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Construction of acceptance sampling plans for the ranked set sampling using: Laplace distribution

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Abstract
In this paper, a new Single Sampling Plan in light of ranked data scheme is proposed. Two main prerequisites are considered for the new plan: The lifetime of the test units is assumed to follow the Logistic distribution, and the data are selected by using the ranked set sampling scheme from a large lot. The distribution function characterization under the ranked set sampling scheme is derived assuming that the set size is known; the minimum number of set cycle and consequently the minimum sample size necessary to ensure the operating characteristic values of the ranked sampling plans as well as the producer's risk are presented. An examples based on the results obtained are given.

Keywords: Ranked set sampling, acceptance sampling plans, laplace distribution, operating characteristic function value, average sample number, average total inspection, average outgoing quality limit, producer's risk and consumer's risk

Introduction

Sampling for Ranked Set (RSS) was suggested by McIntyre (1952) [9]. In the first stage, m independent Simple Random Sample (SRS) each of size m are drawn from a given lot, and then a free cost ranking mechanism is employed to rank the units within each SRS. In the second stage, the items selected systematically; such that the item with the first rank is selected from the first SRS, and then in the second SRS the item with rank two is selected and so on till the unit with the maximum rank is selected from the last SRS (Takahasi and Wakimoto, 1968 [10]; Sinha *et al.*, 1996 [11], Chen *et al.*, 2004) [2].

RSS can be used in many medical, agricultural and economical fields. Several advantage of using ranked data schemes can be obtained over the SRS, the most important is that the fisher information based on RSS is more than the Fisher information based on SRS. The main aim of this article is to use the RSS in acceptance sampling research area rather than improving the RSS scheme. Mainly, an interesting ranked data sampling schemes proposed by Muttlak (1997) [13] and known by the ranked set sampling (RSS) will be considered and used in this article. The advantages of RSS are the ability of increasing the efficiency of the estimator.

The steps of choosing RSS are as follows

- Select 'm' units at random from a specified population.
- Rank these 'm' units by judgment without actual measurement.
- Keep the smallest judgment unit from the ranked set.
- Select second set of 'm' units at random from a specified population, rank these units without measuring them and keep the second smallest judgment unit.
- Continue the process until 'm' ranked units are measured (n=m*r).

The first five steps are referred to as a cycle. Then, the cycle repeats r times and a ranked set sample of size n=m*r is obtained. Now, let $X_{11}, X_{12}, \dots, X_{1m}; X_{21}, X_{22}, \dots, X_{2m}; \dots; X_{m1}, X_{m2}, \dots, X_{mm}$ be m independent SRS each of size m; then among the m samples we select the minimum measurement unit from the first SRS and the second minimum unit from the second SRS, continuing in the same process until we select the maximum measurement unit from the last SRS for actual measurement. Consequently, and based aggregately at the RSS steps: the element of the favored RSS pattern will be inside the shape:

$\{X_{[m,r]ij}$; i= 1,2,...m, j=1,2,....,r} m is odd
$\{X_{[m;r]ij}, X_{[m,r]kj}$; i=1,2,...,m/2; k=m/2+1,....m, j= 1,2,...r} m is even
Where $[m,r]_{ij}$ is the $(m,r)^{th}$ judgment order statistics of the i^{th} random sample of size m in the j^{th} cycle. It should be noted that all of $[m,r]_{ij}$'s are mutually independent and identically distributed. Now, based on RSS scheme the distribution function will be:

$$f_{RSS}(x) = \frac{1}{rm}\sum_{j=1}^{r}\prod_{i=1}^{m} f_{x(m)}(x)$$

David and Nagaraja (2003), showed that the i^{th} order statistic is given by:

$$f_{X(i)}\frac{mr!}{(i-1)!(n-i)!}(F(x))^{i-1}(1-F(x))^{n-i} \quad (1)$$

Therefore, the Ranked Set Sampling is given by

$$f_{RSS(x)=}\frac{(mr)!}{(i-1!)(n-i!)}(F(x))^{i-1}(1-F(x))^{n-i} \quad (2)$$

The procedure of Sampling Plan for Acceptance (ASP) in light of SRS comprises of the resulting steps:
Step 1: Draw SRS of sample size n groups from a lot of size N.
Step 2: detect every groups within the choose sample as good one or non-good one groups.
Step 3: If the number of non- good one groups exceeds the acceptance number(c), then the entire lot is rejected: otherwise, it is accepted.

Therefore, in constructing any sampling plan for acceptance we need to find out the minimum sample size (n) to accept a lot and the acceptance number (c), accordingly we may call the single sampling plans for acceptance by ASP(n, c) the problem is to find the unknown parameters n and c that satisfies:

$$P\,(X\leq C/N,\ p_1) = 1-\alpha$$

$$P\,(X\leq c/n,\ p_{2)} = \beta \quad (3)$$

Where α is the Type I error; the probability a good lot is rejected (producer's risk) and β is the Type II error (consumer's risk) which is the probability that a bad lot is accepted. Moreover, p_1 is the Quality Limit for Acceptance (AQL) and p_2 is the Percent Defective for Lot Tolerance (LTPD). Moreover, a lifetime distribution for the quality characteristic is assumed by Laplace distribution; to obtain Quality Limit for Acceptance (AQL) and Percent Defective for Lot Tolerance (LTPD); then based on the given distribution the minimum sample size (n) is chosen. The main idea of using RSS in acceptance sampling context is to decrease the producer risk that rises when the items selected by the typical Sampling Plan for Acceptance (n, c) based on a SRS techniques.

