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FUZZY SAMPLING PLAN USING ZTPD

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ABSTRACT. In quality control of products, sometimes lots with one defective unit are rejected. But such lots with one defective unit, termed as inferior quality are also sometimes useful. In this paper, Acceptance Single sampling for such lots when the proportion of defective item is fuzzy number is developed using zero truncated Poisson distribution. The operating characteristic curve of the plan is derived using fuzzy probability.

1. INTRODUCTION

Acceptance sampling plans were constructed with proportion of defective that is a crisp value. In the practical applications, sometimes the proportion of defectives may not be known accurately, hence fuzzy parameter is taken into account and the sampling plans are derived based on zero truncated Poisson distribution. The lot under consideration is of inferior quality and hence ZTPD is used in the sampling plan. 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.

2. PRELIMINARIES

Radhakrishnan and Sekkizhasr (2007, [1]) investigated Attribute sampling plans by using ZTPD. Devaarul and Jemmy Joyce (2010, [2]) have studied

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Mixed sampling plans for second quality lots. Ezzatallah Baloui Jamkhaneh, Bahram Sadeghpour Gildeh, Gholamhossein Yari (2009, [3]) have studied Acceptance single sampling plan with fuzzy parameter with Poisson Distribution. Ezzatallah Baloui Jamkhaneh and Bahram Sadeghpour Gilde (2012, [4,5]) have studied Acceptance Double Sampling plan using fuzzy Poisson Distribution.

3. Acceptance fuzzy Single Sampling plan using ZTPD

In order to inspect a inferior quality lot of large size N when the proportion of defective items is a fuzzy number $\hat{p}$, the parameters are n, the sample size, c the acceptance number and d the number of defectives in the sample. If the number of defective units is less than or equal to acceptance number, then the lot is accepted otherwise it is rejected. The number of defectives follows fuzzy zero truncated poisson distribution with parameter $\hat{\lambda} = n\hat{p}$ and hence the fuzzy probability mass function is derived below, with alpha cut of the fuzzy number $\hat{p}$ as $[A]$,

$$\hat{P}(x)[A] = \{\frac{e^{-\lambda}\lambda^x}{x!(1-e^{-\lambda})}/\lambda \in \tilde{\lambda}[A]\}, \quad x = 1, 2, ...$$

The fuzzy probability of number of defective units in the sample is

$$\hat{P}[A] = [P^1[A], P^u[A]]$$

The fuzzy probability of acceptance of the sampling plan is

$$\hat{P}_a = \{\sum_{x=1}^{c} \frac{e^{-\lambda}\lambda^x}{x!(1-e^{-\lambda})}/\lambda \in \tilde{\lambda}[A]\}$$

$$P^1[A] = \min\{\sum_{x=1}^{c} \frac{e^{-\lambda}\lambda^x}{x!(1-e^{-\lambda})}/\lambda \in \tilde{\lambda}[A]\}$$

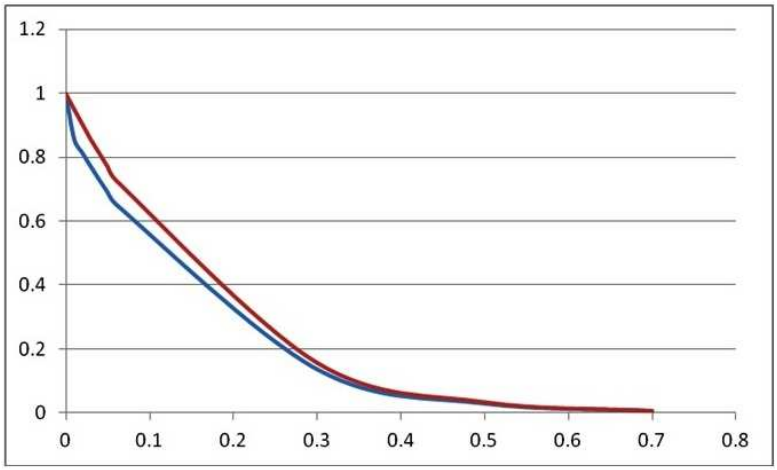
$$P^u[A] = \max\{\sum_{x=1}^{c} \frac{e^{-\lambda}\lambda^x}{x!(1-e^{-\lambda})}/\lambda \in \tilde{\lambda}[A]\}.$$

4. Fuzzy Operating Characteristic Band

Fuzzy OC band is obtained by using the above fuzzy probability of acceptance of the sampling plan using ZTPD. For $n = 10, c = 1,$ and $\hat{p} = (k, 0.02 + k)$, the fuzzy probability of acceptance is calculated and given below:

k	$\hat{p}$	$\hat{P}_a$
0.01	[0.01,0.03]	[0.85748,0.9508]
0.02	[0.02,0.04]	[0.81329,0.9033]
0.03	[0.03,0.05]	[0.77075,0.8557]
0.04	[0.04,0.06]	[0.72982,0.81329]
0.05	[0.05,0.07]	[0.6905,0.77075]
0.06	[0.06,0.08]	[0.6528,0.7282]
0.3	[0.3,0.32]	[0.13598,0.15719]
0.5	[0.5,0.52]	[0.02885,0.03392]
0.7	[0.7,0.72]	[0.0054,0.0064]
0.8	[0.8,0.82]	[0.00228,0.00253]

Graph of FOC band:



5. Conclusion

Fuzzy single sampling plan for inferior quality lots is designed in this paper using zero truncated Poisson distribution, the fuzzy probability of acceptance is derived. The graph of FOC band is given for the above example. When the

proportion of defective is not accurately known, the probability of acceptance gives a band with upper and lower bounds using fuzzy probability.

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