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Procedure and Tables for Construction and Selection of Modified Chain Sampling Plan (MChSP-1) with Zero – Inflated Poisson Distribution

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ABSTRACT

The original chain sampling plan was introduced by Dodge (1995), known as the ChSP-1 plan. It has been used for of past lot inspection results when the current sample has a nonconforming unit. This selective use of related lot inspection results helps to achieve a more discriminating Operating Characteristic curve but it does not lead to a reduction in sample size. This paper is dealt with the tables for the selection of Chain Sampling Plan (Chsp-1) with zero –inflated poisson model with Modified Chain Sampling Plan (MChSP-1) with zero –inflated Poisson is given with illustration.

Keywords: Acceptable Quality Level (AQL), Average Outgoing Quality Level (AOQL). Modified Chain Sampling Plan, Zero – Inflated Poisson distribution.

1. INTRODUCTION

The chain sampling plan of type ChSP-1 of Dodge (1955) is useful there is where the sample size needs to be essentially small because of costly or destructive tests. In the proposed plan, rejection of lots would occur until the sequence of submissions advances to a stage where two or more nonconforming units are no longer included in the sequence of *i* samples. In other words, if two or more nonconforming units are found in a single sample, it will result in *i* subsequent lot rejections.It occurs only when a nonconforming unit is observed in the current sample. This means that the available historical evidence of quality is not fully utilized. Govindaraju and Lai (1998) developed a modified chain sampling plan (MChSP-1) that always utilizes the recently available lot-quality history.

The Zero-Inflated Poisson (ZIP) distribution can be used as the appropriate probability distribution to data consisting many over dispersed zeros. ZIP distribution has been used in a wide range of disciplines such as agriculture, epidemiology, econometrics, public health, process control, medicine an a manufacturing, etc. Some of the applications of ZIP distribution can be found in Bohning *et al*. (1999), Lambert (1992), and Yang *et al*. (2011). Construction of control charts using ZIP distribution are discussed in Sim and Lim (2008).Some theoretical aspects of ZIP distributions are mentioned in McLachlan and Peel (2000). Soundararajan (1971, 1978a, 1978b) developed procedures and tables for the construction and selection of chain sampling plans (ChSP -1) by specified parametersSingle sampling plans by attributes under the conditions of Zero – inflated Poisson distribution are determined by Loganathan and Shalini (2013), Suresh and Latha (2002) have given a procedure and tables for the selection of Bayesian chain sampling plan-1.Palanisamy and Latha,(2018) "Construction of Bayesian Single Sampling Plan attributes under the Conditions of Gamma Zero – Inflated Poisson Distribution. Latha and Palanisamy,(2018) have discussed the Procedure and table for construction and selection of chain sampling Plan with Zero – Inflated Poisson Distribution

2. THE OPERATING PROCEDURE OF SUCH A MODIFIED CHAIN SAMPLING PLAN (MChSP-1) IS GIVEN BELOW.

1. 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.
2. 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.

The OC function Pa(p) of the MChSP-1 plan was derived by Govindaraju and Lai (1998) as $P_a(p) = P_{0,n}\left(P^{i}{}_{o,n} + iP_{0,n}^{i-1}\ P_{1,n}\right)$

3. OPERATING CHARACTERISTIC FOR MODIFIED CHAIN SAMPLING PLANS (MChSP-1) WITH ZIP MODEL

The OC function is defined as

$$P_a(p) = P[X \le c] \quad (1)$$

Where "*p*" is the probability of fraction defective

The numbers of defects are zero for many samples there may consider Zero – inflated Poisson probability distribution. The probability mass function of the ZIP ($,\lambda$) distribution is given by Lambert (1992) and McLachlam and peel (2000)

$P(X = x\,|\phi,\lambda) =$ ¨ f(x) + (1- φ)P(X=x $|\lambda$) (2)

where

$$f(x) = \begin{cases} 1, & if\ x = 0 \\ 0, & if\ x \neq 0 \end{cases}$$

and

$P(X = x/\,^{a}) = \frac{e^{-\lambda}\lambda^{x}}{x!}$, when x =0, 1, 2, …

The probability mass function can also be expressed as

$$P(X=x\mid \¨, \a)=\begin{cases} \¨+(1-\¨)e^{-\a} & when \quad x=0 \\ (1-\¨)\dfrac{e^{-\a}\,\a^{x}}{x!}, & when \quad x=1,2,\ldots,0<\¨<1,\ \a>0 \end{cases}$$

In this distribution, φ may be called as the mixing proportion. φ and λ are the parameters of the ZIP distribution. According to McLachlan and Peel (2000), a Zip distribution is a special kind of mixture distribution.