Characterization of the Laplace Distribution under RSS:
The Laplace distribution has been utilized viably to investigate lifetime records. It manages the cost of a higher suit than the Rayleigh or Exponential distributions. The appropriations could be described fundamentally dependent on the RSS.
Characterization of the Laplace Distribution for SRS:

$$f(x, \mu, b) = \frac{1}{2b}\left(exp\frac{-|x-\mu|}{b}\right) \quad (4)$$

Characterization of the Laplace distribution for RSS:

$$f_{RSS}(x)=\frac{1}{2b}\frac{(mr)!}{(m!)^2}\left(exp\frac{-|x-\mu|}{b}\right)^m\left(1-exp\frac{-|x-\mu|}{b}\right)^m \quad (5)$$

Operating Characteristic (OC) Curve
Related with each examining plan there is an OC curve which portrays the display of the testing plan against perfect and inferior quality. The probability that a great deal will be recognized under a given inspecting plan which is shown by Pa(p) and a plot of Pa(p) against given worth of part or interaction quality p will yield the OC bend. For interesting explanation plans the OC curve is a curve showing the probability of continuing to permit the collaboration to happen without change as an element of the interaction quality.
The curve plots the probability of accepting the lot (Pa) versus the lot fraction defective (p)

$$Pa = P\,\{d\leq c\} = \sum_{i=0}^{c}\frac{(mr)!}{(i-1)!(n-i)!}\,p^i 1-p^{n-i} \quad (6)$$

Laplace distribution for RSS will be

$$Pa=\sum_{d=0}^{c}\left(\frac{n!}{m!(n-m)!}\right)\frac{1}{2b}\frac{(mr)!}{(m!)}\left(exp\frac{-|x-\mu|}{b}\right)^{m}\left(1-exp\frac{-|x-\mu|}{b}\right)^{(n-m)} \quad (7)$$

The given table shows the OC curve values for RSS using Laplace distribution for N=1000, m = 50, s= 20, r= 1, 2, 3, 4, 5, 6 and n= 50, 100, 150, 200, 250 and 300.

Table 1: The OC Curve Values for Laplace Distribution using RSS

N	1M	2M	3M	4M	5M	6M
P	**C = 0**					
0.010	0.993848	0.987734	0.981658	0.975619	0.969617	0.963652
0.015	0.989877	0.979857	0.969938	0.960119	0.9504	0.940779
0.020	0.983364	0.967005	0.950918	0.935098	0.919542	0.904244
0.025	0.972717	0.946179	0.920364	0.895254	0.870829	0.847071
0.030	0.95541	0.912808	0.872106	0.833218	0.796065	0.760568
0.035	0.927531	0.860315	0.797969	0.740141	0.686504	0.636754
0.040	0.883299	0.780217	0.689165	0.608739	0.537698	0.474949
0.045	0.814845	0.663973	0.541035	0.44086	0.359232	0.292719
0.050	0.713169	0.508609	0.362724	0.258684	0.184485	0.131569
0.055	0.572033	0.327222	0.187182	0.107074	0.06125	0.035037
P	**C = 1**					
0.010	0.993971	0.987856	0.981779	0.975739	0.969736	0.963771
0.015	0.990079	0.980056	0.970135	0.960315	0.950593	0.940971
0.020	0.983694	0.967329	0.951237	0.935412	0.91985	0.904548
0.025	0.973256	0.946702	0.920874	0.89575	0.871311	0.847539
0.030	0.956282	0.913641	0.872902	0.833979	0.796792	0.761262
0.035	0.928928	0.86161	0.79917	0.741256	0.687538	0.637713
0.040	0.885494	0.782156	0.690878	0.610252	0.539035	0.476129
0.045	0.818189	0.666697	0.543255	0.442669	0.360706	0.29392
0.050	0.718006	0.51206	0.365185	0.260438	0.185736	0.132461
0.055	0.578459	0.330898	0.189285	0.108277	0.061938	0.035431
P	**C = 2**					
0.010	0.994093	0.987978	0.981658	0.97586	0.969856	0.96389
0.015	0.99028	0.980256	0.970333	0.96051	0.950787	0.941162
0.020	0.984024	0.967654	0.951556	0.935726	0.920159	0.904851
0.025	0.973794	0.947226	0.921383	0.896245	0.871793	0.848008
0.030	0.957155	0.914475	0.873698	0.83474	0.797519	0.761957
0.035	0.930327	0.862907	0.800374	0.742372	0.688573	0.638673
0.040	0.887694	0.7841	0.692594	0.611768	0.540374	0.477312
0.045	0.821546	0.669433	0.545484	0.444485	0.362187	0.295126
0.050	0.722877	0.515533	0.367662	0.262205	0.186996	0.13336
0.055	0.584958	0.334615	0.191411	0.109493	0.062634	0.035829

