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International Journal of Current Research
Vol. 5, Issue, 10, pp.2810-2813, October, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

MINIMUM RISKS THREE STAGE CHAIN SAMPLING PLANS CHSP (0,1,2) WITH REPETITIVE DEFERRED SAMPLING PLAN INDEXED BY ACCEPTABLE QUALITY LEVEL AND LIMITING QUALITY LEVEL

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ARTICLE INFO

Article History:
Received 15th July, 2013
Received in revised form
27th August, 2013
Accepted 24th September 2013
Published online 10th October, 2013

Key words:
Acceptable Quality Level (AQL), Limiting Quality Level(LQL), Minimum Sum of Risk, Three stage chain sampling plan, Repetitive deferred sampling plan.

ABSTRACT

In this paper, a table and procedure are given for finding the three stage Chain Sampling plan ChSP (0,1,2) with repetitive deferred sampling plan involving minimum sum of producer's and consumer's risks for specified Acceptable Quality Level and Limiting Quality Level.

INTRODUCTION

Quality control emerges as an important topic during the industrial economy era. Acceptance sampling is one of its technique. And It began to take root on during in the early nineteenth century and flourished during and after the Second World War. A lot of methodologies were developed in the second half of the last century; in particular, various sampling plans were formulated to cater for various testing situations and quality requirements. Single sampling plans and double sampling plans are the most basic and widely applied testing plans when simple testing is needed. Multiple sampling plans and sequential sampling plans provide marginally better disposition decision at the expense of more complicated operating procedures. Other plans such as the continuous sampling plan, the bulk sampling plan, and the tighten-normal-tighten plan, skip lot sampling plan etc., are well developed and frequently used in their respective working conditions. Among these plans, chain sampling plans have received great attention because of their unique strength in dealing with destructive or costly inspection, where the sample size is kept as low as possible to minimize the total inspection cost without compromising the protection to suppliers and consumers. The objective of this paper is to minimize the consumer risk. In this paper, the starting point is the chain sampling plan (ChSP-1), first introduced by Dodge2. Its original intention was to overcome the problem of the lack of discrimination of a single sampling plan when the acceptance number $c = 0$. Today, this plan and its extensions have become the most frequently used plans in destructive or costly inspection.

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Theoretical calculations of the Three stage ChSP (0,1,2) plan are made on the assumptions that:

Step 1: At the outset, select a random sample of n units from the lot and from each succeeding lot.
Step2: Record the number of defectives d, in each sample and sum the number of defectives, D, in all samples from the first up to and including in the current sample.
Step 3: Accept the lot associated with each new sample during the cumulaion as long as $D_i \leq c_1;\ 1 \leq i \leq k_1.$
Step4: When k_1 consecutive samples have all resulted in acceptance continue to sum the defectives in the k_1 samples plus additional samples upto not more than k_2 samples.
Step 5: Accept the lot associated with each new sample during cumulation as long as $D_i \leq c_2;\ k_1 \leq i \leq k_2$.
Step 6: When k_2 consecutive samples have all resulted in acceptance continue to sum the defectives in the k_2 samples plus additional samples upto not more than k_3 samples.
Step 7: Accept the lot associated with each new sample during cumulation as long as $D_i \leq c_3;\ k_2 \leq i \leq k_3$.
Step 8: When the third stage of the restart period has been successfully completed (i.e.,k_3 consecutive samples have been resulted in acceptance),start cumulation of defectives as moving total over k_3 samples by adding the current sample result while dropping from the sum, the sample result of the k_3th preceding sample. Continue this procedure as long as $D_i \leq c_3$ and in each instance accept the lot.
Step 9: If for any sample at any stage of the above procedure, D_i is greater than the corresponding c, reject the lot.
Step 10: When a lot is rejected return to step-1 and fresh restart of the cumulation procedure.

When k_1=1, k=2 and k_3=3 and $c_2 = c_1 + 1, c_3 = c_2 + 1$, the three stage chain sampling plan becomes a multiple sampling plan

It is well-known that in the case of repetitive deferred sampling plan the acceptance or rejection of a lot in deferred state in dependent on the inspection results of the preceding or succeeding lots under Repetitive Group Sampling (RGS) inspection. So, RGS is the particular case of RDS plan. The operation of a repetitive deferred sampling plan as reference plan with four parameters is as follows.

