Research Journal of Applied Sciences 11 (12): 1470-1472, 2016
ISSN: 1815-932X

Generalized Group Chain Acceptance Sampling Plan Based on Truncated Life Test

Abdur Razzaque Mughal, Zakiyah Zain and Nazrina Aziz
Department of Mathematics and Statistics, School of Quantitative Sciences,
UUM College of Arts and Sciences, Universiti Utara Malaysia (UUM), Sintok,
06010 Kedah, Malaysia

Abstract: In this study we considered a group chain acceptance sampling plan based on life tests. The decision on acceptance of lot can be made the cumulative information of the preceding samples. The design parameters of the proposed plan such as number of groups required and the Operating Characteristic (OC) values are determined to satisfy the specified consumer's risk.

Key words: Group sampling, chain sampling, operating characteristic values, consumer's risk, producer's risk

INTRODUCTION

The quality and lifetime of a product is very important for the consumer's point of view to purchase the product. At the same time the producers are also particular about the quality of their product in terms of quality characteristics in all stages of manufacturing. In quality control, acceptance sampling is the most important technique to inspectingthe lifetime of the submitted product. The acceptance sampling plan is concerned with accepting or rejecting a submitted lot on the basis of sample results taken from the lot. In acceptance sampling plans, it is assumed that a single product will be tested in a tester. However, a group acceptance sampling plan consists of testers in which more thanproduct can be examined at the same time. This group sampling plan may be more desirable and economical than the single acceptance sampling plan in terms of saving cost and testing time.A group acceptance sampling plan calls for acceptance a lot under observation if the number of defective products found in a random sample of size $n = r \times g$ is less than or equal to the acceptance c_* number For situations where small sample size are preferred, an acceptance sampling plan having zero acceptance number is enviable. Unfortunately, this plan has the following two disadvantages:

- The OC curve has no point of inflection and hence it starts to drop quickly even for the very small value of proportion defectives (p)
- The producer also dislikes this plan, since a single defective product will call for the rejection of the whole lot

MATERIALS AND METHODS

Dodge (1955) proposed a Chain Sampling Plan (ChSP-1) using the cumulative information of immediately preceding samples to overcome the drawback of the single acceptance sampling plan having zero acceptance number. It is interesting to note that thecurrent lot under judgment can also be accepted if one defective product is confirmed in the sample provided that noother defective product is found in the lot. The proposed generalized group chain acceptance sampling plan is functional in the following steps:

- For each lot, find the best possible number of ggroups and allocate r products to each group such that the required sample size is $n = r \times g$
- Accept the lot if zero defective is observed and reject the same lot if more than one defective is recorded. If $d = 1$, move to next step
- Also, accept the lot if $d = 1$ and persist the inspection if zero defectives are found in the preceding i lots

The group chain sampling plan is characterized by the designed parameters g and $p_\alpha(p)$. We are interested in searching the optimal group size and probability of lot acceptance at pre-specified values

Corresponding Author: Abdur Razzaque Mughal, Department of Mathematics and Statistics, School of Quantitative Sciences, UUM College of Arts and Sciences, Universiti Utara Malaysia (UUM), Sintok, 06010 Kedah, Malaysia

Table 1: Number of optimal groups required for the proposed plan

Items			p-values					
β	r	1	0.10	0.15	0.20	0.25	0.30	0.50
0.25	2	1	8	6	4	3	3	2
	3	2	5	4	3	2	2	1
	4	3	4	3	2	2	1	1
	5	4	3	2	2	1	1	1
0.10	2	1	12	8	6	5	4	2
	3	2	8	5	4	3	3	2
	4	3	6	4	3	2	2	1
	5	4	5	3	3	2	2	1
0.05	2	1	15	10	8	6	5	3
	3	2	10	7	5	4	3	2
	4	3	8	5	4	3	3	2
	5	4	6	4	3	3	2	1
0.01	2	1	23	15	11	9	7	4
	3	2	15	10	7	6	5	3
	4	3	11	8	6	4	4	2
	5	4	9	6	5	4	3	2

of; β = 0.25, 0.10, 0.05, 0.01; r = 2(1)5 and I = 1(1)4. The probability of lot acceptance in thecase of group chain sampling plan is given by:

$$P_{\alpha}(p) = (1-p)^{(r\times g)} + (r\times g)(p)(1-p)^{(r\times g)-1}(1-p)^{(r\times g)\times i} \quad (1)$$

where, p represents the probability of failure of a product during the test termination time. Table 1 the optimal values of groups g are foundwhen satisfying the Eq. 1. Once the optimal groupsizes are found, one may be interested to find the probability of lot acceptance for the pre-assumed qualitylevel. For a fixed value of r, i, g and p the operating characteristic valuesare obtained and shown in Table 1.

