

Roll No. ....

41255

**B. Sc. (Hons.) Mathematics 4th Semester  
Examination – May, 2019**

**ELEMENTARY INFERENCE**

**Paper : BHM245 Opt-i**

*Time : Three hours / Maximum Marks : 60*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

**Note :** Attempt *five* questions in all, selecting *one* question from each Section. Question No. 9 (Unit - V) is *compulsory*.

**UNIT – I**

- 1. (a) Define Parameter and Statistic. Also define sampling distribution and standard error of estimate.
- (b) For the geometric distribution,  $f(x, \theta) = \theta(1 - \theta)^{x-1}$ ,  $x = 1, 2, \dots$ ,  $0 < \theta < 1$ . Obtain an unbiased estimator of  $\frac{1}{\theta}$ .

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- 2. (a) Let  $\{T_n\}$  be a sequence of estimators such that for all  $\theta \in \Theta$  :
  - (i)  $E_\theta(T_n) \rightarrow r(\theta)$  as  $n \rightarrow \infty$
  - (ii)  $\text{var}_\theta(T_n) \rightarrow 0$  as  $n \rightarrow \infty$

Then  $T_n$  is a consistent estimator of  $r(\theta)$ .

- (b) A random sample  $(X_1, X_2, X_3, X_4, X_5)$  of size 5 is drawn from a normal population with unknown mean  $\mu$ . consider the following estimators to estimate  $\mu$  :

(i)  $t_1 = \frac{X_1 + X_2 + X_3 + X_4 + X_5}{5}$

(ii)  $t_2 = \frac{X_1 + X_2}{2} + X_3$

(iii)  $t_3 = \frac{2X_1 + X_2 + \lambda \times X_3}{3}$  where  $\lambda$  is such that

$t_3$  is an unbiased estimator of  $\mu$ . Find  $\lambda$ . Are  $t_1$  and  $t_2$  unbiased ? State giving reasons, the estimator which is best among  $t_1, t_2$  and  $t_3$ .

**UNIT – II**

- 3. (a) Find the maximum likelihood estimate for the parameter  $\lambda$  of a Poisson distribution on the basis of a sample of size  $n$ . Also find its variance.
- (b) Explain the following Terms
  - (i) Null hypothesis and alternative hypothesis
  - (ii) Type I and Type II errors
- 4. (a) State and prove Neyman - Pearson lemma
- (b) Let  $x_2 \sim N(\mu, \sigma^2)$ ,  $\mu$  unknown. To test  $H_0 : \mu = 0$  against  $H_1 : \mu = 1$ , based on a sample of size 10 from this population, we use the critical region

$x_1 + 2x_2 + \dots + 10x_{10} \geq 0$ . What is its size? What is the power of the test?

### UNIT - III

5. (a) In a sample of 1,000 people in Goa, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 1% level of significance?
- (b) The guaranteed average life of a certain type of electric light bulbs is 1,000 hours with a standard deviation of 125 hours. It is decided to sample the output so as to ensure that 90% of the bulbs do not fall short of the guaranteed average by more than 2.5%. What must be maximum size of the sample?
6. (a) In a survey of buying habits, 400 women shoppers are chosen at random in super market 'A' located in a certain section of the city. Their average weekly food expenditure is Rs. 250 with a standard deviation of Rs. 40. For 400 women shoppers chosen at random in super market B in another section of the city, the average weekly food expenditure is Rs. 220 with a standard deviation of Rs. 55. Test at 1% level of significance whether the average weekly food expenditure of two population of shoppers are equal.
- (b) What are Applications of Z- transformation.

### UNIT - IV

7. (a) A sample analysis of examination results of 200 MBA's was made. It was found that 46 student had failed, 68 secured a IIIrd division, 62 secured a IIrd division and the rest were placed in first

division. Are these figures commensurate with the general examination result which is in the ratio of 4:3:2:1 for various categories respectively?

- (b) A die is thrown 60 times with following results:

Face	1	2	3	4	5	6
Frequency	8	7	12	8	14	11

Test at 5% level of significance if the die is unbiased, assuming that  $P(\chi^2 > 11) = 0.05$  with 5 d.f.

8. (a) The mean weekly sales of soap bars in departmental stores was 146.3 bars per store. After an advertising the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. Was the advertising campaign successful?
- (b) Write a short note on "Anova for one way classified data."

### UNIT - V

9. (a) Write a short note on Efficiency.
- (b) Write a short notes on Sufficiency.
- (c) Write a short note on *one* tailed and *two* tailed tests.
- (d) Define level of significance.
- (e) Write a short note on estimation of a single proportion.
- (f) Write a short note on Analysis of variance two way classified data.