The probability of acceptance for Modified chain sampling plan of type MChSP- 1 based on Zero- inflated Poisson distribution

$$P_a(p)=\left((1+i)\ (\¨+(1-\¨)e^{-np}\ )^{i+1}\right)+i\ (\¨+(1-\¨)e^{-np}\ )^{i}\ (1-\¨)e^{-np}\ np) \qquad (3)$$

4. ACCEPTABLE QUALITY LEVEL (AQL) FOR MODIFIED CHAIN SAMPLING PLANS (MChSP-1) WITH ZIP MODEL

For the modified Chain sampling plans with Zero- inflated Poisson distribution. Average Outgoing Quality (AOQ) is approximately obtained by

$$AOQ = p\,P_a(p)$$

Which implies

$$nAOQ=\left(np(1+i)\ (\¨+(1-\¨)e^{-np}\ )^{i+1}\right)+i\ (\¨+(1-\¨)e^{-np}\ )^{i}\ (1-\¨)e^{-np}\ (np)^2) \qquad (4)$$

Differentiating AOQ with respect to *np* and equating to *0,* the value of Average Outgoing Quantity Limit (AOQL) can be obtained by solving the equation.

$$(\¨+(1-\¨)e^{-np}\ )\ (\¨+(1-\¨)e^{-np})^{i}\left(2i-(1+i)^2-i\,np-i^2\,np\ (1-\¨)e^{-np}\right)$$
$$+(i+1)\ (\¨+(1-\¨)e^{-np}\ )^{i+1}=0 \qquad (5)$$

From Equation (5) the values of $np\ (=np_m)$ can be calculated for different values of ¨ and *i*. Substituting np_m in equation (4) nAOQL values are obtained.

OC Curve and AOQL

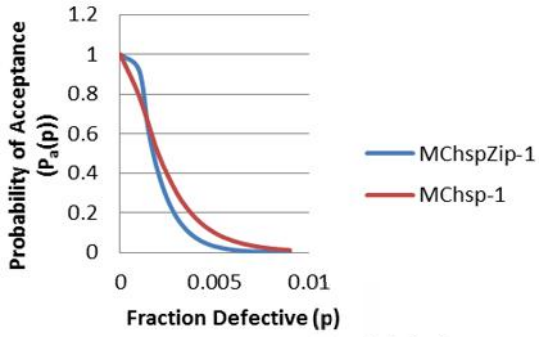

Figure 1: Given MChSP- 1 for n = 500, i = 1 , and MChSP -1with ZIP model for $\varphi = 0.0001$, n= 500, i = 1, Compression between OC curve of MChSP-1 and MChSP -1with ZIP.

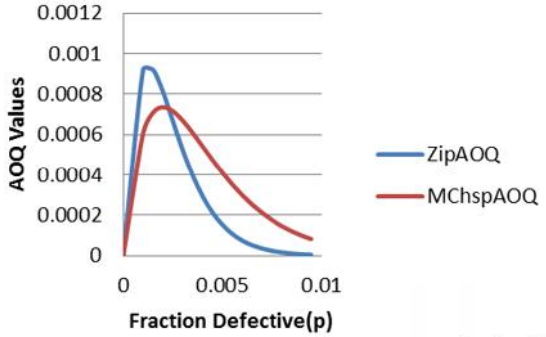

Figure 2: Given MChSP- 1 for AOQL n = 500, i = 1, and MChSP -1with ZIP model for AOQL $\varphi = 0.0001$, n = 500,i = 1, Compression between AOQL curve of MChSP-1 and MChSP- 1 with ZIP.

