

The Open University of Sri Lanka
 B.Sc/B.Ed. DEGREE, CONTINUING EDUCATION PROGRAMME
 Open Book Test - 2016/2017
 Level 05 - Applied Mathematics
 APU3147/APE5147- Statistical Inference



Duration: - One Hour.

DATE: - 23-09-2017

Time: - 9.00 a.m. to 10.00 a.m.

Non programmable calculators are permitted. Statistical tables are provided.

Answer all questions.

1.

(a) Suppose $\hat{\theta}$ is an estimator for parameter θ . State whether the following statements are true or false.

- (i) $E(\hat{\theta}) = \theta$ implies that $\hat{\theta}$ is a consistent estimator for parameter θ
- (ii) $Var(\hat{\theta}) = \frac{1}{n}$ and $\hat{\theta}$ is an unbiased estimator for parameter θ implies that $\hat{\theta}$ is a consistent estimator for parameter θ .
- (iii) $Var(\hat{\theta}) = 0$ implies that $\hat{\theta}$ is an accurate estimator for parameter θ
- (iv) $\hat{\theta}$ is a consistent estimator for parameter θ implies that $\hat{\theta}$ is precise.
- (v) $MSE(\hat{\theta}) \neq 0$ implies that $Biase(\hat{\theta}) \neq 0$.

(b) Let $X_1, X_2, X_3, \dots, X_n$ be a random sample from a distribution with density given by $f(x; \theta)$. Let $\hat{\theta}_1, \hat{\theta}_2, \hat{\theta}_3, \hat{\theta}_4$ are functions of $X_1, X_2, X_3, \dots, X_n$. Suppose $\hat{\theta}_1, \hat{\theta}_2$ are unbiased estimators for parameter θ , $\hat{\theta}_3$ consistent estimator for parameter θ , $\hat{\theta}_4$ is the likelihood estimator for parameter θ and $MSE(\hat{\theta}_3) < MSE(\hat{\theta}_2)$. State whether the following statements are true or false.

- (i) $Biase\left(\frac{\hat{\theta}_1 + \hat{\theta}_2}{2}\right) = 0$
- (ii) $Var(\hat{\theta}_2) < Var(\hat{\theta}_3)$

- (iii) Let $L(\theta)$ be the likelihood function of θ . $L(\hat{\theta}_4) < L(\hat{\theta}_1)$.
- (iv) $\hat{\theta}_4$ is not an accurate estimator for large samples.
- (v) $\hat{\theta}_3$ and $\hat{\theta}_4$ are accurate and precise estimators for large samples.

2.

Suppose weight of a certain product, produced by ABC Company, follows normal distribution. However, the mean weight and variance weight of randomly selected product is unknown.

- (i) What is the population of interest? Is the population finite? Justify your answer.
- (ii) Derive moment estimators for the mean and the variance of a randomly selected product.
- (iii) Weights of 16 randomly selected products in grams are given below. Using part (ii) estimate the mean and the variance of weight of a randomly selected product.

93.91	95.36	106.84	98.11	96.64	94.76	97.25	105.04
104.82	93.98	95.63	96.47	98.67	98.42	102.55	105.79

- (iv) Estimate the standard error of the estimated mean given by you in part (iii).
- (v) Estimate the sample size required to estimate the mean weight of a randomly selected product with an error bound of 3 grams at 95% confidence.