PRAJÑĀ - Journal of Pure and Applied Sciences Vol. 19: 93 - 96 (2011)
ISSN 0975 - 2595

ACCEPTANCE DECISION RULE FOR TYPE-I GENERALIZED HALF LOGISTIC DISTRIBUTION

***K. Rosaiah, *R.R.L. Kantam and **V. Rama krishna**

Department of Statistics, Acharya Nagarjuna University, Guntur – 522 510, India

**Koneru Lakhsmaiah College of Engineering, Vaddeswaram, Guntur (Dt.), India*

ABSTRACT

The well known half logistic distribution is considered and its generalization through failure probability of a parallel system of independently identically distributed components is suggested. With the probability model as the suggested generalized version, a new life testing model is assumed for the life of a product. Based on the observed failure times before a prefixed time, the decision rule for acceptance or otherwise of a submitted lot of products is constructed involving a minimum sample size required for the decision rule. The operating characteristic of the decision rule and the tolerance range of the population average are also worked out. Comparison with similar procedures that exist in literature is presented.

Key worlds : *Type-I generalized half logistic distribution, acceptance decision rule*

INTRODUCTION

If θ is a positive real number, F(x) is the cumulative distribution function (cdf) of continuous random variable, then $[F(x)]^{\theta}$ and the corresponding probability distribution may be named as exponentiated or generalized version of F(x), according to Mudholkar et al [1]; Gupta and Kundu [2]. Whether it is exponentiated version of Mudholkar et al [1], generalized version of Gupta and Kundu [2], the model in either of the cases is obtained by considering the positive power of the cdf of a given continuous distribution. The life of a parallel system of components with independent and identical lifetime distribution given by exponential/Weibull for each component will have a cdf given by integral power of the common cdf governing the life of individual components. Such a system's lifetime model turns to be exponentiated/generalized version of Exponential / Weibull models. We adopt this generalization to half logistic distribution.

Half logistic model obtained as the distribution of absolute standard logistic variate is another probability model of recent origin [3]. The probability density function (pdf), cumulative distribution function (cdf) and hazard function (hf) are given by

$$f(x) = \frac{2e^{-x}}{(1+e^{-x})^2}\ ; \quad x \geq 0 \qquad (1)$$

$$F(x) = \left[\frac{1-e^{-x}}{1+e^{-x}}\right]\ ; \quad x \geq 0 \qquad (2)$$

$$h(x) = \frac{1}{1+e^{-x}}\ ; \quad x \geq 0 \qquad (3)$$

It can be seen that the model is an increasing failure rate (IFR) model and free from any shape parameter. It would be more useful in reliability studies and survival analysis. This model is parallel to half normal distribution as an underlying probability model in the studies of reliability and quality control.

THE PROPOSED MODEL

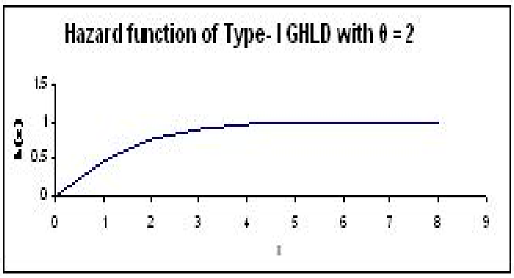
As narrated above, the distribution of the random variable representing life of a parallel system of θ components (θ is natural number) whose individual lifetimes are identically independently distributed with common distribution as that of standard half logistic distribution given by the equations (1), (2) and (3) shall be considered by us in this paper as standard Type–I generalized half logistic distribution (Type-I GHLD). Its pdf, cdf and hazard function are given by

