

APRIL - 2017

M. Sc. Statistics (Sem.-IV) Examination

Time: 2.30 Min]

Paper 15: Decision Theory Reliability & Industrial Statistics

[Marks: 70

Q1 a Define:

Code - 3580

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1. Admissible Decision rule,
2. Complete class and
3. minimal complete class of decision rules

b Let X be a binomial variable with p.m.f. $f(x|\theta) = 2C_x \theta^x (1-\theta)^{2-x}$, $x = 0, 1$. Parametric

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space $\cong \{ \theta_1 = 1/3, \theta_2 = 2/3 \}$ and action space $= \{ a_1, a_2 \}$ and loss function is

	a_1	a_2
θ_1	2	-1
θ_2	-3	4

- 1) Obtain the set of non randomized rules.
- 2) Risk function for all non randomized decision rule
- 3) Obtain Minimax decision rule
- 4) Set of admissible decision rule.

OR

Q1 a Let (Θ, a, L) be a game in which $\Theta = \{ \theta_1, \theta_2 \}$ and $a = \{ a_1, a_2 \}$ and loss function L is as given below

	a_1	a_2
θ_1	4	1
θ_2	-3	0

With respect to above game bring out comparison between game theory and decision theory.

b Explain how a testing hypotheses problem can be viewed as a decision theory problem.

6

Q2a Let parametric space be R^+ , $L(\theta, a) = (\theta - a)^2$ and distribution of X be poisson with parameter $\theta > 0$, find Bayes rule with respect to prior distribution gamma (∞, β) Also determine Bayer risk and Limit Bayes Rule.

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b Define:

4

1. Bayes decision rule,
2. limit of Bayes rule,
3. extended Bayes rule,
4. generalized Bayes rule.

OR

Q2a Let $L(\theta, a) = (\theta - a)^2$ and distribution of and the distribution of X is $N(\theta, 1)$. Find the Baves rule by considering the $N(0, \sigma^2)$ as prior distribution.

7

b State and prove relation between hazard function and probability density function.

7

Q3a Describe Bridge system with illustrations. Derive the expression for reliability of this system.

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b Find the reliability function, hazard function and mean time to failure(MTTF) of $f(x) = (\alpha/\beta) (x/\beta)^{\alpha-1} \exp(-(x/\beta)^\alpha)$, $x, \alpha, \beta > 0$.

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OR

- Q3a Define reliability. Obtain reliability of series and parallel systems. Give your comment. 7
- b Establish expression for $f(t)$ as a function of hazard function. Hence find $f(t)$ when hazard function is $(1/\beta)$, $x > 0$. Also obtain mttf and Reliability function for this model. 7
- Q4a Reliability function of life time distribution is given as following. Hence obtain failure rate. 8

Probability density function and MTTF.

$$(1) \quad R(t) = e^{-t/\theta}, t > 0, \theta > 0$$

$$(2) \quad R(t) = e^{-(\alpha t)^\beta}, \alpha, \beta > 0, t > 0$$

- b Discuss the maximum likelihood method of estimation for two parameter scale-shape family of weibull distributions based on a failed censored sample. 6

OR

- Q4 a What is type-I and Type -II censoring? Discuss with example. Obtain general form of the likelihood functions for both the schemes under without replacement of the failure units.. 7
- b Suppose n items are put on test and the experiment is terminated when we observe r -th failure. Assume life time distribution is exponential. Based this data obtain uniformly minimum variance unbiased estimator (UMVUE) of reliability of the unit at time t . 7
- Q5 a Describe double sampling plan procedures for attributes and find out the expression for OC function 7
- b Describe single sampling plan for variables when the quality characteristic is assumed to follow normal distribution. Obtain its O.C function when upper specification limit is known and process standard deviation is also known. 7

OR

- Q5a Derive expression for AOQ, ATI and ASN functions for double sampling plan for attributes. 8
- b Describe sequential sampling plan with illustration 6