Selection of Single Sampling Plan Using Conditional Weighted Poisson Distribution

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Abstract

This paper presents a new procedure for the selection of single sampling plan (SSP) through Maximum Allowable Average Outgoing Quality (MAAOQ) and Maximum Allowable Percent Defective (MAPD) with conditional weighted Poisson distribution as a basic distribution. Tables are constructed for the selection of plans. ***Key words:*** *Single sampling plan, acceptable quality level, maximum allowable average outgoing quality, and OC curve.*

Introduction

The proportion defective corresponding to the inflection point of the OC curve is interpreted as MAPD (p*). The desirability of developing a set of sampling plans indexed through p* has been explained by Mandelson (1962) and Soundararajan (1975). Pandey (1988) has studied the three stage decision (Accept– Screen– Reject) plan with inflection average outgoing quality and discussed the advantages of IAOQ as an outgoing quality measure over AOQL. Suresh and Ramkumar (1996) have studied the construction of sampling plan through MAAOQ. Suresh and Radhakrishnan (2000) studied continuous sampling plans indexed through MAAOQ. Radhakrishnan (2004) studied Construction of the sampling plan of the type CSP –T. Radhakrishnan and Sampathkumar (2005, 2006) studied mixed sampling plans through MAPD, AQL & IQL through chain sampling and double sampling plans. Radhakrishnan and Sekkizhar (2005) constructed Conditional double sampling plan using Intervened Random Effect Poisson Distribution. The weighted binomial distribution was studied by C.R.Rao (1977) and outlined its uses in the construction of sampling plans.

One of the desirable properties of an OC curve is that the decrease of Pa (p) should be slower for lesser values of p and steeper for larger values of p, which provides a better overall discrimination. If p* is considered as a standard quality measure then the above property of a desirable OC curve is exactly followed. As p* corresponds to the inflection point of the OC curve, it implies that,

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$$\frac{\partial^2 Pa(p)}{\partial p^2} < 0, \qquad p < p^*$$

$$\frac{\partial^2 Pa(p)}{\partial p^2} > 0, \qquad p > p^*$$

$$\frac{\partial^2 Pa(p)}{\partial p^2} = 0, \qquad p = p^*$$

Where Pa(p) is the probability of acceptance at quality level p fraction defective. Taking into consideration, the criticism leveled at AOQL by several authors, and corresponding importance of the MAPD as a quality measure, this study provides procedures and table for the selection of single sampling plan using conditional weighted Poisson distribution for α = 1

Glossary and symbols

p - Quality of submitted lot

p* - Maximum Allowable Percent Defective (MAPD)

n - Sample size

c - Acceptance number

Pa (p) - Probability of acceptance

Definition of MAAOQ

The MAAOQ (maximum allowable average outgoing quality of sampling plan is defined by the average outgoing quality (AOQ) at MAPD.

i.e., AOQ = p Pa (p).

Thus MAAOQ = AOQ at p = p*. This can be written as MAAOQ = p* Pa (p*).

Operating Procedure

The operating procedure of Single Sampling Plan (SSP) is as follows.

Step 1:

From each of the submitted lots, select a sample of size n and observe the number of non-conformities (d).

Step 2:

Accept the current lot if d d≤c and Reject the lot if d > c

Construction of Tables

The probability mass function of SSP using weighted Poisson distribution is given by,

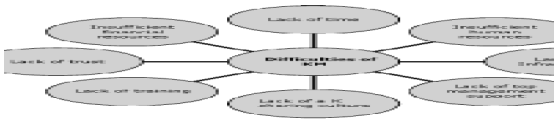

Figure 9: Difficulties of implementi

The OC function of SSP using conditional weighted Poisson distribution for α =1 is given by

$$Pa(p) = \sum_{x=0}^{c} P(X : \lambda, \alpha)$$

$$Pa(p) = \sum_{x=1}^{c} \frac{e^{-np}(np)^{x-1}}{(x-1)!}, \qquad x = 1,2,3,\ldots\ldots\ldots$$

where p is the proportion defective of the lot. Table 1 is constructed for various possible combinations of n and c with $\alpha = 1$ using search procedure.

Selection of the sampling plan

For specified MAAOQ and MAPD

Table 1 is used to construct the plan when the MAPD and MAAOQ are specified. One can find the ratio R = MAPD / MAAOQ which is a function of c alone and strictly increasing and find the value in Table 1 under the column R which is equal to or just greater than the specified ratio. The corresponding value of c is noted. From this, one can determine the parameters n and c for the conditional weighted Poisson distribution.