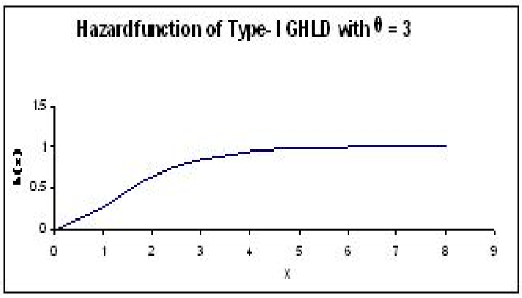
$$f(x) = \frac{2\theta e^{-x}(1-e^{-x})^{\theta-1}}{(1+e^{-x})^{\theta+1}} \qquad (4)$$

$$F(x) = \left[\frac{1-e^{-x}}{1+e^{-x}}\right]^{\theta} \qquad (5)$$

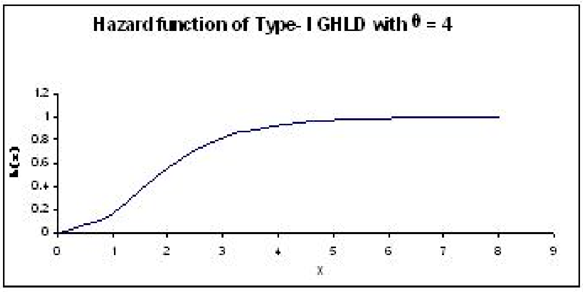
$$h(x) = \frac{2\theta e^{-x}(1-e^{-x})^{\theta-1}}{(1+e^{-x})\left[(1+e^{-x})^{\theta}-(1-e^{-x})^{\theta}\right]} \qquad (6)$$

The graphs of hazard function are shown in the following Figures, which show CFR nature on and after some stage of x for various values of θ. We consider the Type-I generalized version of half logistic distribution and study the construction of reliability test plans using this distribution as the model for a lifetime variable.





*Corresponding author: rosaiah1959@gmail.com



A typical application of acceptance sampling is as follows. A company receives shipment of product from a vendor. This product is often a component or raw material used in the company's manufacturing process. A sample is taken from the lot and some quality characteristic of the unit in the sample is inspected. On the basis of the information in this sample, a decision is made regarding lot disposition. Usually, this decision is either to accept or to reject the lot.

If the distribution of the quality characteristic is non-normal, and a plan based on the normal assumption is employed, serious departures from the advertised risks of accepting or rejecting lots of given quality may be experienced.

Based on the notion of testing a null hypothesis about a population average with a specified minimum, we can think of sampling inspection plans where the sample observations are lifetimes of products put to test. In such a sampling plan the population average stands for average life of the product say σ, σ_o, is a specified value of σ and if a null hypothesis is formulated as $\sigma \geq \sigma_o$, this means that the true unknown population average life of the product exceeds a specified value, which decides a submitted lot of products to be good. The test criterion shall naturally be on the basis of the observed failures in a sample product of size n before a specified time t. If the observed number of failures is large say $\geq$ a number 'c', the hypothesis cannot be accepted and hence lot cannot be accepted. That is, a parallel between a test of hypothesis and a sampling plan can be considered provided the decision rules in either case are with minimum associated risks. Such a sampling plan is named as "Reliability Test Plan" or "Acceptance sampling plan on life tests".

In this paper, we assume that the life of product follows a non-normal distribution called Type-I generalized half logistic distribution (GHLD). If a lot of products with this as the model is submitted for inspection, we develop the necessary sampling plan of characteristics' to decide about the acceptance or otherwise of the submitted lot. Similar sampling plans in other models are developed by many researchers - [4 - 13] and the references therein. Constructing the reliability test plan and its theory, operating characteristics and the sensitivity of sampling plan for the model is described in the following sections.

RELIABILITY TEST PLAN

We consider the cumulative distribution function and probability density function of Type–I generalized half logistic distribution with scale parameter σ are given by

$$G(t) = [F(t)]^{\theta} = \left[\frac{1-e^{-t/\sigma}}{1+e^{-t/\sigma}}\right]^{\theta}, \qquad t>0, \sigma>0 \qquad (7)$$

$$g(t) = \frac{2\theta\left(1-e^{-t/\sigma}\right)^{\theta-1} e^{-t/\sigma}}{\sigma\left(1+e^{-t/\sigma}\right)^{\theta+1}}, \qquad t>0, \sigma>0 \qquad (8)$$

We assume that the life of a product follows a Type–I generalized half logistic distribution defined by [5]. A common practice in life testing is to terminate the life test by a pre-determined time 't' and note the number of failures (assuming that a failure is well defined). One of the objectives of these experiments is to set a lower confidence limit on the average life. It is then desired to establish a specified average life with a given probability of at least 'p'. the decision to accept the specified average life occurs if and only if the number of observed failures at the end of the fixed time-t does not exceed a given number c-called the acceptance number. The test may get terminated before the time-t is reached when the number of failures exceeds in which case the decision is to reject the lot. For such a truncated life test and the associated decision rule, we are interested in obtaining the smallest sample sizes necessary to achieve the objective.

