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Designing double inspection sampling plan based on acceptance numbers

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Abstract
This present work describes to Design of Double Inspection Sampling Plan for costly and mass productive items based on acceptance numbers using bivariate poisson model with reference to single sampling plan. Tables are constructed for readymade selection of sample size.

Keywords: DISP, OC, AOQ and ATI

Introduction
Every industries consists of defectives during the manufacturing due to various reasons. In this situation Acceptance Sampling helps the producer to get decision about the lot with help of sampling plans. Each sampling plan has some unique structure and methodology, some plans reduce the producer risk, some plans reduce the consumer risk some time favour for both. In costliest and mass production the inspectors are strict the inspection procedures for deliver the best and defect free product to the customer. Senthilkumar and Sabarish (2020) [12] have developed the Construction and Selection of Double Inspection Single Sampling Plan [DISSP (0,1)]. This plan helps the producer to improve the quality of the product because we inspecting two quality characteristics for a single sample and also it reduce the sample size. Double Inspection Single Sampling Plan provides minimum of sample size with maximum of acceptance. Senthilkumar and Sabarish (2021) [10, 11] have developed Selection and Development of Double Inspection Single Sampling Plan. Senthilkumar and Sabarish (2021) [10, 11] have developed Economic Design of Double Inspection Single Sampling Plan. This present research work provides the tables for easy selection of sample size based on various combinations of acceptance numbers like $c_2=c_1+1$ and $c_1=c_2$.

Basic Assumptions
- First inspection does not depend on second inspection and vice versa.
- Occurrences of defectives in first inspection and defectives in second inspection are homogenous
- Once the inspection starts continue the inspection process until either accept the lot or reject the lot.

Algorithms
- Operating Characteristics Function Double Inspection Sampling Plan = $(P_{a1}(p))\ (P_{a2}(p))$
- Average Outgoing Quality = $p[P_a(p)]$
- Average Total Inspection = $n + (1-P_a\,p)\ (N-n)$

Illustration
A pencil manufacturing company produce a pencil with eraser, In first inspection the inspector check carbon of the pencil, second inspector check the eraser of the same pencil this two quality characteristics are independent.

Operating Characteristic Curves
Figure 1 shows the Operating Characteristic curves Double inspection single sampling plan for $c_2=c_1+1$ ($n=79$, $c_1=2$ and $c_2=3$).

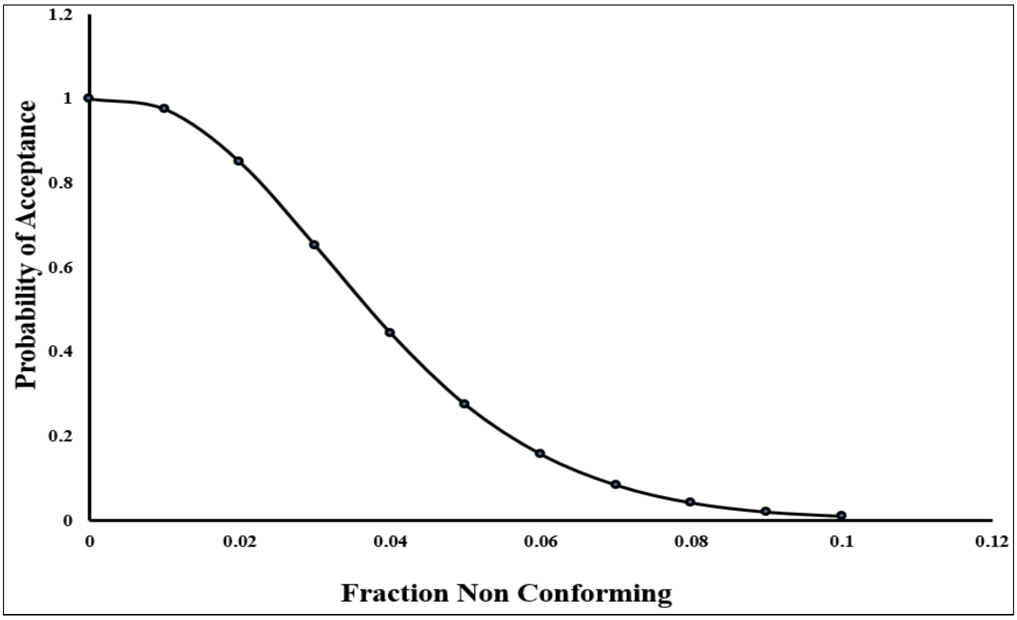

Fig 1: Operating Characteristic curve for $c_2 = c_1+1$

Figure 2 shows the Operating Characteristic curves Double inspection single sampling plan for $c_1=c_2$ (n= 79, c_1= 4 and c_2=4).