Table 1 continu…

N	1M	2M	3M	4M	5M	6M
P	**C = 3**					
0.010	0.994216	0.9881	0.982021	0.97598	0.969976	0.964009
0.015	0.990482	0.980455	0.97053	0.960706	0.95098	0.941354
0.020	0.984354	0.967979	0.951875	0.93604	0.920468	0.905155
0.025	0.974333	0.94775	0.921893	0.896741	0.872276	0.848478
0.030	0.958028	0.91531	0.874496	0.835502	0.798247	0.762653
0.035	0.931728	0.864207	0.801579	0.74349	0.68961	0.639635
0.040	0.8899	0.786048	0.694315	0.613288	0.541717	0.478498
0.045	0.824918	0.67218	0.547723	0.446309	0.363673	0.296337
0.050	0.727781	0.51903	0.370156	0.263984	0.188265	0.134265
0.055	0.591529	0.338374	0.193561	0.110724	0.063338	0.036231
P	**C = 4**					
0.010	0.994339	0.988222	0.982142	0.9761	0.970096	0.964128
0.015	0.990683	0.980655	0.970728	0.960901	0.951174	0.941545
0.020	0.984685	0.968303	0.952195	0.936354	0.920777	0.905459
0.025	0.974872	0.948275	0.922403	0.897238	0.872758	0.848947
0.030	0.958903	0.916145	0.875294	0.836264	0.798975	0.763349
0.035	0.93313	0.865508	0.802786	0.744609	0.690648	0.640598
0.040	0.892112	0.788001	0.696041	0.614812	0.543063	0.479687
0.045	0.828303	0.674938	0.54997	0.448141	0.365165	0.297553

0.050	0.732718	0.522551	0.372667	0.265775	0.189542	0.135175
0.055	0.598174	0.342175	0.195736	0.111967	0.064049	0.036638
P	**C = 5**					
0.010	0.994462	0.988344	0.982264	0.976221	0.970215	0.964247
0.015	0.990885	0.980854	0.970925	0.961097	0.951368	0.941737
0.020	0.985015	0.968628	0.952514	0.936668	0.921086	0.905763
0.025	0.975412	0.9488	0.922914	0.897734	0.873241	0.849417
0.030	0.959778	0.916981	0.876093	0.837028	0.799704	0.764046
0.035	0.934535	0.866811	0.803995	0.74573	0.691688	0.641563
0.040	0.894328	0.789959	0.69777	0.61634	0.544412	0.480879
0.045	0.831702	0.677708	0.552227	0.449979	0.366664	0.298774
0.050	0.737688	0.526096	0.375195	0.267577	0.190828	0.136092
0.055	0.604894	0.346019	0.197935	0.113225	0.064769	0.03705
P	**C = 6**					
0.010	0.994584	0.988466	0.982385	0.976341	0.970335	0.964366
0.015	0.991086	0.981054	0.971123	0.961292	0.951561	0.941929
0.020	0.985346	0.968953	0.952834	0.936983	0.921395	0.906067
0.025	0.975951	0.949325	0.923425	0.898231	0.873725	0.849887
0.030	0.960654	0.917818	0.876892	0.837792	0.800434	0.764743
0.035	0.935943	0.868116	0.805205	0.746853	0.69273	0.642529
0.040	0.896551	0.791922	0.699504	0.617871	0.545765	0.482074
0.045	0.835115	0.680489	0.554493	0.451826	0.368168	0.3
0.050	0.742693	0.529665	0.37774	0.269393	0.192122	0.137016
0.055	0.611689	0.349907	0.200158	0.114497	0.065496	0.037466

The following figure 1 shows the OC curve for the acceptance number c=0, s=20, m=50, r= 1, 2, 3, 4, 5, 6 and sample size n=50, 100, 150, 200, 250 and 300.

