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Some properties of two sided relational chain sampling plans

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Abstract
This research article portrays properties of a Two Sided Relational Chain Sampling Plan TSRGS plans which emphasizes on zero defective in the first sample during inspection and thereafter sampling is tightened with sample sizes. The properties of Two Sided Relational Chain Sampling Plan are studied in detail through the efficiency measures. The OC function plays a vital role in switching, matching and convergence properties. It is interesting to note that TSRChSP converges to well-known sampling plans under certain conditions.

Keywords: Two sided Relational Chain Sampling Plans, Properties, OC function.

Introduction

In Industries, to control quality of the finished or partly finished product of costly items Chain Sampling Plans are recommended. Dodge [1955] [5] has introduced the ChSP-1 plans and many authors have contributed to Chain Sampling Plans. Devaarul, S and Edna K [2012] [3] have developed a new two sided complete chain sampling plans for costly products. Devaarul and Vijila Moses (2017) [4] have developed a novel relational chain sampling plans which has a tremendous application in industries. But relational chain sampling plans give pressure to the producer on one sided (i.e. previous lots) only. Hence to offset the disadvantages a new two sided relational chain sampling plans are developed and the corresponding operating characteristics function is derived by Devaarul S and Jothimani K (2020) [2]. In this paper the properties of TSRChSP are dealt in detail.

The operating procedure of Two Sided Relational Chain Sampling Plans TSRChSP (0, i)

The algorithm for sentencing a lot or batch is as follows:

1. Draw a random sample of size n units and count the number of non-conformities. Let it be d.
2. If d = 0 accept the current lot.
3. If d = 1, accept the current lot provided preceding and succeeding 1 lot is accepted on the basis of zero defective. Otherwise reject it.

If d = 2, accept the current lot provided preceding and succeeding 2 lots are accepted on the basis of zero defective. Otherwise reject it. If d = 3, accept the current lot provided and succeeding 3 lots are accepted on the basis of zero defective. Otherwise reject it.

1. In general, if d = i, accept the current lot provided preceding and succeeding ‘i’ lots are accepted on the basis of zero defective.
2. Otherwise, reject it.

Note: For practical reason it is advisable to have small values of i.

Operating Characteristics function

The probability of acceptance for a two sided relational chain sampling plans TSRChSP(0,i) is defined as

$$P_a(p) = P_{0,n} + P_{1,n}\, P_{0,n}P_{0,n} + P_{2,n}\, P^2_{0,n}P^2_{0,n} + P_{3,n}\, P^3_{0,n}P^3_{0,n} + \ldots + P_{i,n}\, P^i_{0,n}P^i_{0,n}$$

Property 1

Whenever the number of defective is zero in the first sample inspection, then TSRChSP will converge to Ordinary Single Sampling Plan with c=0.

Proof

The OC function of TSRChSP is

$P_a(p) = P_{0,n} + P_{1,n} P_{0,n}P_{0,n} + P_{2,n} P^2_{0,n}P^2_{0,n} + P_{3,n} P^3_{0,n}P^3_{0,n} + \ldots + P_{i,n} P^i_{0,n}P^i_{0,n}$

The lot will be accepted based on the first sample if d=0.

Hence all the other cases are impossible events.

Therefore.

$P_{1,n} P_{0,n}P_{0,n} + P_{2,n} P^2_{0,n}P^2_{0,n} + P_{3,n} P^3_{0,n}P^3_{0,n} + \ldots + P_{i,n} P^i_{0,n}P^i_{0,n} = 0.$

$\Longrightarrow$ $P_a(p) = P_{0,n}$

If the defective pattern follows Poisson law, then

$$Pa(p) = \left(\frac{e^{-np}(np)^0}{0!}\right) = e^{-np}$$

Table 1: Values of OC function based on Property (1)

p	Pa(p) when n=100	Pa(p) when n=500	Pa(p) when n=1000
0.001	0.904837418	0.60653066	0.367879441
0.002	0.818730753	0.367879441	0.135335283
0.003	0.740818221	0.22313016	0.049787068
0.004	0.670320046	0.135335283	0.018315639
0.005	0.60653066	0.082084999	0.006737947
0.006	0.548811636	0.049787068	0.002478752
0.007	0.496585304	0.030197383	0.000911882
0.008	0.449328964	0.018315639	0.000335463
0.009	0.40656966	0.011108997	0.00012341
0.01	0.367879441	0.006737947	0

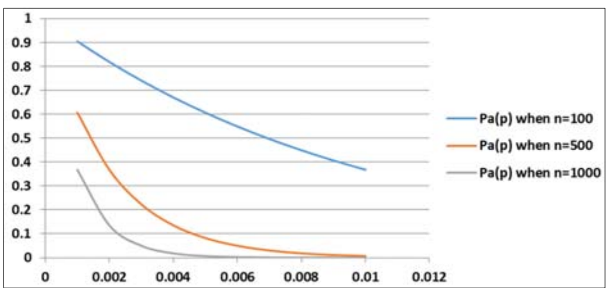

Fig 1: Concave OC curve for increasing sample sizes based on Property (1) of TSRChSP.