5. COMPARISON WITH MODIFIED CHAIN SAMPLING PLAN (MChSP – 1) WITH POISSON MODEL

From Figure 1 it is observed that the MChSP-1 with ZIP plan generally requires a smaller sample size than the matching MChSP-1 plan. The MChSP-1 with ZIP plan also possesses a reasonably discriminating OC curve offering a better producer protection compared to the zero acceptance number single sampling plan. For small sample inspection situations, the MChSP-1 with ZIP plan therefore seems to be a good candidate when compared to the MChSP-1 plan.

Figure 2: The AOQ values of McSP-1 and MChSP- 1 with ZIP. The percentage difference between AOQL of MChSP-1 and MChSP-1 with ZIP for all set of *i* and P_a (p) values are shown. We observed that the AOQL values of the two plans are different with the AOQL values of MChSP-1 with ZIP. It clearly indicated that MChSP-1 was higher than the AOQL values of MChSP-1 for all set of *i* and P_a (p) values.

Illustration 1

For the given ¨ =0.0001 and i=1, the AOQL value for MChSP with ZIP is 0.4797, for MChSP-1 AOQL for the i = 1 same value is 0.050080.

Table 1: *np* values for Modified Chain Sampling Plan with ZIP for given average probability of acceptance

¨		Pa(p)						
	i	**0.99**	**0.95**	**0.90**	**0.50**	**0.10**	**0.05**	**0.01**
0.0001	1	0.4539	0.4797	0.5135	0.8746	1.8220	2.2181	3.1207
	2	0.4585	0.475	0.4967	0.7294	1.3476	1.6079	2.2031
	3	0.4171	0.4292	0.4449	0.6147	1.0696	1.2622	1.7040
	4	0.3766	0.386	0.3983	0.5314	0.8900	1.0424	1.3929
	5	0.3421	0.3498	0.3599	0.4692	0.7646	0.8905	1.1805
	6	0.3134	0.3199	0.3285	0.4210	0.6719	0.7791	1.0261
	7	0.2894	0.295	0.3024	0.3827	0.6006	0.6937	0.9088
	8	0.2691	0.274	0.2806	0.3513	0.5438	0.6262	0.8165
	9	0.2517	0.2561	0.2619	0.3252	0.4975	0.5713	0.7420
0.001	1	0.4543	0.4802	0.5141	0.8757	1.8259	2.2240	3.1355
	2	0.4590	0.4755	0.4972	0.7303	1.3499	1.6110	2.2093
	3	0.4176	0.4296	0.4454	0.6154	1.0712	1.2643	1.7077
	4	0.3770	0.3864	0.3987	0.5320	0.8912	1.0440	1.3954
	5	0.3425	0.3502	0.3603	0.4697	0.7656	0.8917	1.1824
	6	0.3137	0.3203	0.3288	0.4215	0.6728	0.7801	1.0277
	7	0.2897	0.2953	0.3027	0.3831	0.6013	0.6946	0.9101
	8	0.2693	0.2743	0.2809	0.3517	0.5445	0.6270	0.8176
	9	0.2519	0.2564	0.2622	0.3256	0.4981	0.5720	0.7429
0.01	1	0.4593	0.4855	0.5198	0.8872	1.8654	2.2854	3.2955
	2	0.4640	0.4808	0.5028	0.7394	1.3732	1.6435	2.2739
	3	0.4221	0.4343	0.4503	0.6228	1.0875	1.2857	1.7453
	4	0.3810	0.3905	0.4030	0.5382	0.9037	1.0599	1.4214
	5	0.3461	0.3539	0.3641	0.4750	0.7757	0.9043	1.2020
	6	0.3170	0.3236	0.3323	0.4262	0.6813	0.7905	1.0434