Example: 1

Given MAAOQ = 0.00439 & MAPD = 0.0065 the ratio R = MAPD / MAAOQ = 1.48, and locate the nearest value R from Table 1, corresponding value of n = 308, c = 3. Then the SSP with conditional weighted Poisson distribution is n = 308, c = 3 for $\alpha = 1$ with specified MAAOQ = 0.00439 and MAPD = 0.0065. The OC curve for the plan is presented in figure 1.

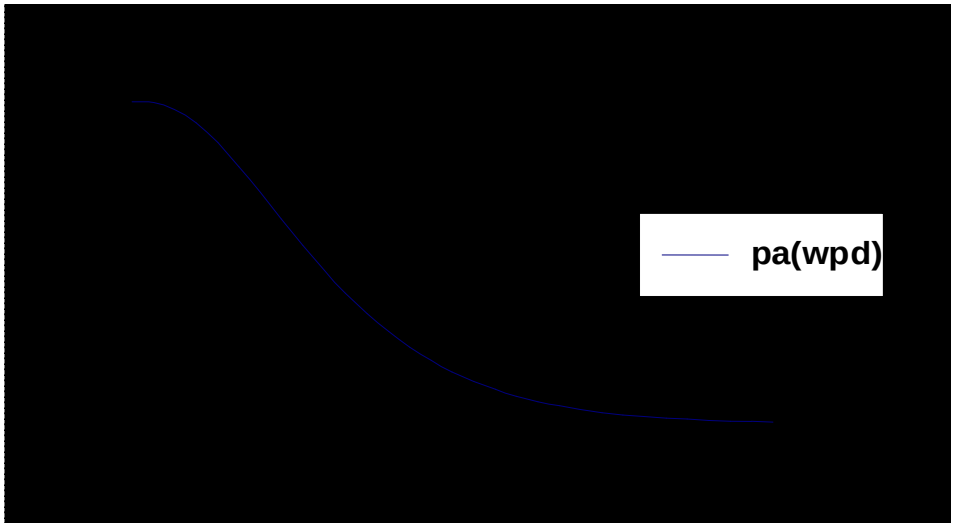

Figure 1. OC curve for n=308,c=3

Example: 2

Given MAAOQ = 0.0037 & MAPD = 0.0065 the ratio R = MAPD / MAAOQ = 1.76, and locate the nearest value R from Table 1, corresponding value of n = 2307, c = 16.Then the SSP with conditional weighted Poisson distribution is n = 2307, c=16 for $\alpha = 1$ with specified MAAOQ = 0.0037 and MAPD = 0.0065.

Table1 : Parameters of single sampling plan using conditional weighted poisson distribution (α =1)

R=MAPD /MAAOQ	MAPD % ==>	0.25	0.4	0.5	0.65	1	1.5	2.5	4	6.5	10
	c	n values									
1.48	3	802	501	401	308	200	134	80	50	31	20
1.54	4	1396	748	698	460	299	200	120	75	46	30
1.6	5	1610	1006	805	619	402	268	160	101	62	40
1.62	6	1996	1247	998	767	499	333	200	125	77	50
1.65	7	2400	1501	1200	924	600	400	240	150	92	60
1.67	8	2800	1750	1400	1077	700	467	280	175	108	70
1.69	9	3204	2003	1602	1233	801	534	320	200	123	80
1.7	10	9594	2247	1797	1383	899	599	359	225	138	90
1.72	11	4012	2740	2006	1686	1096	731	439	274	169	110
1.73	12	4408	2989	2204	1839	1196	797	478	299	184	120
1.74	13	4810	3241	2405	1994	1296	864	518	324	199	130
1.75	14	5214	3494	2607	2150	1398	932	559	350	215	140
1.76	16	6000	3749	3000	2307	1500	1000	600	375	231	150
1.77	17	6411	4007	3205	2466	1603	1068	641	401	246	160
1.78	19	7206	4504	3603	2771	1801	1201	721	450	277	180
1.79	21	8006	5004	4003	3079	2001	1334	800	500	308	200
1.8	24	9193	5746	4597	3536	2298	1532	920	575	354	230
1.81	26	10008	6255	5004	3849	2502	1668	1000	625	385	250

Conclusion

The work presented in this paper will help the floor engineer in deciding about the size of the sample if the incoming quality (MAPD) and the outgoing quality (MAAOQ) are specified. This will help the management in taking quick decisions.

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