A sampling plan consists of, the number of units n on test, the acceptance number c, the maximum test duration t, and the ratio - t/σ_o, where σ_o is the specified average life.

The consumer's risk, i.e., the probability of accepting a bad lot (the one for which the true average life is below the specified life-σ_o) not to exceed 1-p*, so that p* is a minimum confidence level with which a lot of true average life below is rejected by the sampling plan. For a fixed p*, our sampling plan is characterized by (n, c, t/σ_o) Here we consider sufficiently large lots so that the binomial distribution can be applied. The problem is to determine the smallest positive integer n for given values of p* (0< p* <1), σ_o and c such that

$$\sum_{i=0}^{c} \binom{n}{i} p^i (1-p)^{n-i} \leq 1-p^* \qquad (9)$$

holds, where p = G(t; σ_o) given by[5] which indicates the failure probability before time t, and depends only on the ratio t/σ_o. It is sufficient to specify this ratio for designing the experiment.

The minimum values of n satisfying the inequality (9) are obtained for θ = 2,3,4; p* = 0.75, 0.90, 0.95, 0.99 and t/σ_o = 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5 and are presented in Table-1 only for θ = 2.

If p = G(t; σ_o) is small and n is large (as is true in some cases of our present work), the binomial probability may be approximated by Poisson probability with parameter $\lambda = np$ so that the left side of (9) can be written as

$$\sum_{i=0}^{n} \frac{\lambda^i}{i!} e^{-\lambda} \leq 1-p^* \qquad (10)$$

where $\lambda = n\,G(t;\sigma_o)$. The minimum values of n satisfying (10) are obtained for the same combination of θ, p*, t/σ_o as those used for (9). The results are given in Table-2 only for θ = 2.

The operating characteristic function of sampling plan (n, c, t/σ_o) gives the probability L(p) of accepting the lot as

$$L(p) = \sum_{i=0}^{c} \binom{n}{i} p^i (1-p)^{n-i} \qquad (11)$$

where p = G(t;σ_o). It is considered as a function of σ, the lot quality parameter. It can be seen that the operating characteristic is an increasing function of σ for given p*, t/σ_o. Values of the operating characteristic as a function of σ/σ_o for a few sampling plans are given in Table -3.

The producer's risk is the probability of rejecting a lot when $\sigma > \sigma_o$. We can compute the producer's risk by first finding p = G (t; σ) and then using the binomial distribution function. For a given value of the producer's risk 0.05, one may be interested in knowing what value of σ/σ_o will ensure a producer's risk less then or equal to 0.05 if a sampling plan under discussion is adopted. It should be noted that the probability p may be obtained as function of σ/σ_o, as p = G[(σ/σ0) (σ0/σ)]. The value σ/σ_o is the smallest positive number for which the following inequality holds

$$\sum_{i=0}^{c}\binom{n}{i}p^{k}(1-p)^{n-i} \geq 0.95 \qquad (12)$$

For a given sampling plan (n, c, t/σ_o) and specified confidence level p* the minimum values of σ/σ_o satisfying the inequality (12) are given in Table-4.

Our results of Table-1 on comparison with similar results of Gupta and Groll [4] for the gamma distribution reveal that, the sample size of Type–I generalized half logistic distribution (Type-I GHLD) plans are uniformly smaller than those of Gupta and Groll [4] for the gamma distribution, thus giving a saving in cost of experimentation with the same risk probability. Hence, we may say that if type-I GHLD and gamma distribution are good fits for a given data, our decision rule with the present model can be applied with less cost and same risk.

CONCLUSION

In this paper an acceptance decision rule is developed based on the truncated life test when the life distribution of test items follows Type–I generalized half logistic distribution. For the use of plans by the practitioners, we provided some Tables.