1. Draw a random sample of size n from the lot and determine the number of defectives (d) found there in.
2. Accept the lot if $d \le c_1$, Reject the lot if $d > c_2$.
3. If $c_1 < d < c_2$, accept the lot provided 'i' preceding or succeeding lots are accepted under RGS inspection plan, otherwise reject the lot.

Here c_1 and c_2 are acceptance numbers such that $c_1 < c_2$ when i = 1 this plan reduces to RGS plan. The operating characteristic function P_a (p) for RDS plan is derived by Shankar and Mahopatra (1991) using Poisson model as

$$p_a(p) = \frac{p_a(1-p_c)^i + p_c p_a^i}{(1-p_c)^i} \quad \text{..........................(1)}$$

$$p_a = \sum_{r=0}^{c_1} \frac{e^{-x} x^r}{r!}$$

$$p_c = \sum_{r=0}^{c_2} \frac{e^{-x} x^r}{r!} - \sum_{r=0}^{c_1} \frac{e^{-x} x^r}{r!}$$

Where $x = np$

Thus the RDS plan is characterized with parameters namely n, c_1 , c_2, r and the acceptance criterion i.

Selection of sampling Plan

Minimum Risk three stages Chain Sampling Plan with repetitive deferred sampling plan

Table 1 is used to select a three stage Chain Sampling Plan with repetitive deferred sampling plan [6] for given p_1 and p_2 involving the minimum sum of risks. For the plans of Table 1, the producer's and consumer's risk will be atmost 10% each. Against fixed value of the operating ratio p_2 / p_1, Table 1 gives the parameters i ,c_1,c_2,k_1,k_2,and k_3, and the associated producer's and consumer's risks in the body of the Table against the product of sample size and the Acceptable Quality Level (np_1). The following procedure is used for selecting the plans for given p_1, p_2, α and β.

1. Compute the operating ratio p_2 / p_1.
2. With the computed value of p_2 / p_1, enter Table 1 in the row headed by p_2 / p_1 which is equal to or just smaller than the computed ratio.
3. For determining the parameters i and k, one proceeds form left to right in the row identified in Step 2 such that the tabulated producer's and consumer's risks are equal to or just less than the desired values.
4. The sample size n_2 is obtained as n_2= n= np_1/ p_1, where np_1 values are given in the column heading corresponding to the parameter i ,c_1,c_2,k_1,k_2,and k3 identified in step 3. The sample size n_1 is found as n_1= $k_1k_2k_3n_2$ (k>1).

For example, for given p_1=0.005, p_2= 0.1, α= 0.05 and β=0.05, one obtain a three stage chain sampling plan with RDS by the following steps from Table 1.

Table 1. Parametric values for three stage Chain sampling plan with repetitive deferred sampling plan using Minimum Sum of risks