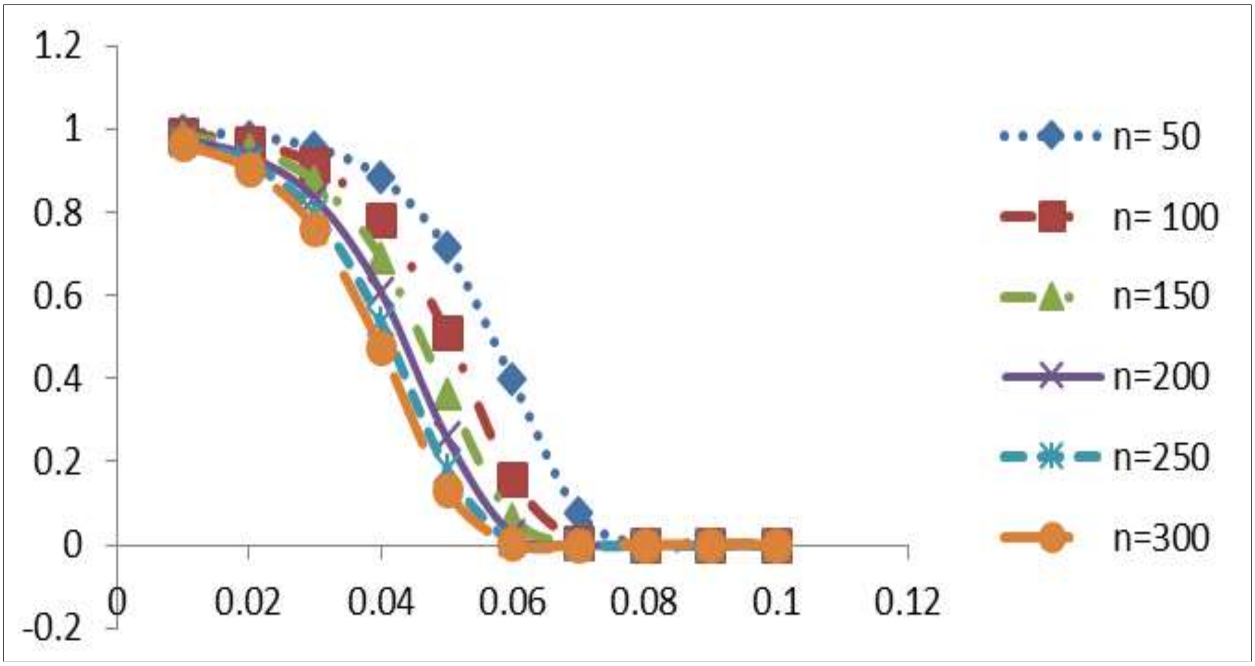

Fig 1: OC Curve for Laplace Distribution using RSS

It shows the impact of expanded sample size on OC curve. We note that each plan utilizes a similar percent deficient which can be considered an acknowledgment lot, the OC curve becomes more extreme and lies nearer to the beginning as the sample size increments.

Average Sample Number (ASN)

The Average Sample Number (ASN) is described as the typical (expected) number of test units per part, as most would consider to be normal to appear at a decision about the affirmation or excusal of the parcel under the affirmation examining plan. The curve drawn between the ASN and the lot quality (p) is known as the ASN curve.

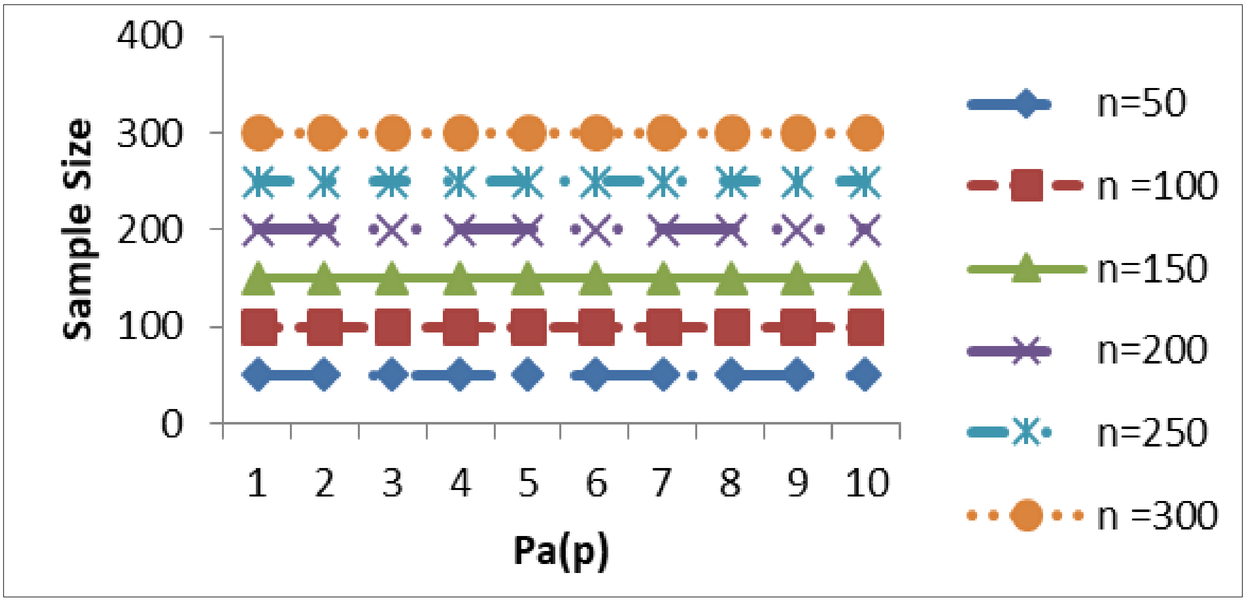

Fig 2: ASN Curve for Laplace Distribution using RSS

In this research, ASN values (n= 50, 100, 150, 200, 250 and 300) of single sampling plan under Laplace distribution are same.

Average Outgoing Quality (AOQ)

A typical strategy, while sampling and testing is non-disastrous, is to 100 percent review dismissed lots and supplants all defectives with great units. For this situation, all dismissed lots are made awesome and the main deformities left are those in lots that were accepted. AOQ's allude to the drawn out imperfection level for this consolidated LASP (lot acceptance sampling plan) and 100 percent examination of dismissed lots process. In the event that all parts come in with a deformity level of precisely p, and the OC curve for the picked (n, c) LASP demonstrates a probability Pa of tolerating such a lot, for a really long time the AOQ can undoubtedly be demonstrated to be:

AOQ = $\frac{Pa(p)(N-n)}{N}$ (8) Where N is the lot size have given expressions for AOQ to different policies adopted for single sampling attribute plans. In this research, AOQ is approximated as p * Pa (p).