RESULTS AND DISCUSSION

Description of tables with example: Consider μ and μ_0 are the true and specifiedmean life of a productand it is acceptable for consumer use only when $\mu>\mu_0$. The producer is interested in knowing the proportion defective rateof a product with confidence level of 0.99. Furthermore, he has the facility to install more than one productfor inspection on a tester. Then the designed parameters of the proposed group chain acceptance sampling plan are (p, r, i, g) = (0.1, 3, 2, 15). Thus, the producer needs to select a random sample of size forty-fiveproducts from the lot and put three products to each of the fifteen groups.The lot will be accepted if no defective product is observed in the sample and if one defective product is recorded but no defective product is found in the precedingtwosamples. For the same design parameters, the probability of lot acceptance is 0.2204 shown in Table 2.

Table 2: Operating characteristics values having r = 3 and i = 2

β	g	p	$P_{\alpha}(p)$
0.25	5	0.10	0.2204
	4	0.15	0.1483
	3	0.20	0.1397
	2	0.25	0.1893
	2	0.30	0.1218
	1	0.50	0.1309
0.10	8	0.10	0.0811
		5.00	0.1500
		4.00	0.2000
	3	0.25	0.0764
	3	0.30	0.0406
	2	0.50	0.0156
0.05	10	0.10	0.0426
	7	0.15	0.0331
	5	0.20	0.0353
	4	0.25	0.0318
	3	0.30	0.0406
	2	0.50	0.0456
0.01	15	0.10	0.2204
	10	0.15	0.0076
	7	0.20	0.0092
	6	0.25	0.0056
	5	0.30	0.0047
	3	0.50	0.0020

CONLUSION

Dodge (1955) developed a chain sampling plan to overcome the problems of acceptance sampling plan with c = 0. The single, group and chain acceptance sampling plan based on truncated life tests were discussed by Epstein (1954), Tsai and Wu (2006), Balakrishnan *et al*. (2007), Aslam *et al*. (2010, 2011), Mughal (2011), Mughal *et al*. (2011), Mughal *et al*. (2011), Mughal and Ismail (2013), Mughal *et al*. (2009), Ramaswamy and Jayasri (2014), Mughal *et al*. (2015a, b).

CATALOG OF SYMBOLS

n = Sample size
g = Number of groups
t = Number of testers
d = Number of defective
i = Allowable acceptance number
α = Producer's risk (Probability of rejecting a good lot)
β = Consumer's risk (Probability of accepting a bad lot)
$p(\rho)$ = Lot acceptanceprobability

REFERENCES

Aslam, M., A.R. Mughal, M. Hanif and M. Ahmad, 2010. Economic reliability group acceptance sampling based on truncated life tests using pareto distribution of the second kind. Commun. Stat. Appl. Methods, 17: 725-731.

Aslam, M., M.A. Razzaque and M. Ahmad, 2011. Comparison of GASP for Pareto distribution of the 2nd kind using Poisson and weighted Poisson distributions. Int. J. Qual. Reliab. Manage., 28: 867-884.

Balakrishnan, N., V. Leiva and J. Lopez, 2007. Acceptance sampling plans from truncated life tests based on the generalized Birnbaum-Saunders distribution. Commun. Stat. Simul. Comput., 36: 643-656.

Dodge, H.F., 1955. Chain sampling plan. Ind. Qual. Control, 11: 10-13.

Epstein, B., 1954. Truncated life tests in the exponential case. Ann. Mathe. Stat., 25: 555-564.

Mughal, A.R. and M. Ismail, 2013. An economic reliability efficient group acceptance sampling plans for family pareto distributions. Res. J. Appl. Sci. Eng. Technol., 6: 4646-4652.

Mughal, A.R., 2011. A hybrid economic group acceptance sampling plan for exponential lifetime distribution. Econ. Qual. Control, 26: 163-171.

Mughal, A.R., M. Aslam, M. Ahmad and Z. Yab, 2009. Group acceptance sampling plans for Pareto distribution of the second kind. J. Test. Eval., 38: 1-8.

Mughal, A.R., M. Hanif, M. Ahmed and A. Rehman, 2011. Economic reliability acceptance sampling plans from truncated life tests based on the Burr Type XII percentiles. Pak. J. Commerce Soc. Sci., 5: 166-176.

Mughal, A.R., Z. Zain and N. Aziz, 2015a. Time truncated group chain sampling strategy for pareto distribution of the 2^(nd) kind. Res. J. Appl. Sci. Eng. Technol., 10: 471-474.

Mughal, A.R., Z. Zain and N. Aziz, 2015b. 2015. New two-sided complete group chain sampling plan for pareto distribution of the 2nd kind. Int. J. Appl. Eng. Res., 10: 31855-31860.

Ramaswamy, A.S. and S. Jayasri, 2014. Time truncated chain sampling plans for generalized rayleigh distribution. Int. Refereed J. Eng. Sci., 3: 49-53.

Tsai, T.R. and S.J. Wu, 2006. Acceptance sampling based on truncated life tests for generalized Rayleigh distribution. J. Applied Stat., 33: 595-600.