OR \ np1	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
44	1, 2, 3, 1 ,2, 3, 3,0.15	1, 2, 3, 1 , 2, 3, 5, 0.3	1 ,2, 3, 1, 2, 3, 7, 0.45	1 ,2 ,3 , 1, 2, 3, 9, 0.6	1 ,2 ,3 , 1, 2,3, 11,0.75	1 ,2 ,3 , 1, 2,3, 13,0.9	1 ,2 ,3 , 1, 2,3, 16,.05	1 ,2 ,3 , 1, 2,3, 18,0.2	1 ,2, 3 , 1, 2,3, 20,0.35	1 ,2, 3 , 1, 2,3, 22,0.5
43	1,2,5, 1, 2, 3, 3,0.1	1,2,5, 1, 2, 3, 5, 0.2	1,2,5, 1, 2, 3, 7, 0.3	1,2,5, 1, 2, 3, 9, 0.4	1,2,5, 1, 2,3, 11,0.5	1,2,5, 1, 2,3, 13,0.6	1,2,5, 1, 2,3, 15,0.7	1,2,5, 1, 2,3, 17,0.8	1,2,5, 1, 2,3, 19,0.9	1,2,5, 1, 2,3, 22,0
42	1, 4 ,5, 1, 2, 3, 3,0.05	1, 4, 5 , 1, 2, 3, 5, 0.1	1 ,4 ,5 , 1, 2, 3, 7, 0.15	1, 4 ,5 , 1, 2, 3, 9, 0.2	1, 4 ,5 , 1, 2,3, 11,0.25	1, 4 ,5 , 1, 2,3, 13,0.3	1, 4 ,5 , 1, 2,3, 15,0.35	1 ,4 ,5 , 1, 2,3, 17,0.4	1, 4 ,5 , 1, 2,3, 19,0.45	1, 4 ,5 , 1, 2,3, 21,0.5
41	2 ,3, 4, 1, 2, 3, 3,0	2 ,3, 4, 1, 2, 3, 5, 0	2 ,3, 4, 1, 2, 3, 7, 0	2 ,3, 4, 1, 2, 3, 9 , 0	2 ,3, 4, 1, 2,3, 11,0	2 ,3, 4, 1, 2,3, 13,0	2 ,3, 4, 1, 2,3, 15,0	2 ,3, 4, 1, 2,3, 17,0	2 ,3, 4, 1, 2,3, 19,0	2 ,3, 4, 1, 2,3, 21,0
40	2,5,10 1, 2, 3, 2,0.95	2,5,10 1, 2, 3, 4, 0.9	2,5,10 1, 2, 3, 6, 0.85	2,5,10 1, 2, 3, 8, 0.8	2,5,10 1, 2,3, 10,0.75	2,5,10 1, 2,3, 12,0.7	2,5,10 1, 2,3, 14,0.65	2,5,10 1, 2,3, 16,0.6	2,5,10 1, 2,3, 18,0.55	2,5,10 1, 2,3, 20,0.5
39	2,9,10, 1, 2, 3, 2,0.9	2,9,10, 1, 2, 3, 4, 0.9	2,9,10, 1, 2, 3, 6, 0.85	2,9,10, 1, 2, 3, 8, 0.8	2,9,10, 1, 2,3, 10,0.5	2,9,10, 1, 2,3, 12,0.4	2,9,10, 1, 2,3, 14,0.3	2,9,10, 1, 2,3, 16,0.2	2,9,10, 1, 2,3, 18,0.1	2,9,10, 1, 2,3, 20, 0