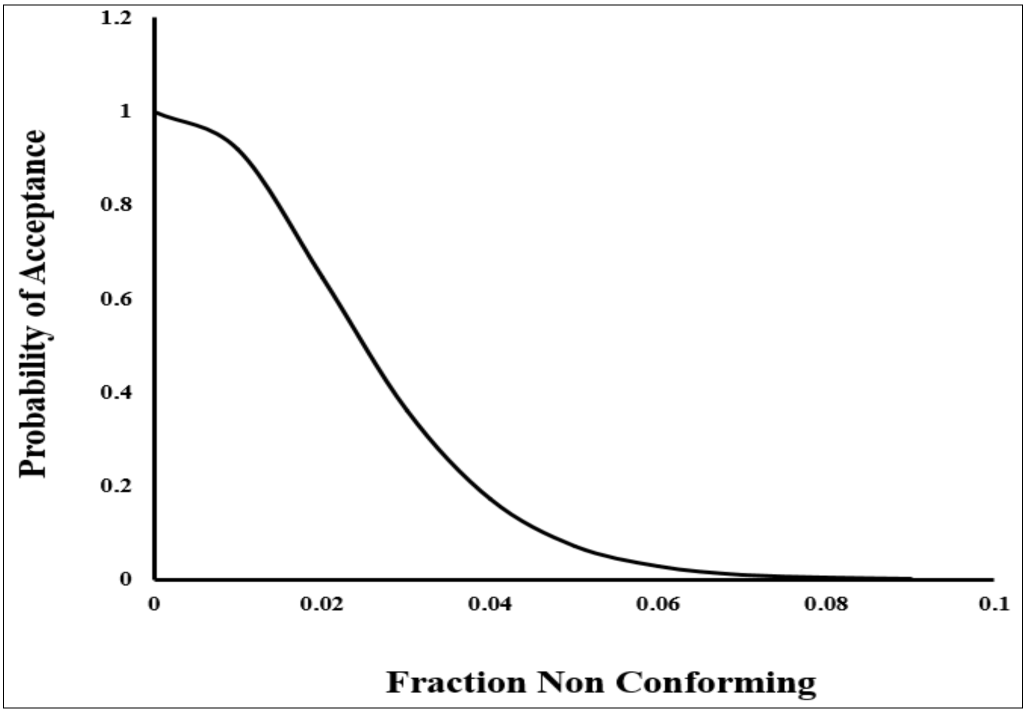

Fig 2: Operating Characteristic curve for $c_1=c_2$

Description of Tables

Table 1 & Table 2 shows the values of sample sizes based on different combinations of acceptance numbers like, $c_2 = c_1+1$ and $c_1=c_2$. Based on the plan parameters c_1, c_2 and P_a (p).

Conclusion

Acceptance numbers are playing important role in quality inspection. In this present research work provides the sample size for the different combinations of acceptance numbers like, $c_2 = c_1+1$, and $c_1=c_2$. In highly competitive and technologically advanced environment, the procedures are implementing the double inspection sampling plan initiatives in their organization to improve the quality of the product / service / system and the consumers also expecting high quality with maximum satisfaction which results in less or nil defects. The proposed Double Inspection Sampling Plan is applicable for, when there is a possibility of producing expensive products (or) mass production like, Foods manufacturing industries, Smart Gadgets, Shoe productions industries, Gold ornament and so on.

Table 1: Entries of values 'n' they are indexed by the parameters of $c_2 = c_1+1$ by Pa (p).

p	Pap	c_1	0	1	2	3	4
		c_2	1	2	3	4	5
0.001	0.99		15	106	409	789	1192
	0.95		50	478	765	1274	1836
	0.90		100	491	1029	1595	2229
0.002	0.99		7	72	210	395	611
	0.95		25	168	381	637	918
	0.90		50	245	504	798	1114
0.003	0.99		5	48	140	263	407
	0.95		18	113	255	424	612
	0.90		35	165	336	532	743
0.004	0.99		3	36	104	197	305
	0.95		12	84	191	318	450
	0.90		25	123	252	399	557
0.005	0.99		3	29	84	158	243
	0.95		12	67	153	254	367
	0.90		20	98	201	319	445
0.006	0.99		3	24	70	131	204
	0.95		12	56	114	212	306
	0.90		17	81	168	266	371
0.007	0.99		2	20	60	112	174
	0.95		11	48	109	185	262
	0.90		15	70	144	228	318
0.008	0.99		2	18	51	98	153
	0.95		11	42	95	159	229
	0.90		13	60	126	199	278
0.009	0.99		1	16	46	83	136
	0.95		1 1	37	85	141	204
	0.90		11	54	112	177	247
0.01	0.99		1	14	42	77	121
	0.95		10	33	79	127	183
	0.90		10	49	100	159	223

Table 2: Entries of values 'n' they are indexed by the parameters of $c_1 = c_2$ by Pa (p).$c_1 = c_2$

p	Pa(p)	1	2	3	4	5
0.001	0.99	103	338	672	1078	1537
	0.95	243	621	1094	1629	2208
	0.90	360	826	1378	1985	2630
0.002	0.99	51	169	336	539	768
	0.95	121	310	547	814	1104
	0.90	180	413	689	992	1315
0.003	0.99	34	112	224	359	512
	0.95	81	207	364	543	736
	0.90	120	275	459	661	876
0.004	0.99	25	84	168	269	384
	0.95	60	155	273	407	552
	0.90	90	206	344	496	657
0.005	0.99	20	67	134	216	307
	0.95	49	124	219	325	441
	0.90	72	165	276	397	526
0.006	0.99	17	56	112	179	256
	0.95	41	103	182	271	368
	0.90	60	137	229	330	438
0.007	0.99	14	48	96	154	217
	0.95	35	89	156	232	315
	0.90	51	118	196	283	375
0.008	0.99	13	42	84	134	192
	0.95	31	78	136	203	276
	0.90	45	103	172	284	328
0.009	0.99	11	37	74	119	170
	0.95	27	69	121	181	245
	0.90	40	91	153	220	292
0.01	0.99	10	33	67	107	153
	0.95	25	62	109	163	220

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