Table – 1 Minimum sample size necessary to assert the average life to exceed specified average life σ_o, with probability p* and the corresponding acceptance number c, using binomial probabilities under Type-I generalized half logistic distribution for θ=2

p*	c	t/σ_o=1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
.75	1	12	6	4	3	3	2	2	2
.75	2	18	9	6	5	4	4	3	3
.75	3	23	12	8	6	5	5	5	4
.75	4	29	15	10	8	7	6	6	5
.75	5	34	18	12	9	8	7	7	6
.75	6	39	20	14	11	9	8	8	8
.75	7	44	23	16	12	11	10	9	9
.75	8	50	26	18	14	12	11	10	10
.75	9	55	28	19	15	13	12	11	11
.75	10	60	31	21	17	14	13	12	12
.90	1	17	9	6	4	3	3	3	2
.90	2	24	12	8	6	5	4	4	4
.90	3	30	15	10	8	6	6	5	5
.90	4	36	18	12	9	8	7	6	6
.90	5	42	21	14	11	9	8	7	7
.90	6	47	24	16	12	10	9	9	8
.90	7	53	27	18	14	12	10	10	9
.90	8	59	30	20	15	13	12	11	10
.90	9	64	33	22	17	14	13	12	11
.90	10	70	36	24	19	16	14	13	12
.95	1	21	10	7	5	4	3	3	3
.95	2	28	14	9	7	5	5	4	4
.95	3	34	17	11	8	7	6	5	5
.95	4	41	20	13	10	8	7	7	6
.95	5	47	24	15	12	10	9	8	7
.95	6	53	27	18	13	11	10	9	8
.95	7	59	30	20	15	12	11	10	10
.95	8	65	33	22	17	14	12	11	11
.95	9	71	36	24	18	15	14	12	12
.95	10	76	39	26	20	17	15	14	13
.99	1	29	14	9	6	5	4	4	3
.99	2	37	18	11	8	7	6	5	5
.99	3	44	22	14	10	8	7	6	6
.99	4	51	25	16	12	10	8	7	7
.99	5	58	29	18	14	11	10	9	8
.99	6	64	32	21	15	13	11	10	9
.99	7	71	35	23	17	14	12	11	10
.99	8	77	38	25	19	16	14	12	12
.99	9	83	42	27	21	17	15	14	13
.99	10	90	45	29	22	18	16	15	14

Table - 2 Minimum sample size necessary to assert the average life, to exceed specified average life σ_o, with probability p* and the corresponding acceptance number c, using Poisson approximation under Type-I generalized half logistic distribution for θ=2

p*	c	t/σ_o=1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
.75	1	13	7	5	4	4	4	3	3
.75	2	19	10	7	6	5	5	5	5
.75	3	24	13	9	8	7	6	6	6
.75	4	30	16	11	9	8	8	7	7
.75	5	35	19	13	11	10	9	8	8
.75	6	41	22	15	12	11	10	10	9
.75	7	46	25	17	14	12	11	11	11
.75	8	51	27	19	16	14	13	12	12
.75	9	56	30	21	17	15	14	13	13
.75	10	61	33	23	19	16	15	15	14
.90	1	19	10	7	6	5	5	5	5
.90	2	25	14	10	8	7	7	6	6
.90	3	32	17	12	10	9	8	8	7
.90	4	38	20	14	12	10	10	9	9
.90	5	44	23	16	13	12	11	10	10
.90	6	50	27	19	15	13	12	12	12
.90	7	56	30	21	17	15	14	13	13
.90	8	61	33	23	19	16	15	14	14
.90	9	67	36	25	20	18	17	16	15
.90	10	73	39	27	22	19	18	17	17
.95	1	23	12	9	7	6	6	6	5
.95	2	30	16	11	9	8	8	7	7
.95	3	37	20	14	11	10	9	9	9
.95	4	43	23	16	13	12	11	10	10
.95	5	50	27	19	15	13	12	12	11
.95	6	56	30	21	17	15	14	13	13
.95	7	62	33	23	19	17	15	15	14
.95	8	68	36	25	21	18	17	16	16
.95	9	74	39	28	22	20	18	17	17
.95	10	80	43	30	24	21	20	19	18
.99	1	32	17	12	10	9	8	8	7
.99	2	40	21	15	12	11	10	10	9
.99	3	48	25	18	14	13	12	11	11
.99	4	55	29	21	17	15	14	13	13
.99	5	62	33	23	19	16	15	15	14
.99	6	69	37	26	21	18	17	16	16
.99	7	75	40	28	23	20	19	18	17
.99	8	82	44	31	25	22	20	19	19
.99	9	88	47	33	27	23	22	21	20
.99	10	95	50	35	28	25	23	22	22