	7	0.2927	0.2984	0.3059	0.3873	0.6086	0.7035	0.9232
	8	0.2721	0.2772	0.2838	0.3555	0.5509	0.6347	0.8289
	9	0.2545	0.2590	0.2649	0.3290	0.5039	0.5789	0.7528
0.05	1	0.4824	0.5103	0.5468	0.9420	2.0690	2.6198	4.5404
	2	0.4878	0.5057	0.5291	0.7829	1.4889	1.8079	2.6325
	3	0.4436	0.4566	0.4735	0.6578	1.1668	1.3915	1.9398
	4	0.4001	0.4102	0.4235	0.5674	0.9638	1.1371	1.5515
	5	0.3633	0.3715	0.3824	0.5001	0.8241	0.9651	1.2988
	6	0.3326	0.3395	0.3487	0.4482	0.7218	0.8406	1.1202
	7	0.3069	0.3129	0.3209	0.4070	0.6435	0.7461	0.9867
	8	0.2852	0.2905	0.2975	0.3733	0.5816	0.6718	0.8830
	9	0.2666	0.2714	0.2776	0.3454	0.5313	0.6118	0.7999
0.09	1	0.5081	0.5378	0.5767	1.0040	2.3357	3.1258	4.6452
	2	0.5142	0.5333	0.5583	0.8320	1.6288	2.0167	3.1993
	3	0.4674	0.4812	0.4993	0.6972	1.2596	1.5186	2.1966
	4	0.4213	0.4321	0.4462	0.6001	1.0330	1.2277	1.7124
	5	0.3822	0.3910	0.4025	0.5282	0.8792	1.0352	1.4147
	6	0.3497	0.3571	0.3668	0.4728	0.7677	0.8977	1.2103
	7	0.3226	0.3290	0.3373	0.4289	0.6829	0.7944	1.0603
	8	0.2996	0.3052	0.3126	0.3931	0.6161	0.7136	0.9452
	9	0.2800	0.2850	0.2916	0.3634	0.5620	0.6487	0.8537

Table 2: Values of np_1, ¨ and i for construction chain sampling plan, whose OC curve is required to pass through the Two points (p_1 ,1 – ~) and (p_2 ,)

Value of (p_2/p_1)for											
¨	i	~ = 0.05 = 0.10	~ = 0.05 = 0.05	~ = 0.05 = 0.01	np_1	¨	i	~ = 0.05 = 0.10	~ = 0.05 = 0.05	~ = 0.05 = 0.01	np_1
	1	3.7982	4.6239	6.5055	0.4797		6	2.1054	2.4428	3.2244	0.3236
	2	2.8371	3.3851	4.6381	0.4750		7	2.0395	2.3576	3.0938	0.2984
	3	2.4921	2.9408	3.9702	0.4292		8	1.9874	2.2897	2.9903	0.2772
	4	2.3057	2.7005	3.6085	0.3860		9	1.9456	2.2351	2.9066	0.2590
0.0001	5	2.1858	2.5457	3.3748	0.3498		1	4.0545	5.1338	8.8975	0.5103
	6	2.1003	2.4354	3.2076	0.3199		2	2.9442	3.5750	5.2057	0.5057
	7	2.0359	2.3515	3.0807	0.2950		3	2.5554	3.0475	4.2484	0.4566
	8	1.9847	2.2854	2.9799	0.2740		4	2.3496	2.7721	3.7823	0.4102
	9	1.9426	2.2308	2.8973	0.2561	0.05	5	2.2183	2.5978	3.4961	0.3715
	1	3.8024	4.6314	6.5296	0.4802		6	2.1261	2.4760	3.2996	0.3395
	2	2.8389	3.3880	4.6463	0.4755		7	2.0566	2.3845	3.1534	0.3129
	3	2.4935	2.9430	3.9751	0.4296		8	2.0021	2.3126	3.0396	0.2905
	4	2.3064	2.7019	3.6113	0.3864		9	1.9576	2.2542	2.9473	0.2714
0.001	5	2.1862	2.5463	3.3764	0.3502		1	4.3431	5.8122	8.6374	0.5378
	6	2.1005	2.4355	3.2086	0.3203		2	3.0542	3.7815	5.9991	0.5333
	7	2.0362	2.3522	3.0820	0.2953		3	2.6176	3.1559	4.5648	0.4812
	8	1.9851	2.2858	2.9807	0.2743		4	2.3907	2.8412	3.9630	0.4321
	9	1.9427	2.2309	2.8974	0.2564	0.09	5	2.2486	2.6476	3.6182	0.3910
	1	3.8422	4.7073	6.7878	0.4855		6	2.1498	2.5139	3.3892	0.3571
	2	2.8561	3.4183	4.7294	0.4808		7	2.0757	2.4146	3.2228	0.3290
0.01	3	2.5040	2.9604	4.0187	0.4343		8	2.0187	2.3381	3.0970	0.3052
	4	2.3142	2.7142	3.6399	0.3905		9	1.9719	2.2761	2.9954	0.2850
	5	2.1919	2.5552	3.3964	0.3539						