Property 2

Whenever the Chain index i is replicated with respect to only preceding samples then it leads to Relational Chain Sampling Plans.

Proof: The OC function of TSRChSP is

$P_a(p) = P_{0,n} + P_{1,n} P_{0,n}P_{0,n} + P_{2,n} P^2_{0,n}P^2_{0,n} + P_{3,n} P^3_{0,n}P^3_{0,n} + \ldots + P_{i,n} P^i_{0,n}P^i_{0,n}$

If one defective is found in the sample then one preceding lot is taken into account for sentencing the current lot.

Similarly if two defectives are found, then the preceding two lots are considered.

Therefore in general,

$P_a(p) = P_{0,n} + P_{1,n} P_{0,n} + P_{2,n} P^2_{0,n} + P_{3,n} P^3_{0,n} + \ldots + P_{i,n} P^i_{0,n}.$

The above OC function is Relational Chain Sampling Plans developed by Devaarul and Vijila (2017) [4].

$$Pa(p) = \left(\frac{e^{-np}(np)^0}{0!}\right) + \left(\frac{e^{-np}(np)^0}{0!}\right)\left(\frac{e^{-np}(np)^1}{1!}\right) + \ldots\ldots\ldots + \left(\frac{e^{-np}(np)^0}{0!}\right)^i \left(\frac{e^{-np}(np)^i}{I!}\right)$$

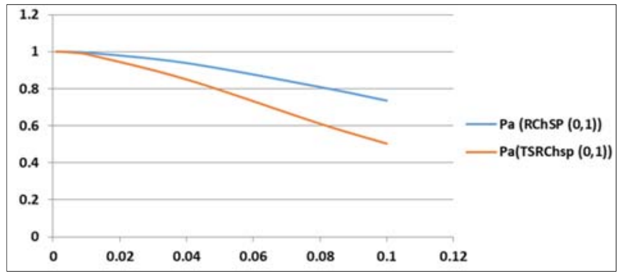

Fig 2: Comparison of OC values of RchSP and TSRChSP based on property 2.

Property 3

Whenever a condition is imposed on TSRChSP that the number of defective is zero in the first sample inspection and only one defective is allowed to accept the lot with an index i, then TSRChSP will converge to Ordinary ChSP(0,1) due to Dodge(1955) [5].

Proof

The OC function of TSRChSP is

$P_a(p) = P_{0,n} + P_{1,n} P_{0,n}P_{0,n} + P_{2,n} P^2_{0,n}P^2_{0,n} + P_{3,n} P^3_{0,n}P^3_{0,n} + \ldots + P_{i,n} P^i_{0,n}P^i_{0,n}$

Whenever a condition is imposed on TSRChSP that the number of defective is zero in the first sample inspection and only one defective is allowed to accept the lot with an index i, then the cases of

$P_{1,n} P_{0,n}P_{0,n} + P_{2,n} P^2_{0,n}P^2_{0,n} + P_{3,n} P^3_{0,n}P^3_{0,n} + \ldots$

Become impossible events.

Therefore, the remaining probability of acceptance is

$P_a(p) = P_{0,n} + P_{1,n} P^i_{0,n}$

He above OC function is due to Dodge (1955) [5].

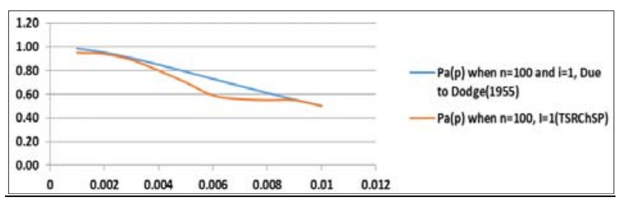

Fig 3: Comparison of OC values due to property 3 of TSRChSP.

References

1. Dodge HF. "Chain sampling Inspection Plan", Industrial Quality control. USA. 1955; 2:10-13.
2. Devaarul S, Jothimani K. "Design and Development of Two Sided Relational Chain Sampling Plans", International Journal of Statistics and System", India. 2020; 15(1):7-17.
3. Devaarul S, Rebecca Jebaseeli Edna K. "Two Sided Complete Chain Sampling Plans for Attribute Quality Characteristics (CChSP- 0, 1)", Karunya Journal of Research, India. INDIA. 2012; 3(1):25-36.
4. Devaarul S, Vijila M. Design and Development of Relational Chain Sampling Plans [RChSP(0, i)] for attribute quality characteristics, COGENT Mathematics & Statistics, USA. 2017; 4-408232:1-8.
5. Dodge HF "Chain sampling Inspection Plan", Industrial Quality control. USA. 1955; 2:10-13.
6. Dodge HF, Stephens KS. "Some new chain sampling Inspection," Industrial Quality Control. USA. 1966; 23(2):61-67.