Table - 3 Operating characteristic values of the sampling plan (n, c, t/σ_o) for a given p* under Type-I generalized half logistic distribution for θ=2

p*	n	c	t/σ_o	σ/σ_o 2	4	6	8	10	12
.75	23	3	1.000	.9541	.9996	1.0000	1.0000	1.0000	1.0000
.75	12	3	1.500	.9425	.9994	1.0000	1.0000	1.0000	1.0000
.75	8	3	2.000	.9304	.9993	1.0000	1.0000	1.0000	1.0000
.75	6	3	2.500	.9233	.9991	1.0000	1.0000	1.0000	1.0000
.75	5	3	3.000	.9103	.9988	.9999	1.0000	1.0000	1.0000
.75	5	3	3.500	.8181	.9964	.9998	1.0000	1.0000	1.0000
.75	5	3	4.000	.6967	.9914	.9995	.9999	1.0000	1.0000
.75	4	3	4.500	.8160	.9954	.9997	1.0000	1.0000	1.0000
.90	30	3	1.000	.8975	.9989	.9999	1.0000	1.0000	1.0000
.90	15	3	1.500	.8837	.9986	.9999	1.0000	1.0000	1.0000
.90	10	3	2.000	.8541	.9980	.9999	1.0000	1.0000	1.0000
.90	8	3	2.500	.7919	.9964	.9998	1.0000	1.0000	1.0000
.90	6	3	3.000	.8160	.9967	.9998	1.0000	1.0000	1.0000
.90	6	3	3.500	.6647	.9908	.9994	.9999	1.0000	1.0000
.90	5	3	4.000	.6967	.9914	.9995	.9999	1.0000	1.0000
.90	5	3	4.500	.5620	.9819	.9988	.9999	1.0000	1.0000
.95	34	3	1.000	.8555	.9982	.9999	1.0000	1.0000	1.0000
.95	17	3	1.500	.8344	.9977	.9999	1.0000	1.0000	1.0000
.95	11	3	2.000	.8076	.9970	.9998	1.0000	1.0000	1.0000
.95	8	3	2.500	.7919	.9964	.9998	1.0000	1.0000	1.0000
.95	7	3	3.000	.7036	.9931	.9996	1.0000	1.0000	1.0000
.95	6	3	3.500	.6647	.9908	.9994	.9999	1.0000	1.0000
.95	5	3	4.000	.6967	.9914	.9995	.9999	1.0000	1.0000
.95	5	3	4.500	.5620	.9819	.9988	.9999	1.0000	1.0000
.99	44	3	1.000	.7300	.9953	.9998	1.0000	1.0000	1.0000
.99	22	3	1.500	.6895	.9938	.9997	1.0000	1.0000	1.0000
.99	14	3	2.000	.6509	.9920	.9996	.9999	1.0000	1.0000
.99	10	3	2.500	.6293	.9906	.9995	.9999	1.0000	1.0000
.99	8	3	3.000	.5861	.9876	.9993	.9999	1.0000	1.0000
.99	6	3	4.500	.3429	.9569	.9967	.9996	.9999	1.0000
.99	6	3	4.000	.4970	.9785	.9986	.9998	1.0000	1.0000

Table – 4 Minimum ratio of true mean life to specified mean life for the acceptability of a lot under Type-I generalized half logistic distribution with producer's risk of 0.05 for $\theta = 2$.