The given table shows the AOQ values for RSS using Logistic distribution for N=1000, m= 50, s=20, r= 1, 2, 3, 4, 5, 6 and n=50, 100, 150, 200, 250 and 300.

Table 2: The AOQ Values for Laplace Distribution using RSS

N	1M	2M	3M	4M	5M	6M
P			**C = 0**			
0.010	0.944156	0.888961	0.834409	0.780495	0.727213	0.674556
0.015	0.940383	0.881871	0.824447	0.768095	0.7128	0.658545
0.020	0.934196	0.870304	0.80828	0.748079	0.689656	0.632971
0.025	0.924081	0.851561	0.78231	0.716203	0.653122	0.592949
0.030	0.907639	0.821527	0.74129	0.666575	0.597049	0.532398
0.035	0.881155	0.774283	0.678274	0.592113	0.514878	0.445728
0.040	0.839134	0.702195	0.58579	0.486991	0.403274	0.332464
0.045	0.774103	0.597575	0.45988	0.352688	0.269424	0.204903
0.050	0.67751	0.457748	0.308316	0.206947	0.138364	0.092098
0.055	0.543432	0.2945	0.159105	0.085659	0.045938	0.024526
P			**C = 1**			
0.010	0.944272	0.88907	0.834512	0.780591	0.727302	0.67464
0.015	0.940575	0.882051	0.824615	0.768252	0.712945	0.65868
0.020	0.934509	0.870596	0.808551	0.74833	0.689888	0.633183
0.025	0.924593	0.852032	0.782743	0.7166	0.653483	0.593278
0.030	0.908468	0.822277	0.741966	0.667183	0.597594	0.532884
0.035	0.882482	0.775449	0.679295	0.593005	0.515654	0.446399
0.040	0.841219	0.70394	0.587246	0.488201	0.404276	0.33329
0.045	0.777279	0.600027	0.461767	0.354135	0.27053	0.205744
0.050	0.682106	0.460854	0.310407	0.208351	0.139302	0.092723
0.055	0.549536	0.297808	0.160892	0.086622	0.046454	0.024801
P			**C = 2**			
0.010	0.944389	0.88918	0.834409	0.780688	0.727392	0.674723
0.015	0.940766	0.88223	0.824783	0.768408	0.71309	0.658814
0.020	0.934823	0.870888	0.808823	0.748581	0.690119	0.633396

0.025	0.925104	0.852504	0.783176	0.716996	0.653845	0.593606
0.030	0.909297	0.823027	0.742644	0.667792	0.598139	0.53337
0.035	0.88381	0.776617	0.680318	0.593898	0.51643	0.447071
0.040	0.84331	0.70569	0.588705	0.489414	0.405281	0.334118
0.045	0.780469	0.60249	0.463662	0.355588	0.27164	0.206588
0.050	0.686733	0.46398	0.312513	0.209764	0.140247	0.093352
0.055	0.55571	0.301154	0.162699	0.087595	0.046975	0.02508

Table 2 continu…

N	1M	2M	3M	4M	5M	6M
P	**C = 3**					
0.010	0.944505	0.88929	0.834718	0.780784	0.727482	0.674806
0.015	0.940958	0.88241	0.824951	0.768564	0.713235	0.658948
0.020	0.935137	0.871181	0.809094	0.748832	0.690351	0.633608
0.025	0.925616	0.852975	0.783609	0.717393	0.654207	0.593934
0.030	0.910127	0.823779	0.743321	0.668401	0.598685	0.533857
0.035	0.885141	0.777786	0.681342	0.594792	0.517208	0.447745
0.040	0.845405	0.707443	0.590168	0.490631	0.406288	0.334949
0.045	0.783672	0.604962	0.465564	0.357047	0.272755	0.207436
0.050	0.691392	0.467127	0.314633	0.211187	0.141199	0.093985
0.055	0.561953	0.304537	0.164527	0.088579	0.047503	0.025362
P	**C = 4**					
0.010	0.944622	0.8894	0.834821	0.78088	0.727572	0.674889
0.015	0.941149	0.882589	0.825118	0.768721	0.71338	0.659082
0.020	0.93545	0.871473	0.809365	0.749083	0.690583	0.633821
0.025	0.926129	0.853447	0.784043	0.71779	0.654569	0.594263
0.030	0.910958	0.824531	0.744	0.669012	0.599231	0.534344
0.035	0.886474	0.778957	0.682368	0.595687	0.517986	0.448419
0.040	0.847506	0.709201	0.591635	0.49185	0.407297	0.335781
0.045	0.786888	0.607445	0.467475	0.358512	0.273874	0.208287
0.050	0.696082	0.470296	0.316767	0.21262	0.142157	0.094623
0.055	0.568265	0.307958	0.166375	0.089574	0.048037	0.025647
P	**C =5**					
0.010	0.944739	0.889509	0.834924	0.780977	0.727661	0.674973
0.015	0.941341	0.882769	0.825286	0.768877	0.713526	0.659216
0.020	0.935764	0.871766	0.809637	0.749335	0.690814	0.634034
0.025	0.926641	0.85392	0.784477	0.718187	0.654931	0.594592
0.030	0.911789	0.825283	0.744679	0.669622	0.599778	0.534832
0.035	0.887809	0.78013	0.683395	0.596584	0.518766	0.449094
0.040	0.849612	0.710963	0.593105	0.493072	0.408309	0.336615
0.045	0.790117	0.609937	0.469393	0.359984	0.274998	0.209142
0.050	0.700804	0.473487	0.318916	0.214062	0.143121	0.095265
0.055	0.574649	0.311417	0.168244	0.09058	0.048576	0.025935
P	**C = 6**					
0.010	0.944855	0.889619	0.835027	0.781073	0.727751	0.675056
0.015	0.941532	0.882948	0.825454	0.769034	0.713671	0.65935
0.020	0.936078	0.872058	0.809909	0.749586	0.691046	0.634247
0.025	0.927154	0.854392	0.784911	0.718585	0.655294	0.594921
0.030	0.912621	0.826036	0.745359	0.670233	0.600326	0.53532
0.035	0.889145	0.781305	0.684424	0.597483	0.519547	0.44977
0.040	0.851723	0.71273	0.594579	0.494297	0.409324	0.337452
0.045	0.793359	0.61244	0.471319	0.361461	0.276126	0.21
0.050	0.705558	0.476699	0.321079	0.215514	0.144092	0.095911
0.055	0.581105	0.314916	0.170134	0.091598	0.049122	0.026226