Table 3: Parameter values of Modified Chain Sampling Plan (MChSP-1) with ZIP Model

..	*i*	np_1	np_2	np_m	*nAOQL*	p_2/p_1	*AOQL*/ p_1	..	*i*	np_1	np_2	np_m	*nAOQL*	p_2/p_1	*AOQL*/ p_1
0.0001	1	0.4797	1.8220	0.6181	0.4701	3.7982	0.9800		6	0.3203	0.6728	0.1602	0.4160	2.1005	1.2988
	2	0.4750	1.3476	0.4041	0.4579	2.8371	0.9640		7	0.2953	0.6013	0.1386	0.4107	2.0362	1.3908
	3	0.4292	1.0696	0.2953	0.4429	2.4921	1.0319		8	0.2743	0.5445	0.1221	0.4064	1.9851	1.4816
	4	0.3860	0.8900	0.2312	0.4312	2.3057	1.1171		9	0.2564	0.4981	0.1090	0.4029	1.9427	1.5714
	5	0.3498	0.7646	0.1894	0.4224	2.1858	1.2075		1	0.5103	2.0690	0.6722	0.5021	4.0545	0.9839
	6	0.3199	0.6719	0.1601	0.4156	2.1003	1.2992		2	0.5057	1.4889	0.4340	0.4865	2.9442	0.9620
	7	0.2950	0.6006	0.1385	0.4103	2.0359	1.3908		3	0.4566	1.1668	0.3154	0.4694	2.5554	1.0280
	8	0.2740	0.5438	0.1219	0.4060	1.9847	1.4818		4	0.4102	0.9638	0.2462	0.4563	2.3496	1.1124
	9	0.2561	0.4975	0.1089	0.4025	1.9426	1.5717	0.05	5	0.3715	0.8241	0.2012	0.4466	2.2183	1.2022
0.001	1	0.4802	1.8259	0.6190	0.4707	3.8024	0.9802		6	0.3395	0.7218	0.1698	0.4391	2.1261	1.2934
	2	0.4755	1.3499	0.4046	0.4584	2.8389	0.9640		7	0.3129	0.6435	0.1468	0.4333	2.0566	1.3848
	3	0.4296	1.0712	0.2957	0.4433	2.4935	1.0319		8	0.2905	0.5816	0.1291	0.4286	2.0021	1.4754
	4	0.3864	0.8912	0.2315	0.4316	2.3064	1.1170		9	0.2714	0.5313	0.1152	0.4219	1.9576	1.5545
	5	0.3502	0.7656	0.1896	0.4228	2.1862	1.2073		1	0.5378	2.3357	0.7241	0.5314	4.3431	0.9881
	6	0.3203	0.6728	0.1602	0.4160	2.1005	1.2988		2	0.5333	1.6288	0.4615	0.5122	3.0542	0.9604
	7	0.2953	0.6013	0.1386	0.4107	2.0362	1.3908		3	0.4812	1.2596	0.3337	0.4931	2.6176	1.0247
	8	0.2743	0.5445	0.1221	0.4064	1.9851	1.4816		4	0.4321	1.0330	0.2597	0.4788	2.3907	1.1081
	9	0.2564	0.4981	0.1090	0.4029	1.9427	1.5714	0.09	5	0.3910	0.8792	0.2118	0.4681	2.2486	1.1972
0.01	1	0.4802	1.8259	0.6190	0.4707	3.8024	0.9802		6	0.3571	0.7677	0.1786	0.4600	2.1498	1.2882
	2	0.4755	1.3499	0.4046	0.4584	2.8389	0.9640		7	0.3290	0.6829	0.1542	0.4537	2.0757	1.3790
	3	0.4296	1.0712	0.2957	0.4433	2.4935	1.0319		8	0.3052	0.6161	0.1356	0.4486	2.0187	1.4699
	4	0.3864	0.8912	0.2315	0.4316	2.3064	1.1170		9	0.2850	0.5620	0.1209	0.4445	1.9719	1.5596
	5	0.3502	0.7656	0.1896	0.4228	2.1862	1.2073								