θ	p*	c	t/σ_0 =1	1.5	2	2.5	3.0	3.5	4.0	4.5
2.00	.75	1	1.96	2.33	2.59	3.25	2.92	3.41	3.90	4.40
2.00	.75	2	1.55	1.82	2.15	2.29	2.75	2.49	2.84	3.20
2.00	.75	3	1.37	1.59	1.73	1.87	2.24	2.61	2.37	2.68
2.00	.75	4	1.26	1.47	1.67	1.87	1.95	2.28	2.10	2.36
2.00	.75	5	1.20	1.38	1.49	1.68	1.76	2.06	1.92	2.16
2.00	.75	6	1.11	1.32	1.47	1.54	1.63	1.90	2.17	2.44
2.00	.75	7	1.08	1.28	1.37	1.58	1.72	1.78	2.03	2.29
2.00	.75	8	1.06	1.24	1.37	1.48	1.62	1.68	1.92	2.17
2.00	.75	9	1.02	1.17	1.29	1.41	1.54	1.61	1.83	2.06
2.00	.75	10	1.00	1.15	1.30	1.34	1.48	1.54	1.76	1.98
2.00	.90	1	2.44	2.93	3.09	3.25	3.89	4.55	5.40	4.90
2.00	.90	2	1.82	2.17	2.42	2.68	2.75	3.20	3.65	3.45
2.00	.90	3	1.56	1.84	2.12	2.17	2.60	2.61	2.99	2.68
2.00	.90	4	1.41	1.65	1.82	2.08	2.25	2.28	2.61	2.32
2.00	.90	5	1.31	1.53	1.73	1.86	2.01	2.06	2.35	2.16
2.00	.90	6	1.24	1.45	1.58	1.70	1.85	2.16	2.17	2.01
2.00	.90	7	1.19	1.39	1.55	1.71	1.72	2.01	2.03	1.90
2.00	.90	8	1.16	1.34	1.45	1.60	1.78	1.89	1.92	1.81
2.00	.90	9	1.12	1.30	1.43	1.52	1.69	1.80	1.83	1.74
2.00	.90	10	1.10	1.27	1.42	1.54	1.61	1.73	1.76	1.67
2.00	.95	1	2.58	3.19	3.53	3.87	3.89	4.55	5.20	4.40
2.00	.95	2	1.98	2.32	2.67	2.68	3.23	3.20	3.65	3.20
2.00	.95	3	1.67	1.95	2.12	2.43	2.60	2.61	2.99	2.68
2.00	.95	4	1.50	1.74	1.96	2.08	2.25	2.62	2.61	2.36
2.00	.95	5	1.42	1.60	1.84	2.02	2.23	2.35	2.36	2.16
2.00	.95	6	1.33	1.57	1.67	1.84	2.04	2.16	2.17	2.01
2.00	.95	7	1.27	1.49	1.63	1.71	1.89	2.01	2.30	2.29
2.00	.95	8	1.22	1.43	1.59	1.71	1.78	1.89	2.17	2.18
2.00	.95	9	1.18	1.38	1.50	1.61	1.82	1.80	2.06	2.08
2.00	.95	10	1.15	1.34	1.48	1.62	1.73	1.88	1.97	1.98
2.00	.99	1	3.08	3.65	3.90	4.42	4.64	5.42	5.20	4.40
2.00	.99	2	2.27	2.61	2.89	3.33	3.64	3.76	4.29	4.12
2.00	.99	3	1.93	2.25	2.45	2.66	2.92	3.03	3.47	3.36
2.00	.99	4	1.70	1.97	2.20	2.44	2.50	2.62	2.99	2.92
2.00	.99	5	1.58	1.79	2.04	2.17	2.43	2.60	2.68	2.64
2.00	.99	6	1.47	1.72	1.85	2.09	2.21	2.38	2.46	2.44
2.00	.99	7	1.39	1.62	1.78	1.93	2.05	2.21	2.30	2.29
2.00	.99	8	1.33	1.55	1.72	1.90	2.05	2.08	2.37	2.17
2.00	.99	9	1.30	1.49	1.68	1.79	1.93	2.12	2.25	2.32
2.00	.99	10	1.25	1.44	1.59	1.70	1.84	2.02	2.15	2.22
3.00	.75	1	1.45	1.78	2.01	2.21	2.64	2.49	2.84	3.25
3.00	.75	2	1.23	1.43	1.67	1.91	2.03	2.37	2.22	2.54
3.00	.75	3	1.11	1.32	1.52	1.62	1.73	2.02	1.92	2.23
3.00	.75	4	1.06	1.22	1.35	1.57	1.74	1.81	1.74	1.96
3.00	.75	5	1.00	1.18	1.30	1.44	1.59	1.67	1.90	1.81
3.00	.75	6	.98	1.12	1.26	1.34	1.48	1.56	1.78	1.71
3.00	.75	7	.95	1.11	1.24	1.34	1.40	1.48	1.69	1.62
3.00	.75	8	.93	1.07	1.21	1.28	1.44	1.56	2.04	1.56
3.00	.75	9	.91	1.06	1.16	1.28	1.38	1.49	1.55	1.74
3.00	.75	10	.90	1.04	1.15	1.23	1.33	1.44	1.50	1.45
3.00	.90	1	1.64	1.99	2.21	2.51	2.64	3.09	3.53	3.20
3.00	.90	2	1.38	1.64	1.80	2.10	2.30	2.37	2.71	2.50
3.00	.90	3	1.24	1.47	1.61	1.77	1.95	2.02	2.31	2.16
3.00	.90	4	1.15	1.34	1.50	1.68	1.74	2.03	2.07	1.95
3.00	.90	5	1.09	1.28	1.42	1.54	1.73	1.86	1.90	1.81
3.00	.90	6	1.05	1.23	1.37	1.51	1.61	1.73	1.78	1.71