The following figure 3 shows the AOQ Values for the acceptance number c=0, s=20, m=50, r= 1, 2, 3, 4, 5, 6 and sample size n=50, 100, 150, 200, 250 and 300.

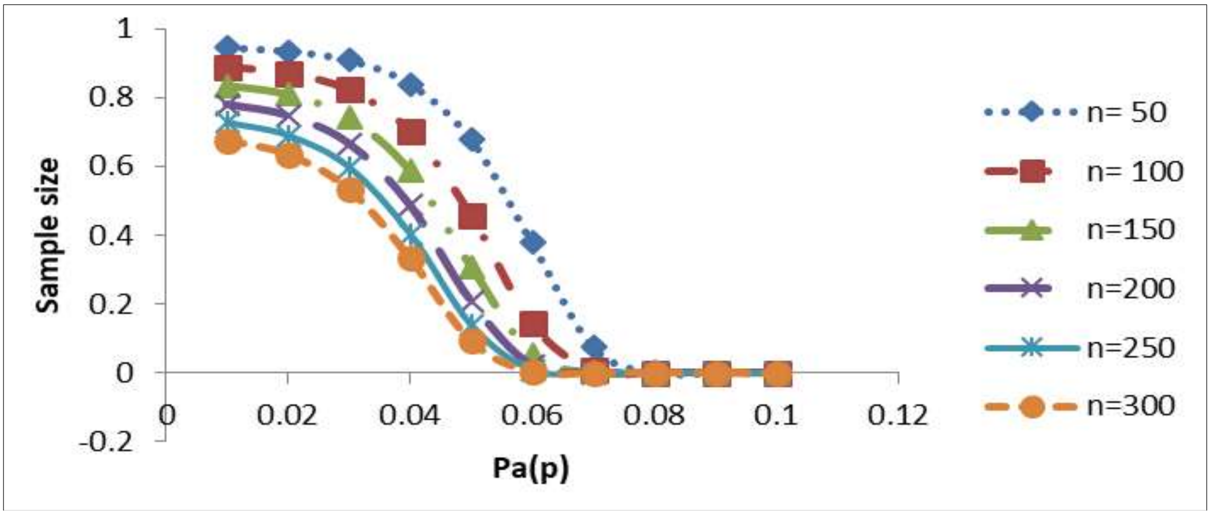

Fig 3: AOQ Curve for Laplace Distribution using RSS

For the acceptance sampling plan in which rectification is not done, the AOQ is the same as the incoming quality. Therefore when the lot is either accepted or rejected, the AOQ is the same as the quality of the submitted lot.

Average Total Inspection (ATI)

Exactly when excused lots are 100% examined, it is easy to work out the ATI if lots come dependably with a disfigurement level of ' p'. For a LASP (n, c) with a probability Pa of enduring a lot with disfigurement level p, one can have

$$ATI = N+(1-Pa), (N-n) \tag{9}$$

Where N is the lot size, n is the sample size.

Table 3 shows the ATI values for RSS using Laplace distribution for N=1000, m=50, s=20,
r= 1, 2, 3, 4, 5, 6 and n=50,100,150, 200, 250 and 300.