6. SELECTION PROCEDURE OF MODIFIED CHAIN SAMPLING PLAN-1 WITH ZIP FOR GIVE AOQL AND ¨

Table 4 is constructed for the selection of a Modified chain sampling plan (MChSP-1) with ZIP given ¨ , the parameter of Zero inflated Poisson distribution and for the required AOQL. Such table can be extended for the required AOQL. Such table can be extended for any value of ¨ and AOQL. For example when AOQL =1%, ¨ =0.0001,i=1,then plans can be (470,1),(458,2), (443,3),(431,4),(422,5),(416,6),(410,7),(406,8) or (403) one of which may be chosen according to the requirement of inspection

Table 4: Value of Sample size for given AOQL, ¨ and *i*

..		AOQL in Percent																	
	i	**0.10**	**0.25**	**0.50**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**
0.0001	1	470	188	94	63	47	31	24	19	16	13	12	10	9	8	7	6	5	5
	2	458	183	92	61	46	31	23	18	15	13	11	10	9	8	7	6	5	5
	3	443	177	89	59	44	30	22	18	15	13	11	10	9	7	6	6	5	4
	4	431	172	86	57	43	29	22	17	14	12	11	10	9	7	6	5	5	4
	5	422	169	84	56	42	28	21	17	14	12	11	9	8	7	6	5	5	4
	6	416	166	83	55	42	28	21	17	14	12	10	9	8	7	6	5	5	4
	7	410	164	82	55	41	27	21	16	14	12	10	9	8	7	6	5	5	4
	8	406	162	81	54	41	27	20	16	14	12	10	9	8	7	6	5	5	4
	9	403	161	81	54	40	27	20	16	13	12	10	9	8	7	6	5	4	4
0.001	1	471	188	94	63	47	31	24	19	16	13	12	10	9	8	7	6	5	5
	2	458	183	92	61	46	31	23	18	15	13	11	10	9	8	7	6	5	5
	3	443	177	89	59	44	30	22	18	15	13	11	10	9	7	6	6	5	4
	4	432	173	86	58	43	29	22	17	14	12	11	10	9	7	6	5	5	4
	5	423	169	85	56	42	28	21	17	14	12	11	9	8	7	6	5	5	4
	6	416	166	83	55	42	28	21	17	14	12	10	9	8	7	6	5	5	4
	7	411	164	82	55	41	27	21	16	14	12	10	9	8	7	6	5	5	4
	8	406	163	81	54	41	27	20	16	14	12	10	9	8	7	6	5	5	4
	9	403	161	81	54	40	27	20	16	13	12	10	9	8	7	6	5	4	4
0.01	1	476	190	95	63	48	32	24	19	16	14	12	11	10	8	7	6	5	5
	2	463	185	93	62	46	31	23	19	15	13	12	10	9	8	7	6	5	5
	3	448	179	90	60	45	30	22	18	15	13	11	10	9	7	6	6	5	4

