) is a random sample taken from Poisson distribution ( $\lambda$ ) then show that sample mean ( $\bar{X}$ ) is a consistent estimator of  $\lambda$ .

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**OR**

Two kinds of fertilizers (I and II) were applied to 9 and 7 one-acre plots, respectively, keeping other conditions constant. The yields are given as follows :

Fertilizer I : 18, 20, 36, 50, 49, 36, 34, 49, 41

Fertilizer II : 29, 28, 26, 28, 16, 11, 23

- (a) Assuming that the variances are equal, compute 95% confidence limits for the difference of the average yields due to both fertilizers.

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- (b) Compute the point estimates of the average yields due to both fertilizers.

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4. An experiment was conducted to compare two types of pig foods A and B.

The following results of increase in weights (lbs) were observed in two different groups of pigs :

Food A	49	53	51	53	47	50	52	53
Food B	53	55	52	53	50	54	54	53

Assuming that the increase in weights due to both foods follows normal distribution, test that increase in weight due to Food A has a larger variance than that of Food B at 1% level of significance.

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**OR**

- (a) The weights of 10 students (in kgs) are given below :

38, 40, 45, 53, 47, 43, 55, 48, 52, 49

Do we infer that the variance of the distribution of weights of all students from which the above sample was taken is equal to  $20 \text{ kg}^2$  ? ( $\alpha = 0.05$ )

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- (b) A machine produced 20 defective articles in a batch of 400. After overhauling, it produced 10 defective articles in a batch of 300. Has the machine improved ? (Consider  $\alpha = 0.01$ ).

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5. A company has selected 10 employees randomly to assess the effectiveness of the training programme and administered a well-structured questionnaire.

The scores (out of 100) obtained by the employees are given in the following table :

S.No.	Before Training	After Training
1	60	68
2	62	70
3	67	80
4	64	74
5	66	66
6	63	72
7	69	84
8	63	60
9	60	65
10	62	90

Assuming that the distribution of the scores before and after the training is symmetrical about its median, answer the following questions to ascertain whether the training programme has improved the efficiency :  $1+1+1+7$

- (i) Are the two samples paired or independent ?
- (ii) State the null and alternative hypothesis.

- (iii) Which test is used for testing the null hypothesis in this case and why ?
- (iv) Conduct the test at 1% level of significance and conclude the result.

**OR**

The following table gives the number of aircraft accidents that occurred during the various days of the week. Find whether the accidents are uniformly distributed over the week at 5% level of significance :

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<i>Days</i>	<i>No. of Accidents</i>
Sunday	14
Monday	15
Tuesday	8
Wednesday	20
Thursday	11
Friday	9
Saturday	14