

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086  
(For candidates admitted from the academic year 2004–05)

SUBJECT CODE : MT/MC/SI64

B. Sc. DEGREE EXAMINATION, APRIL 2007  
BRANCH I – MATHEMATICS  
SIXTH SEMESTER

COURSE : MAJOR CORE  
PAPER : STATISTICAL INFERENCE  
TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A  
ANSWER ALL QUESTIONS

(10 X 2 = 20)

1. Distinguish between a parameter and a statistic.
2. State the central limit theorem.
3. Define F distribution.
4. If a statistic  $t$  is unbiased for  $\theta$ , then show that  $t^2$  is biased for  $\theta^2$ .
5. Define a maximum likelihood estimator.
6. State the general method of constructing confidence intervals.
7. What are the confidence limits for the mean when the sample is from normal distribution ?
8. Define critical region.
9. Define level of significance.
10. What is a contingency table ?

SECTION – B  
ANSWER ANY FIVE QUESTIONS

(5 X 8 = 40)

11. Obtain the standard error for the sample mean when population is large.
12. Establish the relation between  $F$  and  $\chi^2$  distribution.
13.  $X_1, X_2$  and  $X_3$  is a random sample of size 3 from a population with mean  $\mu$  and variance  $\sigma^2$ .  $T_1, T_2$  and  $T_3$  are the estimators used to estimate mean value  $\mu$  where  $T_1 = X_1 + X_2 - X_3$ ,  $T_2 = 2X_1 + 3X_3 - 4X_2$  and  $T_3 = \frac{1}{3}(X_1 + X_2 + X_3)$ .
  - i) Are  $T_1$  and  $T_2$  unbiased estimators ?
  - ii) Which is the best estimator ?
14. Find the MLE of the parameter  $\alpha$  of a population having the p.d.f.  
 $f(x, \alpha) = \frac{2}{\alpha^2}(\alpha - x)$ ,  $0 < x < \alpha$  for a sample of unit size  $\alpha$ .
15. Obtain the confidence interval for the difference between means when standard deviations are unknown.
16. 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 same population with std. deviation 2.5 inches ?
17. A random sample of 27 pairs observations from a normal population gave a correlation coefficient of .6. Is this significant of correlation in the population ?

**SECTION – C**  
**ANSWER ANY TWO QUESTIONS**

**(2X20=40)**

18. a) Derive the sampling distribution of  $S^2$  for samples taken from a normal population with mean  $\mu$  and variance  $\sigma^2$ .  
b) State and prove any two properties of  $\chi^2$  distribution.
19. a) Explain the method of moments in estimation.  
b) Find the maximum likelihood estimator for the parameter  $\lambda$  of a Poisson distribution on the basis of a sample of size  $n$ . Also find its variance.
20. a) Investigate the association between darkness of eye colour in father and son from the following data:  
Fathers with dark eyes and sons with dark eyes = 50  
Fathers with dark eyes and sons with not dark eyes = 79  
Fathers with not dark eyes and sons with dark eyes = 89  
Fathers with not dark eyes and sons with not dark eyes = 782  
b) In one sample of 8 observations, the sum of 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% level.

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