No. of Printed Pages : 6

MST-004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

01141 **December, 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.*

---

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

(a) If the probability density function of a random variable X which follows F-distribution is $f(x) = \frac{1}{(1+x)^2}$; $0 < x < \infty$, then the degrees of freedom of the distribution will be (2, 2).

(b) If the monthly incomes (in thousands) of a random sample of five workers in a small company are 25, 20, 30, 15 and 10, then the unbiased estimate of the average monthly income of all workers will be 25.

(c) Consider a hypothesis $H_0 : p = p_0 = \frac{1}{2}$ against $H_1 : p = p_1 = \frac{1}{4}$ on the basis of tossing a coin once, where p is the probability of getting head in a single toss. If we reject H_0 when a head appears, then the size of the test is 0·5.

(d) The number of runs in the sequence A A B A A B B A B B B A A A is 6.

(e) The tabulated value of F-variate for which the area on the right tail is $\alpha = 0{\cdot}99$ and the degrees of freedom are $\nu_1 = 5$, $\nu_2 = 10$, will be 10·05.

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

46, 40, 48, 50, 42

(a) How many samples of size 2 are possible without replacement ? Write them.

(b) Compute the mean of all samples of size 2 and set up the sampling distribution of the sample mean.

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

OR

The truck tyres of a company A have an average weight of 220 pounds with a standard deviation of 5 pounds, while the truck tyres of company B have an average weight of 200 pounds with a standard deviation of 3 pounds. If random samples of 125 and 180 tyres of companies A and B, respectively are tested,

(a) What is the sampling distribution of the difference of average weight of tyres ?

(b) Calculate the mean and variance of the above sampling distribution.

(c) Find the probability that the tyres of company A will have the average weight at least 21 pounds more than that of company B. *1+3+6*

3. Obtain maximum likelihood estimate of θ in $f(x, \theta) = (1 + \theta) \cdot x^{\theta}$; $0 < x < 1$, based on a random sample (10, 12, 13, 11, 14) of size 5. Also examine whether this estimate is sufficient for θ. *10*

OR

(a) In a medical survey, it is found that 45 people out of a sample of 150 people from city A and 48 people out of a sample of 120 people from city B are suffering from diabetes. Construct a 99% confidence interval for the difference in proportions of people suffering from diabetes.

(b) A sample of 10 workers is selected to check the number of items produced per shift. The sample standard deviation is found to be 10 for the number of items produced. Estimate 95% confidence limits for the variance of the number of items produced. *6+4*

4. A chocolate manufacturing company claims that the average weight of the chocolate bars is 10 grams. For testing the claim, a sample of 9 chocolate bars is selected randomly, under normal conditions. The data is given in the following table :

Weight (grams)	10·3	9·8	9·9	10·1	9·6	9·7	9·6	9·8	10·3

Assuming that the weights of chocolate bars are normally distributed,

(a) Formulate the null and alternative hypotheses.

(b) Use a suitable test for testing the claim at 5% level of significance when the standard deviation of chocolate bars is

(i) known to be 0·2 grams,

(ii) unknown. *1+4+5*

OR

(a) A researcher wishes to test the hypothesis that the standard deviation of the weight of the filled boxes for Machine A is greater than for Machine B. The data obtained from both machines are as follows :

Machine A	*Machine B*
$n_1 = 9$	$n_2 = 11$
$\bar{x} = 59$	$\bar{y} = 60$
$\sum (x_i - \bar{x})^2 = 26$	$\sum (y_i - \bar{y})^2 = 36$

Is there enough evidence to support the claim at 5% level of significance ?

(b) A mobile manufacturer claims that at most 10% of the mobiles it produces are defective. A company wants to purchase the mobiles but before that they decided to test samples of 200 mobiles. If there are 30 defective mobiles among these 200 mobiles, can we agree with the manufacturer's claim at 1% level of significance ? *5+5*

5. The following table gives the classification of 300 products according to types of machines and materials used to produce these products :

Machine	Material		
	A	B	C
M_1	30	10	40
M_2	40	20	40
M_3	50	30	40

Test whether the machines and materials used are independent at 5% level of significance. *10*

OR

A basketball coach has developed a new method for shooting free throws. To determine how well this method works, the coach selected two teams (A and B) of 12 players in each team. Each player of team A was asked to shoot 60 free throws by the old method, while each player of team B, by the new method. The number of successful attempts for each player of teams A and B is given in the following table :

Team A	*Team B*
40	45
30	60
55	50
35	60
40	35
40	50
30	55
40	60
50	50
45	50
40	40
35	55

Examine whether the average successful attempts by the two methods are the same at 1% level of significance, using the Mann-Whitney U-test. Write the conclusion. *10*