Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-641043
Bachelor's Degree Examination – November 2017
III Semester

Class : II UG **Time :3 Hrs**
Major : Mathematics **Max.Marks :100**

15BMAC07 Inferential Statistics

Part – A **10x1=10**

Choose the correct answer

1. The amount of bias $b(\theta)$ is given by ------------
   a. $E(\hat{\theta})$
   b. $E(\hat{\theta}) + 1$
   c. $E(\hat{\theta}) - 1$
   d. 0

2. The theory of estimation was founded by ---------------
   a. Pearson
   b. Rao
   c. Cramer
   d. Fisher

3. The likelihood equation is given by --------------
   a. $\frac{\partial \log L}{\partial \theta} = 0$
   b. $\frac{\partial^2 L}{\partial \theta^2} = 0$
   c. $\frac{\partial^2 \log L}{\partial \theta^2} = 0$
   d. $\frac{\partial L}{\partial \theta} = L$

4. The maximum likelihood estimators ------------
   a. are always unbiased
   b. are always biased
   c. need not necessarily be unbiased
   d. never be unbiased

5. A simple statistical hypothesis specifies the population
   a. partially
   b. completely
   c. alternately
   d. randomly

6. Type II error is the error of -------------
   a. accepting Ho when Ho is false
   b. rejecting Ho when Ho is true
   c. accepting H_1 when H_1 is false
   d. rejecting H_1 when H_1 is false

7. A region in the sample space which amounts to rejection of Ho is termed as -------------
   a. non – critical region
   b. region of acceptance
   c. critical region
   d. sample region

8. The standard error of mean of a random sample of size n form a population with variance σ^2 is ----------
   a. $\sigma/\sqrt{n}$
   b. σ/n
   c. σ/n^2
   d. σ^2/n

9. Chi-square test of goodness of fit was proposed by --------------
   a. Fisher
   b. Karl Pearson
   c. Neyman
   d. Cramer

10. If χ_1^2 and χ_2^2 are two independent chi-square variates with V_1 and V_2 d . f . respectively, then F - stastic is defined by --------------
    a. $\frac{\chi_1^2/v_1}{\chi_2^2/v_2}$, ($V_1 > V_2$)
    b. $\frac{\chi_1^2}{\chi_2^2}$
    c. $\frac{\chi_1^2/v_1}{\chi_2^2/v_2}$, ($V_2 > V_1$)
    d. $\frac{v_1}{v_2}$, ($V_1 > V_2$)

Part – B **5x6=30**

Answer the following

11. a. State the following : (i) Neyman factorization theorem
(ii) Rao-Blackwell theorem

(or)

11. b. If $x_1, x_2, \ldots, x_n$ is a random sample from a normal population N(μ,1), show that t = $\frac{1}{n}\sum_{i=1}^{n} x_i^2$ is an unbiased estimator of μ^2+1.

12. a. What are the commonly used methods for obtaining good estimators?

(or)

12. b. State any three properties of maximum likelihood estimators.

13. a. What are the major steps involved in the solution of testing of hypothesis problem?

(or)

13. b. Explain the following (i) Null hypothesis and (ii) alternate hypothesis.

14. a. A normal population has a mean of 0.1 and standard deviation 2.1. Find the probability that mean of a sample of size 900 will be negative.

(or)

14. b. The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the sample population of standard deviation 2.5 inches?

15. a. The theory predicts the proportion of beans in the four groups A,B,C and D should be 9:3:3:1. In an experiment among 1600 means, the numbers in the four groups were 882,313,287 and 118. Does the experimental result support the theory?

(or)

15. b. In one sample of 8 observations, the sun of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5 percent level, given that the 5 percent point of F for $n_1 = 7$ and $n_2 = 9$ degrees of freedom is 3.29.

Part – C **5x12=60**

Answer the following

16. a. Explain the following (i) Consistency (ii) Unbiasedness (iii) Efficiency

(or)

16. b. Prove that for Cauchy's distribution not sample mean but sample median is a consistent estimator of the population mean.

17. a. Find the M.L.E. for the parameter λ of a poisson distribution from n sample values. Also find its variance.

(or)

17. b. For random sampling from normal population N(μ, σ^2), find the M.L.E for (i) μ when σ^2 is known (ii) σ^2 when μ is known and (iii) the simultaneous estimation of μ and σ^2.

18. a. Given the frequency function f $(x, \theta) = \begin{cases} 1/\theta, & 0 \le x \le \theta \\ 0, & elsewhere \end{cases}$
and that you are testing the null hypothesis $H_0 : \theta = 1$ against $H_1 : \theta = 2$ by means of a single observed value of x, what would be the sizes of the type I and type II errors, if you choose the interval (i) $0.5 \le x$, (ii) $1 \le x \le 1.5$ as the critical regions? Also obtain the power function of the test.

(or)

18. b. State and prove Neyman – Pearson lemma.

19. a. A sample of 900 members has a mean 3.4cms and s.d. 2.61cms. Is the sample from a large population of mean 3.25 cms and s.d. 2.61cms? If the population is normal and its mean is unknown, find the 95% and 98% fiducial limits of true mean.

(or)

19. b. Discuss in detail about the test of significance for (i) Single mean with small and large samples and (ii) Difference of means with small and large samples.

20. a. For the 2 × 2 table

a	b
c	d

, prove that chi – square test of independence gives $\chi^2 = \frac{N(ad-bc)^2}{(a+c)\,(b+d)\ \ (a+b)\ \ (c+d))}$, N = a+b+c+d.

(or)

20. b. It is known that the mean diameters of rivets produced by two firms A and B , are practically the same, but the standard deviations may differ. For 22 rivets produced by firm A, the s.d. is 2.9 mm., while for 16 rivets produced by firm B, the s.d. is 3.8mm. Compute the statistic you would use to test whether the products of firm A have the same variability as those of firm B. Also state how you would proceed further.