38	3,4,5, 1, 2, 3, 2,0.85	3,4,5, 1, 2, 3, 4, 0.7	3,4,5, 1, 2, 3, 6, 0.55	3,4,5, 1, 2, 3, 8, 0.4	3,4,5, 1, 2,3, 10,0.25	3,4,5, 1, 2,3, 12,0.1	3,4,5, 1, 2,3, 13,0.95	3,4,5, 1, 2,3, 15,0.8	3,4,5, 1, 2,3, 17,0.65	3,4,5, 1, 2,3, 19,0.5
37	4,5,6, 1, 2, 3, 2,0.8	4,5,6, 1, 2, 3, 4, 0.6	4,5,6, 1, 2, 3, 6, 0.4	4,5,6, 1, 2, 3, 8, 0.2	4,5,6, 1, 2,3, 10,0	4,5,6, 1, 2,3, 11,0.8	4,5,6, 1, 2,3, 13,0.6	4,5,6, 1, 2,3, 15,0.4	4,5,6, 1, 2,3, 17,0.2	4,5,6, 1, 2,3, 19, 0
36	5,6,7, 1, 2, 3, 2,0.75	5,6,7, 1, 2, 3, 4, 0.5	5,6,7, 1, 2, 3, 6, 0.25	5,6,7, 1, 2, 3, 8, 0	5,6,7, 1, 2,3, 9,0.75	5,6,7, 1, 2,3, 11,0.5	5,6,7, 1, 2,3, 13,0.25	5,6,7, 1, 2,3, 15,0	5,6,7, 1, 2,3, 16,0.75	5,6,7, 1, 2,3, 18,0.5
35	6,7,8, 1, 2, 3, 2,0.7	6,7,8, 1, 2, 3, 4, 0.4	6,7,8, 1, 2, 3, 6, 0.1	6,7,8, 1, 2, 3, 7, 0.8	6,7,8, 1, 2,3, 9,0.5	6,7,8, 1, 2,3, 11,0.2	6,7,8, 1, 2,3, 12,0.9	6,7,8, 1, 2,3, 14,0.6	6,7,8, 1, 2,3, 16,0.3	6,7,8, 1, 2,3, 18, 0
34	7,8,9, 1, 2, 3, 2,0.65	7,8,9, 1, 2, 3, 4, 0.3	7,8,9, 1, 2, 3, 5, 0.95	7,8,9, 1, 2, 3, 7, 0.6	7,8,9, 1, 2,3, 9,0.25	7,8,9, 1, 2,3, 10,0.9	7,8,9, 1, 2,3, 12,0.55	7,8,9, 1, 2,3, 14,0.2	7,8,9, 1, 2,3, 15,0.85	7,8,9, 1, 2,3, 17,0.5
33	8,9,10, 1, 2, 3, 2,0.6	8,9,10, 1, 2, 3, 4, 0.2	8,9,10, 1, 2, 3, 5,0.8	8,9,10, 1, 2, 3, 7, 0.4	8,9,10, 1, 2,3, 9,0	8,9,10, 1, 2,3, 10,0.6	8,9,10, 1, 2,3, 12,0.2	8,9,10, 1, 2,3, 13,0.8	8,9,10, 1, 2,3, 15,0.4	8,9,10, 1, 2,3, 17, 0
32	9,10,11, 1, 2, 3, 2,0.55	9,10,11, 1, 2, 3, 4, 0.1	9,10,11, 1, 2, 3, 5, 0.65	9,10,11, 1, 2, 3, 7, 0.2	9,10,11, 1, 2,3, 8,0.75	9,10,11, 1, 2,3, 10,0.3	9,10,11, 1, 2,3, 11,0.85	9,10,11, 1, 2,3, 13,0.4	9,10,11, 1, 2,3, 14,0.95	9,10,11, 1, 2,3, 16,0.5