	4	436	174	87	58	44	29	22	17	15	12	11	10	9	7	6	5	5	4
	5	427	171	85	57	43	28	21	17	14	12	11	9	9	7	6	5	5	4
	6	420	168	84	56	42	28	21	17	14	12	11	9	8	7	6	5	5	4
	7	415	166	83	55	41	28	21	17	14	12	10	9	8	7	6	5	5	4
	8	410	164	82	55	41	27	21	16	14	12	10	9	8	7	6	5	5	4
	9	407	163	81	54	41	27	20	16	14	12	10	9	8	7	6	5	5	4
0.05	1	502	201	100	67	50	33	25	20	17	14	13	11	10	8	7	6	6	5
	2	487	195	97	65	49	32	24	19	16	14	12	11	10	8	7	6	5	5
	3	469	188	94	63	47	31	23	19	16	13	12	10	9	8	7	6	5	5
	4	456	183	91	61	46	30	23	18	15	13	11	10	9	8	7	6	5	5
	5	447	179	89	60	45	30	22	18	15	13	11	10	9	7	6	6	5	4
	6	439	176	88	59	44	29	22	18	15	13	11	10	9	7	6	5	5	4
	7	433	173	87	58	43	29	22	17	14	12	11	10	9	7	6	5	5	4
	8	429	171	86	57	43	29	21	17	14	12	11	10	9	7	6	5	5	4
	9	422	169	84	56	42	28	21	17	14	12	11	9	8	7	6	5	5	4
0.09	1	531	213	106	71	53	35	27	21	18	15	13	12	11	9	8	7	6	5
	2	512	205	102	68	51	34	26	20	17	15	13	11	10	9	7	6	6	5
	3	493	197	99	66	49	33	25	20	16	14	12	11	10	8	7	6	5	5
	4	479	192	96	64	48	32	24	19	16	14	12	11	10	8	7	6	5	5
	5	468	187	94	62	47	31	23	19	16	13	12	10	9	8	7	6	5	5
	6	460	184	92	61	46	31	23	18	15	13	12	10	9	8	7	6	5	5
	7	454	181	91	60	45	30	23	18	15	13	11	10	9	8	6	6	5	5
	8	449	179	90	60	45	30	22	18	15	13	11	10	9	7	6	6	5	4
	9	445	178	89	59	44	30	22	18	15	13	11	10	9	7	6	6	5	4

7. SELECTION PROCEDURE BASED ON MODIFIED CHAIN SAMPLING PLAN (MChSP-1) with ZIP MODEL BASED ON AOQL AND AQL

Table 5 is constructed for the selection of ZIP modified chain sampling plan-1 for the given value of AOQL and AQL. For given values AQL and AOQL the ratio AOQL/AQL is obtained. The sample size n is obtained and hence a combination (¨ ,n,i) for given AOQL and AQL for the ZIP modified chain sampling plan is obtained.For example, when AOQL =0.1 and AQL=0.075, the table values closer to the ratio AOQL/AQL=1.3 is obtained as 1.2992 for which (¨ .i) = (0.0001,6).Similarly more combination of (¨ ,i) can be formed as per the inspection.

8. CONSTRUCTION OF AQL/ AOQL TABLE

In the Table 3, values of np_1 have been calculated for p_1 defined as AQL such that Pa(p) = 0.95. Also nAOQL values and the ratio AOQL/AQL are given .Given that AQL=0.075 percent and AOQL is 0.1 percent, then (AOQL/AQL) = 1.333. From table 3, the values closer to this is 1.3908 which corresponding to a value of ¨ = 0.0001 with i = 7, np_1 = 0.2950. Hence np_1 / p_1 = 0.2950/ 0.0007 = 393.33, i.e., about 394. Thus the MChSP-1 with corresponding to given AQL=0.075 percent and AOQL = 0.1 percent is given by n = 416, ¨ = 0.0001 and i = 7. In similar manner, Modified chain sampling plans can be constructed for a wide range of AQL and AOQL values from the given table.

