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SELECTION OF MODIFIED CHAIN SAMPLING PLAN THROUGH MINIMUM ANGLE CRITERIA

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ABSTRACT

In this article a design procedure of attribute Modified chain sampling plan using minimum angle is presented. In acceptance sampling, producer's risk and consumer's risk are common in maintaining quality products especially in industries. In production field, these issues should be considered simultaneously when determining quality decision. In this paper, Producer's risk and Consumer's risk has been minimized by minimizing the tangent angle passing through (AQL, 1-α) and (LQL, β),using Modified Chain sampling plan as reference plan. Designing methodologies are provided to illustrate the solution procedures.

Key words: Modified Chain Sampling Plan, Producer's risk, consumer's risk, tangent angle.

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1. INTRODUCTION

Acceptance sampling plan is used to either accept or reject a lot based on the sampling inspection. The primary objective of sampling inspection is to reduce the cost of inspection while at the same time assuring the customer to satisfy an adequate level of quality on items being inspected. Inspection of raw materials, semi-finished products, or a finished product is an important part of quality assurance. When inspection is done for the purpose of acceptance or rejection of a product, and it is based on adherence to a standard the type of inspection procedure employed, such a procedure is usually called acceptance sampling. Sampling is widely used in government sector and industry for controlling the quality of shipment of components, supplies and final products.

In this section modified chain sampling plan as reference plan ,Producer risk and Consumer Risk has been minimized through minimizing the tangent angle passing through (AQL,1-α) and (LQL, β). It is discussed how the declination angle of the tangent at the inflection point of the OC curve which discriminates the Modified chain sampling plan. Tables are presented for the selection of plans based on Acceptable Quality Level (AQL) and

Limiting Quality Level (LQL) with discriminant or declination angle of the tangent. Dodge (1955) has developed the concept of skip-lot sampling, by applying the principles of a continuous sampling plan of type CSP-1 to a series of lots or batches of material. Govindaraju and Lai (1998) have developed modified chain sampling plans for costly or destructive items. Deva Arul (2003) has developed new mixed sampling plans by inculcating the blend of process and product control measures. V.Soundararajan and A.L.Christina(1997) contributed to Selection of single sampling variables Plans based on the minimum angle. Jemmy Joyce, Devaarul and Edna(2013) have developed mixed sampling plans based on tangent angle. Muthulakshmi (2009) has designed Minimum angle Skiplot sampling Plans. Bush et al. (1953) used different techniques to describe the direction of the operating characteristic (OC) curve.

2. THE OPERATING PROCEDURE OF MODIFIED CHAIN SAMPLING PLAN

(i) From each of the submitted lots, draw a random sample of size n. Reject the lot if one or more nonconforming units are found in the sample.

(ii) Accept the lot if no nonconforming units are found in the sample provided the preceding i samples also contain no nonconforming units except in one sample which may contain at most one nonconforming unit. Otherwise, reject the lot.

Thus a MChSP – 1 plan has two parameters namely n, the sample size for each submitted lot and i, the number of previous samples on which the decision of acceptance or

3. OPERATING CHARACTERISTICS FUNCTION

The operating characteristics function Pa(p) of Modified chain sampling plan using Poisson model as

$$P_a(p) = e^{-np(i+1)}\left[1 + inp\right]$$

i=Preceding sample

n=Sample size

p=Fraction defective

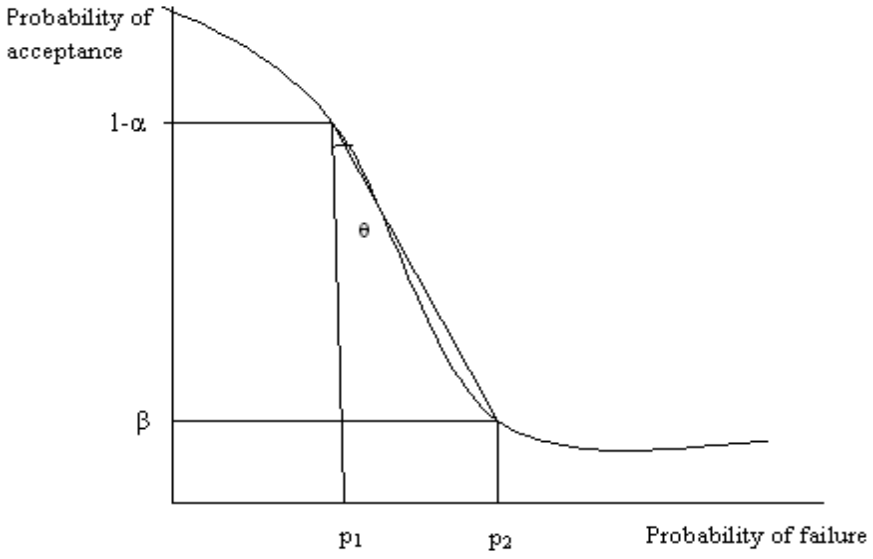

Figure 1

$$Tan\theta = \frac{p_2 - p_1}{(1-\alpha) - \beta}$$

$$Tan\theta = \frac{p_2 - p_1}{P_a(p_1) - P_a(p_2)}$$

4. DESIGNING MODIFIED CHAIN SAMPLING PLAN BASED ON TANGENT ANGLE THROUGH AQL AND LQL:

This section provides the procedure of designing the plane indexed through AQL and LQL.

