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FUZZY MODIFIED CHAIN SAMPLING PLAN FOR VERY EXPENSIVE PRODUCTS

K. REBBECA JEBASEELI EDNA[1] AND V. JEMMY JOYCE

ABSTRACT. In quality control, when the inspection is done for destructive or very expensive products, sampling plans with small sample sizes are normally selected. In this paper the acceptance modified chain sampling plan is developed, when the fraction defective (p) is a fuzzy number. It is found that the operating characteristic (oc) curves of the plan is a band having upper and lower bounds when the proportion of defective is s fuzzy number. The operating characteristic curve of the plan is derived using fuzzy probability.

1. INTRODUCTION

Tn acceptance sampling plans, a lot is accepted or rejected when the proportion defective is a crisp value. In cases if the proportion of defectives are not known accurately, fuzzy parameter is taken into account and the sampling plans are derived. The lot under consideration is of very expensive or destructive, modified chain sampling plan is used. The operating characteristic curve of the plan is a band having a upper and lower bounds, as the proportion of defective is a fuzzy number.

[1]*corresponding author*

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Key words and phrases. Modified chain sampling, FOC, Fuzzy probability.

2. PRELIMINARIES

Dodge H.P [1] has presented Chain Sampling Inspection Plans. Govindaraju and Lai have created modified chain sampling plans for costly or destructive items. Devaarul and Edna [2] have contributed mixed sampling product control for expensive or destructive items. Buckley, J.J [3] has done Fuzzy Probability and Statistics. Chakraborty, T.K [4] has designed a class of single sampling plans based on fuzzy optimization and possiblistic parameter single sampling inspection plans. Clark [5] has contributed OC curve for Chsp-1 chain sampling plans. Hryniewisz [6] has introduced statistics with fuzzy data in statistical quality control. Tamaki, Kanagawa and Ohta [7] have given a fuzzy design of sampling inspection plans by attributes.

3. FUZZY MODIFIED CHAIN SAMPLING PLAN

In order to inspect a costly or destructive quality lot of large size N, when the fraction defective is a fuzzy number $\hat{\hat{p}}$, the modified chain sampling plan with parameters n, the sample size, i the number of lots to be chained is defined as:

From the selected lot, draw a random sample of size n. (i) The lot is accepted if the present sample and the previous i samples contain zero defective units. (ii). the present sample contains zero defective units, while any one of the i previous samples contain only one defective unit and the remaining $(i-1)$ samples have zero defective units. (iii) Otherwise reject the lot. The fuzzy probability of acceptance, with alpha cut of the fuzzy number $\hat{p}$ as $[A]$, is

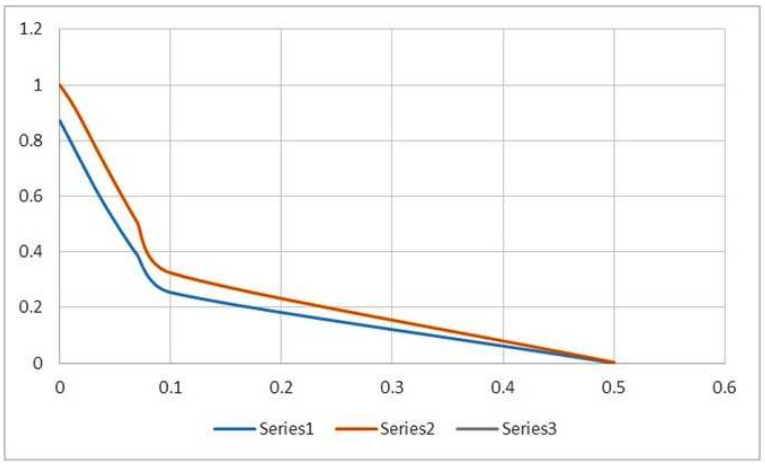
$$\begin{aligned}
\tilde{P}[A] &= \{P_0(P_0^i + iP_1^{i-1}/A\} \\
&= [P^l[A], P^u[A] \\
P^l[A] &= \min\{P_0(P_0^i + iP_0^{i-1}P_1/A\} \\
P^u[A] &= \max\{P_0(P_0^i + iP_0^{i-1}P_1/A\} \\
\tilde{P}_a &= \{e^{-np(i+1)}(1+inp)/p \in \tilde{P}[A]\}\,.
\end{aligned}$$

4. Fuzzy Operating Characteristic Band (FOC)

FOC band is obtained by using the above probability of acceptance of the fuzzy modified chain sampling plan. For $n = 5, i = 3$, and $\hat{p} = (k, 0.02 + k)$, the fuzzy probability of acceptance is calculated and given below:

k	$\tilde{P}_k[0]$	$\tilde{P} = \{e^{-20(0.02+k)}(1.3+15k), e^{-20k}(1+15k)\}$, $i = 3$ and $n = 5$	$\tilde{P} = \{e^{-20(0.02+k)}(1.3+15k), e^{-20k}(1+15k)\}$, $i = 3$ and $n = 10$
0	[0,0.02]	[0.8175,1]	[0.7189,1]
0.01	[0.01,0.03]	[0.7957,0.9415]	[0.5723,0.8714]
0.02	[0.02,0.04]	0.7189,0.8715]	[0.4441,0.7189]
0.04	[0.04,0.06]	[0.5723,0.7189]	[0.2540,0.4441]
0.07	[0.07,0.09]	[0.3885,0.5055]	[0.1011,0.1885]
0.1	[0.1,0.12]	[0.2540,0.4123]	[0.0379,0.07326]
0.5	[0.5,0.52]	[0.000267,0.002342]	[0.00153,0.00000003]

Fig 1: FOC band - Modified Chain Sampling Plan $(n = 5, i = 3)$



5. Conclusion

By using fuzzy probability theory, a modified chain sampling plan with fuzzy parameter is designed for very expensive or destructive lots. The probability of acceptance with fuzzy parameter is derived. When the fraction defective is not actually known, FOC is a band with upper and lower bounds.

REFERENCES

[1] H. F. DODGE: *Chain Sampling Inspection Plan*, Industrial Quality Control, **11**(4) (1955), 10–13.

[2] S. DEVA ARUL, K. REBECCA JEBASEELI EDNA: *Mixed Sampling Product Control for Costly or Destructive Items*, Journal of Mathematical Sciences and Computer Applications, **1**(3) (2011), 85–94,

[3] J. J. BUCKLEY: *Fuzzy probability and statistics*, Springer-Verlag, Berlin Heidelberg, 2006.

[4] T. K. CHAKRABORTY: *A class of single sampling plans based on fuzzy optimization*, Opsearch, **29**(1) (1992), 11–20.

[5] C. R. CLARK: *OC Curves for Chsp-1, Chain sampling plans*, Industrial Quality Control, **17**(4) (1955), 10–12.

[6] HRYNIEWISZ: *Statistics with fuzzy data in statistical quality control*, SoftComput. **12**(2008), 229–234.

[7] TAMAKI, KANAGAWA, OHTA: *Fuzzy design of sampling inspection plans by attributes*, Jpn. Jyst., **3** (1999), 315–327.

DEPARTMENT OF MATHEMATICS
KARUNYA INSTITUTE OF TECHNOLOGY AND SCIENCES
COIMBATORE-641114, TAMIL NADU, INDIA
E-mail address: edna@karunya.edu

DEPARTMENT OF MATHEMATICS
KARUNYA INSTITUTE OF TECHNOLOGY AND SCIENCES
COIMBATORE-641114, TAMIL NADU, INDIA
E-mail address: jemmy@karunya.edu