REFERENCES

[1] Mudholkar S Govind., Srivastava Deo Kumar. (1995). The exponentiated Weibull family, A reanalysis of the bus-motor failure data, *Technometrics*, **37**(4), 436-445.

[2] Gupta, R.D. and Kundu, D. (2001). Generalized exponential distribution. Different methods of estimation, *J. of Statistical Computation and Simulation*, **69**, 315-338.

[3] Balakrishnan, N. (1985). Order statistics from the half logistic distribution, *J. Statist. Comput. Simul.*, **20**, 287-309.

[4] Gupta, S.S. and Groll, P.A. (1961). Gamma distribution in acceptance sampling based on life tests, *Journal of American Statistical Association (JASA)*, **56**, 942-970.

[5] Kantam, R.R.L. and Rosaiah, K. (1998). Half logistic distribution in acceptance sampling based on life tests, *Journal of the Indian Association for Productivity, Quality & Reliability* (*IAPQR Transactions)*, **23**(2), 117-125.

[6] Kantam, R.R.L., Rosaiah, K. and Srinivasarao, G. (2001). Acceptance sampling based on life tests : Log-logistic model, *Journal of Applied Statistics (U.K.)*, **28**(1), 121-128.

[7] Rosaiah, K. and Kantam, R.R.L. (2005). Acceptance Sampling based on the Inverse Rayleigh distribution, *Economic Quality Control*, **20**(2), 277-286.

[8] Kantam, R.R.L., Srinivasarao, G. and Sriram, B. (2006). An economic reliability test plan : Log-logistic distribution, *Journal of Applied Statistics (U.K.)*, **33**(3), 291-296.

[9] Rosaiah, K., Kantam, R.R.L. and Santosh Kumar, Ch. (2006). Reliability test plans for exponentiated log-logistic distribution, *Economic Quality Control*, **21**(2), 165-175.

[10] Rosaiah, K., Kantam, R. R. L. and Santosh Kumar, Ch. (2007). Exponentiated log- logistic distribution-An economic reliability test plan, Pakistan J. of Statistics, 23(2), 147-156.

[11] Rosaiah, K., Kantam, R. R. L. and Pratap Reddy, J. (2008). An economic reliability test plan with Inverse Rayleigh variate, Pakistan J. of Statistics, **24**(1), 57-65.

[12] Balakrishnan, N., Leiva, V. and Lopez, J. (2007). Acceptance sampling from truncated life tests based on the generalized Birnbaum-Saunders distribution, *Commun. Statist. Simul.-Comput.*, **36**, 643-656.

[13] Rosaiah, K., Kantam, R. R. L. and Srinivasa Rao, B. (2009). Reliability test plan for half logistic distribution, *Calcutta Statistical Association Bulletin*, **61**(241-244), 183-196.