Table 2. Parametric values for three stage Chain sampling plan with repetitive deferred sampling plan using Minimum Sum of risks

OR \ np1	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	0.70	0.75	0.80	0.85	0.90	0.95
31	9,10,11, 1 , 2, 3, 0.5,17	9,10,11, 1 , 2, 3, 0,19	9,10,11, 1 , 2, 3, 0.5,20	9,10,11, 1 , 2, 3, 0,22	9,10,11, 1 , 2, 3, 0.5,23	9,10,11, 1 , 2, 3, 0,25	9,10,11, 1 , 2, 3, 0.5,26	9,10,11, 1 , 2, 3, 0,28	9,10,11, 1 , 2, 3, 0.5,29						
30	9,10,20, 1, 2, 3, 0.95,16	9,10,20, 1, 2, 3, 0.4,18	9,10,20, 1, 2, 3, 0.85,19	9,10,20, 1, 2, 3, 0.3,21	9,10,20, 1, 2, 3, 0.75,22	9,10,20, 1, 2, 3, 0.2,24	9,10,20, 1, 2, 3, 0.65,25	9,10,20, 1, 2, 3, 0.1,27	9,10,20, 1, 2, 3, 0.55,28	9,10,20, 1, 2,3, 0	9,10,20, 1, 2,3, 0	9,10,20, 1, 2,3, 0	9,10,20, 1, 2,3, 0	9,10,20, 1, 2,3, 0,	9,10,20, 1, 2,3, 0,
29	10,11,12 , 1, 2, 3, 0.4,16	10,11,12 , 1, 2, 3, 0.8,17	10,11,12, 1, 2, 3, 0.2,19	10,11,12 , 1, 2, 3, 0.6,20	10,11,12 , 1, 2, 3, 0,22	10,11,12 , 1, 2, 3, 0.4,23	10,11,12 , 1, 2, 3, 0.8,24	10,11,12 , 1, 2, 3, 0.2,26	10,11,12 , 1, 2, 3, 0.6,27	10,11,12 , 1, 2,3, 0	10,11,12 , 1, 2,3, 0	10,11,12 , 1, 2,3, 0	10,11,12 , 1, 2,3, 0	10,11,12 , 1, 2,3, 0	10,11,12 , 1, 2,3, 0
28	11 ,12,13, 1, 2, 3, 0.85,15	11 ,12,13, 1, 2, 3, 0.2,17	11 ,12,13, 1, 2, 3, 0.55,18	11 ,12,13, 1, 2, 3, 0.9,19	11 ,12,13, 1, 2, 3, 0.25,21	11 ,12,13, 1, 2, 3, 0.6,22	11 ,12,13, 1, 2, 3, 0.95,23	11 ,12,13, 1, 2, 3, 0.3,25	11 ,12,13, 1, 2, 3, 0.65,26	11 ,12,13, 1, 2,3, 0,	11 ,12,13, 1, 2,3, 0,	11 ,12,13, 1, 2,3, 0,	11 ,12,13, 1, 2,3, 0,	11 ,12,13, 1, 2,3, 0,	11 ,12,13, 1, 2,3, 0,
27	11,12,19 1, 2, 3, 0.3,15	11,12,19 1, 2, 3, 0.6,16	11,12,19 1, 2, 3, 0.9,17	11,12,19 1, 2, 3, 0.2,19	11,12,19 1, 2, 3, 0.5,20	11,12,19 1, 2, 3, 0.8,21	11,12,19 1, 2, 3, 0.1,23	11,12,19 1, 2, 3, 0.4,24	11,12,19 1, 2, 3, 0.7,25	11,12,19 1, 2,3, 0,	11,12,19 1, 2,3, 0,	11,12,19 1, 2,3, 0,	11,12,19 1, 2,3, 0,	11,12,19 1, 2,3, 0,	11,12,19 1, 2,3, 0,
26	11,17,20, 1, 2, 3, 0.75,14	11,17,20, 1, 2, 3, 0,16	11,17,20, 1, 2, 3, 0.25,17	11,17,20, 1, 2, 3, 0.5,18	11,17,20, 1, 2, 3, 0.75,19	11,17,20, 1, 2, 3, 0,21	11,17,20, 1, 2, 3, 0.25,22	11,17,20, 1, 2, 3, 0.5,23	11,17,20, 1, 2, 3, 0.75,24	11,17,20, 1, 2,3, 0,	11,17,20, 1, 2,3, 0,	11,17,20, 1, 2,3, 0,	11,17,20, 1, 2,3, 0,	11,17,20, 1, 2,3, 0,	11,17,20, 1, 2,3, 0,