PROCEDURE

- Two points on the OC curve can be fixed such that the probability of acceptance of fraction defective p_1 is 1-α and p_2 is β.
- Fix the sample size n.
- Calculate Pa (p_1) and Pa(p_2) for the given p_1 and p_2.
- Find tanθ=$\frac{p_2-p_1}{Pa(p_1)-Pa(p_2)}$.
- For the given p_1 and p_2 Calculate α, β and then find α+β**.**

Table 1 Sum of risks and Tangent angle for n=10, i=1

p_1	p_2	Pa(p_1)	Pa(p_2)	Tanθ	α	β	α+β
0.001	0.4	0.9900	0.0016	0.4036	0.0100	0.0016	0.0116
0.002	0.5	0.9800	0.0002	0.5082	0.0200	0.0002	0.0200
0.003	0.6	0.9700	0.00003	0.6156	0.0300	0.00003	0.0300
0.004	0.7	0.9600	0.00006	0.7250	0.0400	0.00006	0.0400
0.005	0.8	0.9500	0.000001	0.8368	0.0500	0.000001	0.0500
0.006	0.9	0.9401	0.0000001	0.9509	0.0599	0.0000001	0.0599

Table 2 Sum of risks and Tangent angle for i=2 and n=10

p_1	p_2	Pa(p_1)	Pa(p_2)	Tanθ	α	β	α+β
0.001	0.4	0.9898	0.00005	0.4031	0.0102	0.0005	0.0102
0.002	0.5	0.9794	0.000003	0.5084	0.0206	0.00003	0.0206
0.003	0.6	0.9687	$1.197*10^{-7}$	0.6162	0.0313	$1.197*10^{-7}$	0.0313
0.004	0.7	0.9578	$1.137*10^{-8}$	0.7266	0.0421	$1.137*10^{-8}$	0.0421
0.005	0.8	0.9487	$6.417*10^{--10}$	0.8488	0.0533	$6.417*0^{--10}$	0.0533
0.006	0.9	0.9355	$3.57*10^{-11}$	0.9532	0.0645	$3.57*10^{-11}$	0.0645

Table 3 Sum of risks and Tangent angle for i=1 and n=15

p_1	p_2	Pa(p_1)	Pa(p_2)	Tanθ	α	β	α+β
0.001	0.4	0.9850	0.00004	0.4050	0.0150	0.0004	0.0150
0.002	0.5	0.9700	0.000002	0.5134	0.0300	0.00002	0.0300
0.003	0.6	0.9413	$1.522*10^{-7}$	0.6342	0.0587	$1.522*10^{-7}$	0.0587
0.004	0.7	0.9401	$8.71*10^{-8}$	0.7403	0.0599	$8.71*10^{-8}$	0.0599
0.005	0.8	0.9252	$4.325*10^{-9}$	0.8592	0.0748	$4.325*10^{-9}$	0.0748
0.006	0.9	0.9104	$2.725*10^{-11}$	0.9819	0.0896	$2.725*10^{-11}$	0.0896

Table 4 Sum of risks and Tangent angle for i=2 and n=15

p_1	p_2	Pa(p_1)	Pa(p_2)	Tanθ	α	B	α+β
0.001	0.4	0.9846	$1.522*10^{-7}$	0.4244	0.0050	$1.522*10^{-7}$	0.0599
0.002	0.5	0.9687	$8.71*10^{-8}$	0.5152	0.0100	$8.71*10^{-8}$	0.0335
0.003	0.6	0.9523	$7.235*10^{-9}$	0.6122	0.0150	$7.235*10^{-9}$	0.0249
0.004	0.7	0.9355	$2.365*10^{-11}$	0.7131	0.0200	$2.365*10^{-11}$	0.0241
0.005	0.8	0.9182	$6.825*10^{-11}$	0.8167	0.0250	$6.825*10^{-11}$	0.0266
0.006	0.9	0.9007	$8.255*10^{-11}$	0.9222	0.0300	$8.255*10^{-11}$	0.0306

EXAMPLE: 1

Calculate the producer's risk, consumer's risk and the sum of the risks for the following data n=10, i=1, p_1=0.001 and p_2=0.4.

Solution: From the table 1,

Producer's risk (**α**) =0.0100, Consumer's risk (**β**) =0.0016

Sum of the risks (**α+β**) =0.0116, tanθ = 0.4036

5. CONCLUSIONS

The above tables give the tangent angle and the sum of the risks for variation p_1 ,p_2. The table shows that at a point where the tangent angle is minimum, the sum of the risks is also minimum. The result presented in this paper are mainly related with new procedure for designing sampling plan and necessary tables for selection of sampling system through minimum angle method involving producer and consumer quality levels.

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