Table 5: Selection procedure based on AQL and AOQL

	AOQL % 0.1					
AQL in %		0.0001	0.001	0.01	0.05	**0.09**
		n.i	n.i	n.i	n.i	n.i
	0.075	416,6	416,6	420,6	439,6	454,6
	0.10	443,3	443,3	448,3	469,3	493,3

Table 6: Values of *nAOQL* and Relative unity Values for MChsP-1 Plan and MChsP-1 plan with ZIP Model

(MChSP-1) with ZIP Model					**(MChSP-1) Plan**			
	i	***npm***	***n AOQL***	***AOQL/P1***	***i***	***npm***	***n AOQL***	***AOQL/P1***
0.0001	1	0.6181	0.4701	0.9800	1	0.7071	0.2935	5.86
0.001		0.6190	0.4707	0.9802				
0.01		0.6280	0.4761	0.9806				
0.05		0.6722	0.5021	0.9839				
0.09		0.7241	0.5314	0.9881				
0.0001	2	0.4041	0.4579	0.9640	2	0.5000	0.2231	4.74
0.001		0.4046	0.4584	0.9640				
0.01		0.4097	0.4633	0.9636				
0.05		0.4340	0.4865	0.9620				
0.09		0.4615	0.5122	0.9604				
0.0001	3	0.2953	0.4429	1.0319	3	0.3838	0.1779	4.09
0.001		0.2957	0.4433	1.0319				
0.01		0.2991	0.4479	1.0313				
0.05		0.3154	0.4694	1.0280				
0.09		0.3337	0.4931	1.0247				
0.0001	4	0.2312	0.4312	1.1171	4	0.3108	0.1474	3.70
0.001		0.2315	0.4316	1.1170				
0.01		0.2340	0.4360	1.1165				
0.05		0.2462	0.4563	1.1124				
0.09		0.2462	0.4563	1.1124				
0.0001	5	0.1894	0.4224	1.2075	5	0.2610	0.1257	3.45
0.001		0.1896	0.4228	1.2073				
0.01		0.1916	0.4270	1.2066				
0.05		0.2012	0.4466	1.2022				
0.09		0.2118	0.4681	1.1972				
0.0001	6	0.1601	0.4156	1.2992	6	0.2249	0.1095	3.27
0.001		0.1602	0.4160	1.2988				
0.01		0.1619	0.4201	1.2982				
0.05		0.1698	0.4391	1.2934				
0.09		0.1786	0.4600	1.2882				
0.0001	7	0.1385	0.4103	1.3908	7	0.1975	0.0969	3.14
0.001		0.1386	0.4107	1.3908				
0.01		0.1400	0.4146	1.3894				
0.05		0.1468	0.4333	1.3848				
0.09		0.1542	0.4537	1.3790				
0.0001	8	0.1219	0.4060	1.4818	8	0.1761	0.0869	3.04
0.001		0.1221	0.4064	1.4816				
0.01		0.1233	0.4103	1.4802				
0.05		0.1291	0.4286	1.4754				
0.09		0.1356	0.4486	1.4699				
0.0001	9	0.1089	0.4025	1.5717	9	0.1588	0.0788	2.97
0.001		0.1090	0.4029	1.5714				
0.01		0.1101	0.4067	1.5703				
0.05		0.1152	0.4219	1.5545				
0.09		0.1209	0.4445	1.5596				

9. COMPARISON OF (MChSP-1) WITH ZIP MODEL WITH (MChSP-1) PLAN

Based on observations, evaluated values in the table are compared with referred values[3] have some deviations. Specifically, in the table, np_m values of (MChSP-1) with ZIP Model are less than that of (MChSP-1) Plan, poisson model for small values of ¨ and as ¨ increases np_m for ZIP model approaches the nAOQL values in the table of (MChSP-1) with ZIP Model are much higher than that of (MChSP-1) plan which is shown in table. The $AOQL/P_1$ values in the table of (MChSP-1) with ZIP Model are less than that of (MChSP-1) Plan.

10. CONCLUSION

The Chain sampling plan gives more pressure on the producer if the quality deteriorates. These plans provide consumer an assurance regarding the outgoing quality or the quality of the lot after the inspection.The modified chain sampling plan MChSP-1 plan with ZIP developed in this paper is an improvement of the ChSP-1 plan. It utilizes more information from the prior lot quality history.This plan will be more useful to the quality control practitioner to meet out the consumer requirements.It means that the MChSP-1 plan with ZIP is likely to be suitable for inspections involving destructive or costly testing by attributes.

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