25	12,13,14, 1, 2, 3, 0.2,14	12,13,14, 1, 2, 3, 0.4,15	12,13,14, 1, 2, 3, 0.6,16	12,13,14, 1, 2, 3, 0.8,17	12,13,14, 1, 2, 3, 0,19	12,13,14, 1, 2, 3, 0.2,20	12,13,14, 1, 2, 3, 0.4,21	12,13,14, 1, 2, 3, 0.6,22	12,13,14, 1, 2, 3, 0.8,23	12,13,14, 1, 2,3, 0,	12,13,14, 1, 2,3, 0,	12,13,14, 1, 2,3, 0,	12,13,14, 1, 2,3, 0,	12,13,14, 1, 2,3, 0,	12,13,14, 1, 2,3, 0,
24	13,14,15, 1, 2, 3, 0.65,13	13,14,15, 1, 2, 3, 0.8,14	13,14,15, 1, 2, 3, 0.95,15	13,14,15, 1, 2, 3, 0.1,17	13,14,15, 1, 2, 3, 0.25,18	13,14,15, 1, 2, 3, 0,4,19	13,14,15, 1, 2, 3, 0.55,20	13,14,15, 1, 2, 3, 0.7,21	13,14,15, 1, 2, 3, 0.85,22	13,14,15, 1, 2,3, 0,	13,14,15, 1, 2,3, 0,	13,14,15, 1, 2,3, 0,	13,14,15, 1, 2,3, 0,	13,14,15, 1, 2,3, 0,	13,14,15, 1, 2,3, 0,
23	13,14,19, 1, 2, 3, 0.1,13	13,14,19, 1, 2, 3, 0.2,14	13,14,19, 1, 2, 3, 0.3,15	13,14,19, 1, 2, 3, 0.4,16	13,14,19, 1, 2, 3, 0.5,17	13,14,19, 1, 2, 3, 0.6,18	13,14,19, 1, 2, 3, 0.7,19	13,14,19, 1, 2, 3, 0.8,20	13,14,19, 1, 2, 3, 0.9,21	13,14,19, 1, 2,3, 0,	13,14,19, 1, 2,3, 0,	13,14,19, 1, 2,3, 0,	13,14,19, 1, 2,3, 0,	13,14,19, 1, 2,3, 0,	13,14,19, 1, 2,3, 0,
22	13,14,22, 1, 2, 3, 0.55,12	13,14,22, 1, 2, 3, 0.6,13	13,14,22, 1, 2, 3, 0.65,14	13,14,22, 1, 2, 3, 0.7,15	13,14,22, 1, 2, 3, 0.75,16	13,14,22, 1, 2, 3, 0.8,17	13,14,22, 1, 2, 3, 0.85,18	13,14,22, 1, 2, 3, 0.9,19	13,14,22, 1, 2, 3, 0.95,20	13,14,22, 1, 2,3, 0,	13,14,22, 1, 2,3, 0,	13,14,22, 1, 2,3, 0,	13,14,22, 1, 2,3, 0,	13,14,22, 1, 2,3, 0,	13,14,22, 1, 2,3, 0,
21	13,17,22, 1, 2, 3, 0,12	13,17,22, 1, 2, 3, 0,13	13,17,22, 1, 2, 3, 0,14	13,17,22, 1, 2, 3, 0,15	13,17,22, 1, 2, 3, 0,16	13,17,22, 1, 2, 3, 0,17	13,17,22, 1, 2, 3, 0,18	13,17,22, 1, 2, 3, 0,19	13,17,22, 1, 2, 3, 0,20	13,17,22, 1, 2,3, 0,	13,17,22, 1, 2,3, 0,	13,17,22, 1, 2,3, 0,	13,17,22, 1, 2,3, 0,	13,17,22, 1, 2,3, 0,	13,17,22, 1, 2,3, 0,
20	13,20,22, 1, 2 ,3, 0,10	13,20,22, 1, 2, 3, 0,9	13,20,22, 1, 2, 3, 0,8	13,20,22, 1, 2, 3, 0,7	13,20,22, 1, 2, 3, 0,6	13,20,22, 1, 2, 3, 0,5	13,20,22, 1, 2, 3, 0,4	13,20,22, 1, 2, 3, 0,3	13,20,22, 1, 2 ,3, 0,2	13,20,22, 1, 2,3, 0,	13,20,22, 1, 2,3, 0,	13,20,22, 1, 2,3, 0,	13,20,22, 1, 2,3, 0,	13,20,22, 1, 2,3, 0,	13,20,22, 1, 2,3, 0,
19	14,15,16, 1, 2 ,3, 0.55,9	14,15,16, 1, 2, 3, 0.6,8	14,15,16, 1, 2,3, 0.65,7	14,15,16, 1, 2,3, 0.7,6	14,15,16, 1, 2, 3, 0.75,5	14,15,16, 1, 2 ,3, 0.8,4	14,15,16, 1, 2, 3, 0.85,3	14,15,16, 1, 2, 3, 0.9,2	14,15,16, 1, 2, 3, 0.95,1	14,15,16, 1, 2,3, 0	14,15,16, 1, 2,3, 0	14,15,16, 1, 2,3, 0	14,15,16, 1, 2,3, 0	14,15,16, 1, 2,3, 0	14,15,16, 1, 2,3, 0