Table 3: The ATI Values for Laplace Distribution using RSS

N	1M	2M	3M	4M	5M	6M
P			**C=0**			
0.010	55.84428	111.0393	165.591	219.5051	272.7874	325.4437
0.015	59.61673	118.1289	175.5529	231.9046	287.2	341.4545
0.020	65.80421	129.6957	191.72	251.9215	310.3436	367.029
0.025	75.91864	148.4391	217.6903	283.7966	346.8781	407.0506
0.030	92.36067	178.4729	258.7102	333.4254	402.9513	467.6022
0.035	118.8451	225.7168	321.7264	407.8869	485.1217	554.2719
0.040	160.8659	297.8045	414.2097	513.0089	596.7261	667.536
0.045	225.8972	402.4247	540.1205	647.3124	730.5758	795.097
0.050	322.4899	542.2515	691.6844	793.0532	861.6363	907.9018
0.055	456.5684	705.5001	840.8954	914.3406	954.0625	975.4741
P			**C = 1**			
0.010	55.72774	110.9296	165.488	219.4087	272.6977	325.3605
0.015	59.42535	117.9495	175.3851	231.7483	287.0549	341.3205
0.020	65.49072	129.4037	191.4488	251.6704	310.1122	366.8166
0.025	75.40727	147.9678	217.2573	283.4002	346.5166	406.7224
0.030	91.53226	177.723	258.0336	332.817	402.4063	467.1163
0.035	117.5183	224.5509	320.7051	406.9954	484.3464	553.6007
0.040	158.7807	296.0596	412.754	511.7988	595.724	666.7099
0.045	222.7206	399.9726	538.2333	645.8651	729.4702	794.2562
0.050	317.8939	539.1463	689.5929	791.6493	860.6977	907.277
0.055	450.4636	702.1918	839.108	913.3783	953.5464	975.1985
P			**C = 2**			
0.010	55.6112	110.8199	165.591	219.3124	272.6079	325.2772
0.015	59.23393	117.77	175.2173	231.592	286.9098	341.1864
0.020	65.17712	129.1115	191.1774	251.4193	309.8807	366.6041
0.025	74.89561	147.4963	216.8242	283.0037	346.155	406.3941
0.030	90.70308	176.9725	257.3564	332.208	401.8609	466.6299
0.035	116.1896	223.3834	319.6823	406.1025	483.57	552.9286
0.040	156.6904	294.3104	411.2948	510.5856	594.7195	665.8817
0.045	219.531	397.5103	536.3384	644.4119	728.3601	793.4119
0.050	313.2667	536.0201	687.4872	790.2359	859.7527	906.648
0.055	444.2902	698.8463	837.3006	912.4052	953.0246	974.9199

Table 3 coutin…

N	1M	2M	3M	4M	5M	6M
P	**C = 3**					
0.010	55.49464	110.7101	165.282	219.216	272.5181	325.1939
0.015	59.04248	117.5904	175.0494	231.4356	286.7647	341.0524
0.020	64.86342	128.8193	190.906	251.1681	309.6491	366.3915
0.025	74.38366	147.0246	216.3908	282.6069	345.7932	406.0656
0.030	89.87316	176.2214	256.6786	331.5985	401.315	466.1431
0.035	114.8588	222.214	318.6579	405.2083	482.7924	552.2554
0.040	154.5948	292.5568	409.8319	509.3695	593.7124	665.0514
0.045	216.3283	395.038	534.4358	642.9527	727.2454	792.5641
0.050	308.6081	532.8726	685.3672	788.813	858.8013	906.0148
0.055	438.0475	695.4632	835.4729	911.4212	952.4968	974.6382
P	**C = 4**					
0.010	55.37806	110.6003	165.1789	219.1197	272.4283	325.1106
0.015	58.85098	117.4108	174.8816	231.2792	286.6195	340.9183
0.020	64.54961	128.5269	190.6345	250.9168	309.4174	366.1789
0.025	73.87143	146.5525	215.9571	282.2099	345.4311	405.7369
0.030	89.04247	175.4695	256.0001	330.9885	400.7686	465.6558
0.035	113.526	221.0429	317.632	404.3127	482.0137	551.5813
0.040	152.4941	290.7989	408.3654	508.1503	592.7028	664.2191
0.045	213.1125	392.5555	532.5253	641.4876	726.1262	791.7129
0.050	303.918	529.7037	683.2329	787.3804	857.8435	905.3772
0.055	431.7346	692.0421	833.6246	910.4261	951.9632	974.3533
P	**C = 5**					
0.010	55.26147	110.4906	165.0759	219.0233	272.3385	325.0273
0.015	58.65945	117.2312	174.7136	231.1227	286.4744	340.7841
0.020	64.2357	128.2345	190.3629	250.6655	309.1857	365.9662
0.025	73.35892	146.0803	215.5233	281.8127	345.0689	405.4081
0.030	88.21103	174.7169	255.3211	330.3778	400.2216	465.1681
0.035	112.1913	219.87	316.6046	403.4157	481.2337	550.9061
0.040	150.3881	289.0366	406.8952	506.9281	591.6907	663.3847
0.045	209.8835	390.0628	530.607	640.0164	725.0023	790.8582
0.050	299.196	526.5134	681.084	785.938	856.8791	904.7353
0.055	425.3508	688.5825	831.7556	909.4199	951.4236	974.0652
P	**C = 6**					
0.010	55.14487	110.3808	164.9728	218.9269	272.2487	324.944
0.015	58.46788	117.0516	174.5457	230.9663	286.3291	340.65
0.020	63.92168	127.942	190.0912	250.414	308.9539	365.7534
0.025	72.84613	145.6077	215.0891	281.4152	344.7065	405.079
0.030	87.37882	173.9637	254.6414	329.7667	399.6742	464.68
0.035	110.8545	218.6954	315.5756	402.5175	480.4526	550.2299
0.040	148.2769	287.2699	405.4214	505.7029	590.6761	662.5483
0.045	206.6412	387.5599	528.6809	638.5392	723.8739	790
0.050	294.442	523.3015	678.9206	784.4859	855.9082	904.0891
0.055	418.8954	685.0841	829.8656	908.4023	950.8779	973.7738

