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Algorithm for Reliability Sampling Plans of Expensive Products

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Abstract:

In this paper,sampling plans for life testing of expensive products are developed using Lomax distribution. The probability of acceptance of new sampling plan is derived. Sample size is calculated and tabulated using Lomax distribution and the sample size is compared with the one obtained using exponential distribution.
Keywords: *Lomax distribution, OC curve, sample size.*

1. **INTRODUCTION:** Modified chain sampling plans are designed for inspection of costly products.[3], an algorithmof reliability sampling plan is developed using Lomax distribution and it is compared with reliability sampling plan using exponential distribution.
2. **Algorithm of RSP using Lomax distribution:** The sampling plan is derived using the parameterm, T, L, I, where m is the sample size, T is test time, L is mean life and,' I' is index of chaining. The algorithm is as follows,take a sample of size m from a lot and put it into life test for the given testing time'T' .Reject the lot if there is one or more failures within the testing time 'T'. Accept the lot, if there are no failures in current testing and preceding 'I' lots also contain no failures, except in one lot which may contain atmost one failure unit. [5]
3. **OPERATING CHARACTERISTIC FUNCTION**: Using the above algorithm for Lomax distribution,

$$P_a(p) = \left(\exp\left(-m(1-\left(1+\frac{T}{L}\right)^{-\alpha})(I+1)\right)\right)(1+ Im(1-\left(1+\frac{T}{L}\right)^{-\alpha}) \quad (1)$$

Using the above algorithm for exponential distribution,

$$P_a(p) = \left(\exp\left(-m(1-(\exp(\frac{-T}{L})(I+1)\right)\right)(1+ In(1-\left(\exp\left(-\frac{T}{L}\right)\right)) \ ) \quad (2)$$

4. **Tables of sample size(m):**

Table:1`m' for I=1 using Lomax distribution

P_a	T/L = 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	14	7	4	2	1
0.75	12	6	3	2	1
0.8	10	5	3	2	1
0.85	8	4	2	1	1
0.9	6	3	2	1	1
0.95	4	2	1	1	1

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Table:2`m' for I=2 using Lomax distribution

P_a	T/L= 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	11	6	3	2	1
0.75	9	5	3	2	1
0.8	7	4	2	1	1
0.85	5	3	2	1	1
0.9	3	2	1	1	1

Table:3`m' for I=3 using Lomax distribution

P_a	T/L= 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	10	5	3	2	1
0.75	8	4	2	1	1
0.8	6	3	2	1	1
0.85	4	2	1	1	1
0.9	2	1	1	1	1

Table:4`m' for I=1 using exponential distribution

P_a	T/L= 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	30	15	10	8	6
0.75	25	12	8	5	4
0.8	20	10	7	5	4
0.85	15	8	5	4	3
0.9	10	5	4	3	2
0.95	5	3	2	2	1

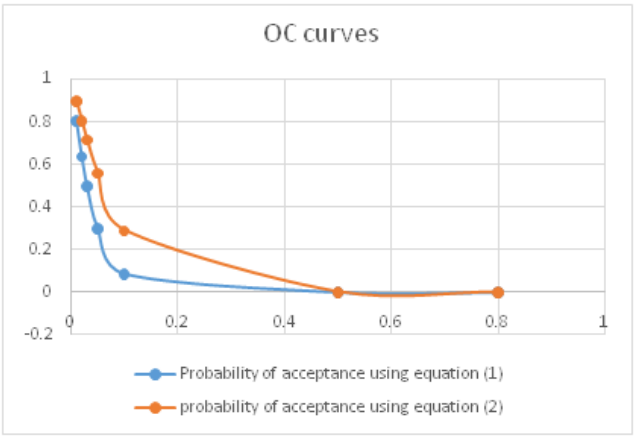
Table:5`m' for I=2 using exponential distribution

P_a	T/L= 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	26	13	9	7	5
0.75	20	10	7	5	4
0.8	18	9	7	5	4
0.85	14	7	5	4	3
0.9	13	7	4	3	3

Table:6`m' for I=1 using exponential distribution

P_a	T/L= 0.01	T/L= 0.02	T/L= 0.03	T/L= 0.04	T/L= 0.05
0.7	22	11	7	6	4
0.75	20	10	7	5	4
0.8	15	8	5	4	3
.9	10	5	3	2	2

5. OPERATING CHARACTERISTIC CURVES



6. Interpretation: The above tables that give the derived values of 'm' shows that reliability sampling plans based on Lomax distribution gives less 'm' than the other with exponential distribution using the new algorithm. The graph of probability of acceptance using Lomax distribution is more efficient the other.

7.Example: Find the samlple size for reliability sampling plan using Lomax distribution for I=2 with test time2 hours and L=100 hours w`m' for I=1 with probability of acceptance 0.8
Solution: The sample size m = 4.

8. CONCLUSION

The algorithm developed using Lomax distribution is found to give less sample size than the other using exponential distribution, and the

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graph of probability of acceptance shows that the new plan is better than the existing one. The sample size for selection of plan is given in the tables.

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