k_1	k_2	k_3
i	c_1	c_2
α	β	

1. $p_2 / p_1 = 0.01/ 0.005 = 20.0$,
2. Tabulated $p_2 / p_1 = 20.0$,
3. Corresponding to i = 1 and $k_1 = 1$, $k_2=4$, $k_3= 5$given in the body of the Table 1, one obtain α = 5 and β = 0.1 against the desired α = 0.05 and β =0.05.
4. $n_2 = n = np_1/ p_1 = 0.01/0.005 = 20$
$n_1 = k_1k_2k_3*n_2 = 20(20) = 400$

Table 1 given here does not assume any fixed values of α and β, and gives three stage chin sampling plan with repetitive deferred sampling plan for rounded values of the operating ratio. The Table presented here directly assume p_2 / p_1 values and give the parameters with corresponding producer's and consumer's risks such that their sum is minimum. For example, if one fixes $p_1 = 0.004$, $p_2 = 0.07$ with α = 0.05 and β = 0.10, one gets the following plan using the Table 2 of Subramani [8], for which the tabulated operating ratio is 17.16 with $np_1 = 0.0610$:$n_1 = 33$, $n_2 = 15$, i = 6 and k = 2.2

For the same conditions, one obtains the following two stage plan of Bagchi from Table 1 of this paper as $n_1 = 40$, $n_2 = 8$, i = 2 and k = 5. This plan has α = 0.02 and β = 0.07, giving α+β = 0.09.

Table 1 can also be used to select a three stage chain sampling plan with repetitive deferred sample plan when the sample size is fixed. For example, if one fixes $n_2 = n =15$, $p_1 = 0.004$, $p_2 = 0.04$, one gets $np_1 = 0.06$ and $p_2 / p_1 = 10$. With the computed value of np_1 and p_2 / p_1, one obtains from Table 1 the following parameters corresponding to the minimum sum of producer's and consumer's risks [9]. $n_2 = 15$, $n_1 = 75$, i = 2 and k = 5 (α = 0.05; β = 0.05)

The OC function for three stage chain sampling plan with RDS obtained bySuresh and Anamiya is

$$P_a(P) =$$

$$\frac{p_0 + p_1 p_0^{k_2-1} + (k_3-k_2-1)p_1^2 p_0^{k_3-2} + \frac{p_a(1-p_c)^i + p_c p_a^i}{(1-p_c)^i} p_0^{k_3-1} + p_1 p_0^{k1}\left[\frac{1-p_0^{k_2-k_1-1}}{1-p_0}\right] + (k_2-k_1)p_1^2 p_0^{k_2-1} + p_1^2 p_0^{k_2}\left[\frac{1-(k_3-k_2-1)p_0^{k_3-k-2_2}}{1-p_0} + \frac{p_{0(}(1-p_0^{k_3-k-2_2})}{(1-p_0)^2}\right] + \frac{p_a(1-p_c)^i + p_c p_a^i}{(1-p_c)^i} p_0^{k_2}\left[\frac{1-p_0^{k-k_2-1_3}}{1-p_0}\right]}{1 + p_1 p_0^{k_1}\left[\frac{1-p_0^{k_2-k_1-1}}{1-p_0}\right] + (k_2-k_1)p_1^2 p_0^{k_2-1`} + p_1^2 p_0^{k_2}\left[\frac{1-(k_3-k_2-1)p_0^{k_3-k-2_2}}{1-p_0} + \frac{p_{0(}(1-p_0^{k_3-k-2_2})}{(1-p_0)^2}\right] + \frac{p_a(1-p_c)^i + p_c p_a^i}{(1-p_c)^i} p_0^{k_2}\left[\frac{1-p_0^{k-k_2-1_3}}{1-p_0}\right]} \quad ....(2)$$

The expression for the sum of producer's and consumer's risks is given by

α + β = 1- $Pa(p_1)$ + $Pa(p_2)$………………………..(4)

If the operating ratio p_2/ p_1 are known, then np_2 can be written as

$np_2 = (p_2 / p_1) (np_1)$ ……………………………..(5)

Under the Poisson assumptions, one has the expression for the sum of producer's and consumer's risks is given by For fixed np_1 the value of np_2 is calculated from equation (5) and used in equation (4). The parameters i and k corresponding to the minimum 1- $Pa(p_1)$ + $Pa(p_2)$ are obtained searching for i =1(1)10 and k = 1(0.1)5 for fixed value of np_1 and p_2 / p_1 using a computer program. The producer's and consumer's risks are then obtained corresponding to the i and k values for which the sum of risks is minimum.