The following figure 4 shows the ATI values for the acceptance number C = 0, S = 20, M = 50, R = 1, 2, 3, 4, 5, 6 and sample size N = 50, 100, 150, 200, 250 and 300.

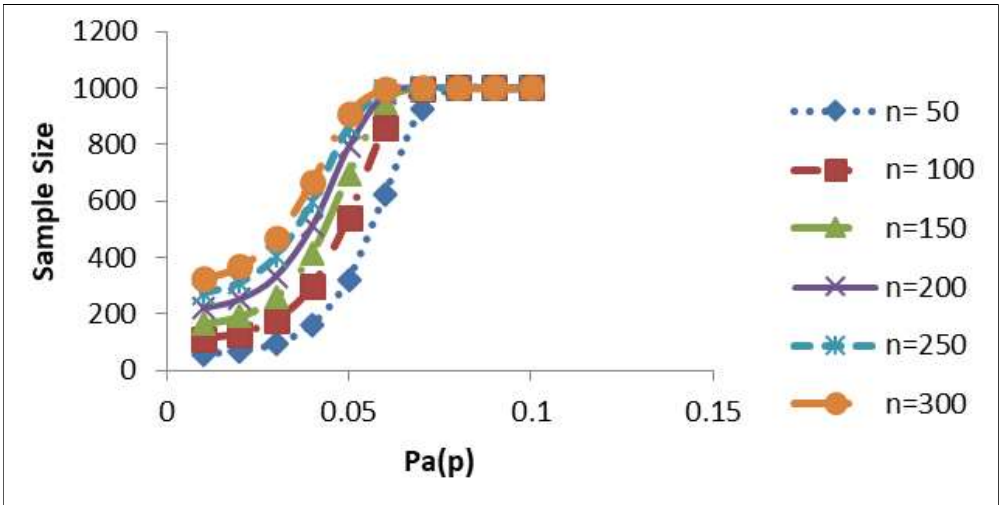

Fig 4: ATI Curve for Laplace Distribution using RSS

The curve drawn between ATI and the lot quality (p) is known as ATI curve. A typical ATI curve for a single sample plan is shown for N = 1000, N = 50,100, 150, 200, 250 and 300.

Illustration

A manufacturer of bicycle produces bicycle in lots (N) of 1000 by using RSS method, distributed by Laplace distribution. Then, the scale parameter (b) is 20, sample set size (m) is 50 and the cycle size (r) is 5. The quality of incoming lot as 0.02 and acceptance numbers is 0 and 1.

Explanation

It is given, sample size of bicycle m =50 and sample cycle size R = 5 (specified by the producer). Hence, N = m*r (250 = 50*5). For a fixed lot quality P = 0.02, the value of the parameter b is 20. Then $[m$, r] is the (m, r)^h judgment order statistics of the i^{th} random sample of size m in the j^{th} cycle. In a sample of n=250 specimens selected from a lot of a bicycle manufacturing company, if X $\leq$ c, the lot is accepted, otherwise reject the lot and inform the management for further action. If X represents the number of defective bicycles in the sample, if X = 0 the probability of accepting the lot Pa (p) is 0.919542, ASN is 250, AOQ is 0.689656, ATI is 310 (310.3436 is equivalent to 310). If X = 1 the probability of accepting the lot Pa (p) is 0.91985, ASN is 250, AOQ is 0.68988, ATI is 310.

Conclusion

Construction of Acceptance Sampling Plans for the Ranked Set Sampling using Laplace Distribution makes to advance the planning system in the simple manner in the assurance of the boundaries in the review of quality control. Targets of limiting the AOQ, ASN and ATI are considered in the enhancement cycle

An application has been considered in the Sampling such that AOQ, ASN or ATI is minimized subject to the probabilistic constraints considered by Guenther (1969) [12]. It was found to work very well in the process of the Operating Characteristic curve which is drawn for the chosen sampling and more discriminating than the existing.

In this paper, a new RSS method is suggested for considering Operating Characteristic Curve, Average Sample Number, Average Outgoing Quality and Average Total Inspection. It is more effective than basic arbitrary testing on the grounds that fewer samples should be gathered and estimated. It has been advised to use the proposed sampling plans, because it is cost-effective. The created plan can be used to evaluate big data analytics starting with health research, ecology and other areas that could be expanded.

This study can be extended further for the various parameters such as AQL, LQL, IQL, AOQL MAPD and MAAOQL. Further it can be extended to Double Sampling Plan, Multi-stage Sampling Plan, other Special Purpose Plans such as Chain Sampling, Skip Plot Sampling Plans and schemes as well.

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