Conclusion

Acceptance sampling is the techniques which deals with the procedure in which decision either accept or reject lots or processes which are based on the examination of samples. This paper relates to the new procedure for the selection of three stage chain sampling plan with repetitive deferred sampling plan as reference plan using Minimum sum of risks.

In acceptance sampling the producer and consumer plays a dominant role and hence one allows certain level of risk for producer and consumer, namely α = 0.05, β = 0.10. In practice it is desirable to design any sampling plan with the associated quality levels which concern to producer and consumer. The result presented in this paper are mainly related with new procedure and necessary tables for selection of sampling system through minimum sum of risks involving producer’s and onsumer’s quality levels. The emphasis in the present work is that the selection of sampling system with this procedure is more advantages to the producer and consumer. Tables are provided here which are tailor made, handy and ready- made uses to the industrial shop-floor condition. These tables are useful for both producer and consumer for obtaining good quality products with less cost for inspection.

REFERENCES

1. Anamiya Baby (2011):” A study on special purpose plans through Minimum Angle Method”, M.phil Thesis, Bharathiar University, Tamilnadu, India.
2. Bagchi S.B (1976):”An extension of chain sampling plan”, IAPQR Trans.Vol.1,pp19-22.
3. Dodge .H.F 1977). Chain sampling plan. *Journal of Quality Technology*. 9(3):139–142.
4. Clark C.R (1960):”O-C Curves for ChSP-1 Chain sampling plans,Ind.Qual.Contr,Vol.17 pp10-12.
5. Frishman .F (1960). An extended chain sampling inspection plan. *Industrial Quality Control* . 17(1):10–12.
6. Govindaraju K, Balamurali S(1998). Chain sampling plan for variables inspection. *Journal of Applied Statistics* .25(1):103–109.
7. Govindaraju K, Kuralmani V(1991). Determination of ChSP-1 chain sampling plans for given (AQL, AOQL). *International Journal of Management and Systems.*; 7(2):149–154.
8. Jothikumar J, RAJU C (1996). Two stage chain sampling plans ChSP-(0,2) and ChSP-(1,2)—part 2. *Communications in Statistics: Simulation and Computation* . 25(3):817–834.
9. Ohta. H (1979):”Gert analysis of chain sampling inspection plans”, Bull, Uni.Osaka Prefecture Sec. A.Eng.Nat.Sci.Vol.27, pp167-174.
10. Raju C. Three stage chain sampling plans. *Communications in Statistics—Theory and Methods* 1991;20(5-6):1777–1801.
11. Raju C, Jothikumar J (1997). Procedures and tables for the construction and selection of chain sampling plans ChSP-4A (C1, C2)R—part 5. *Journal of Applied Statistics* . 24(1):49–76.
12. Raju C, Murthy NMN(1995). Minimum risks chain sampling plans (ChSP-4 (*c*1, c2)) indexed by acceptable quality level and limiting quality level. *Journal of Applied Statistics* . 22(3):389–426.
13. Raju C, Murthy NMN (1995). Procedures and tables for the construction and selection of chain sampling plans ChSP-4A (C1, C2)—part 4. *Journal of Applied Statistics.*; 22(2):261–271.
14. Raju C, Murthy NMN (1996). Two-stage chain sampling plans ChSP-(0,2) And ChSP-(1,2)—part 1. *Communications in Statistics: Simulation and Computation* . 25(2):557–572.
15. Soundararajan V (1978). Procedures and tables for construction and selection of chain sampling plans (ChSP-1) part 1. *Journal of Quality Technology*. 10(2):56–60.
16. Soundararajan V (1978). Procedures and tables for construction and selection of chain sampling plans (ChSP-1) part 2: Tables for selection of chain sampling plans. *Journal of Quality Technology*. 10(3):99–103.
17. Sripriya, K. (2007): Certain results on Three Stage Chain Sampling Plan Indexed through Outgoing Quality levels, M.Phil thesis, Bharathiar University, Tamilnadu.
18. Stephen K.S, Dodge H.F (1976):”Two stage chain sampling inspection plans with different sample sizes in two stages” Journal of Quality Technology Vol.8,pp209-224.

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