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Time Truncated Special Purpose Double Sampling Plan for Selected Distributions

Ramaswamy A. R. Sudamani[1], S. Jayasri[2*]

[1]Associate Professor, Department of Mathematics, Avinashilingam University, Coimbatore, India.
[2]Assistant professor, Department of Mathematics, CIT, Coimbatore, India.

ABSTRACT :

DSP-(0,1) sampling plan is developed for a truncated life test when the life time of an item follows different life time distributions. The minimum sample sizes are determined when the consumer's risk and the test termination time are specified. The operating characteristic values for various quality levels are obtained and the results are discussed with the help of tables and examples.

KEYWORDS : Truncated life test, Marshall olkin extended exponential distribution, Generalized Exponential distribution, Marshall – Olkin extended Lomax distribution, Weibull distribution, Rayleigh distribution and Inverse Rayleigh distribution, Consumer's risk, Producer's risk.

*Corresponding Author:

S. Jayasri

Assistant professor, Department of Mathematics,

CIT, Coimbatore, India

1. INTRODUCTION:

An acceptance sampling plan involves quality contracting on product orders between the producers and the consumers. It is an essential tool in the Statistical Quality Control. The acceptance sampling plan was applied in the US Military for testing the bullets during World War II. For example, if every bullet was tested in advance, no bullets were available for shipment, and on the other hand if no bullets were tested, then disaster might occur in the battle field at the crucial time.

In a truncated life test, the units are randomly selected from a lot of products and are subjected to a set of test procedures, where the number of failures is recorded until the pre- specified time. If the number of observed failures at the end of the fixed time is not greater than the specified acceptance number, then the lot will be accepted. The test may get terminated before the pre specified time is reached when the number of failures exceeds the acceptance number in which case the decision is to reject the lot. For such a truncated life test and the associated decision rule we are interested in obtaining the smallest sample size to arrive at a decision where the life time of an item follows different distributions. Two risks are continually associated to a time truncated acceptance sampling plan. The probability of accepting a bad lot is known as the producer's risk and the probability of rejecting a good lot is called the consumer's risk. An ordinary time truncated acceptance sampling plan have been discussed by many authors, Goode and Kao[8], Gupta and Groll[7], Baklizi and EI Masri[1], Rosaiah and Kantam[10] , Tzong and Shou[16], Balakrishnan, Victor Leiva & Lopez[3]. All these authors developed the sampling plans for life tests using single sampling plan.

From Cameron[5] table, one can observe a jump between the operating ratios of Single Sampling Plan with c=0 and c=1 and slow reduction of operating ratios for other values of c. It may also be seen that, in between the operating characteristic (OC) curves of Single Sampling Plan with c=0 and c=1 plans, there is a vast gap to be filled which leads one to assess the possibility of designing plans having OC curves lying between the OC curves of c=0 and c=1 plan. To overcome such situation Craig[4] have proposed Double sampling plan with acceptance numbers 0 and 1 and rejection number 2.Vijayaragavan[18] has presented tables for the selection of DSP(0,1) plan for attributes under Poisson and Binomial conditions of sampling. Dodge and Romig[6] (1959) have studied the use of Dsp-(0,1) plan to product characteristics involving costly and destructive testing.

In this paper a new approach of designing special purpose Double sampling plan of type DSP (0,1) for truncated life test is proposed assuming that the experiment is truncated at preassigned time , when the lifetime of the items follows different distributions. The distributions considered in this paper are Marshall olkin extended exponential distribution, Generalized Exponential distribution, Marshall – Olkin extended Lomax distribution, Weibull distribution, Rayleigh distribution and Inverse Rayleigh distribution. The test termination time and the mean ratio's are specified. The design parameter is obtained such that it satisfies the consumer's risk. The probability of acceptance for Dsp(0,1) plan are also determined when the life time of the items follows the above distributions. The tables of the design parameter are provided for easy selection of the plan parameter. The results are analysed with the help of tables and examples.

2. GLOSSARY OF SYMBOLS:

N - Lot size

n_1 - Size of the first sample

n_2 - Size of the second sample

d_1 - Number of defectives in the first sample

d_2 - Number of defectives in the second sample

c - Acceptance number

$P_a(p)$ - Probability of acceptance of a lot submitted for inspection

p - Failure probability

α - Producer's risk

β - Consumer's risk

σ - Scale parameter

λ , γ - Shape parameter

T - Prefixed time

3. DISTRIBUTIONS:

The following are the distributions used in this paper :

(i) Generalized Exponential Distribution:

The cumulative distribution function (cdf) of the generalized exponential distribution is given by

$$F(t,\sigma) = \left(1 - e^{-\frac{t}{\sigma}}\right)^{\lambda} \quad , \quad t > 0 \qquad (1)$$

where σ is a scale parameter and λ is the shape parameter and it is fixed as 2.

(ii) Marshall – Olkin extended Lomax distribution:

The cumulative distribution function (cdf) of the Marshall – Olkin extended Lomax distribution is given by

$$F(t,\sigma) = \frac{(1+ t/\sigma)^{\theta} - 1}{(1+ t/\sigma)^{\theta} - \bar{\gamma}}, \bar{\gamma} = 1 - \gamma \quad , \quad t > 0 \qquad (2)$$

where σ is a scale parameter and θ and γ are the shape parameters and they are fixed as 2.

(iii) Marshall – Olkin extended exponential distribution:

The cumulative distribution function (cdf) of the Marshall – Olkin extended exponential distribution is given by

$$F(t,\sigma) = \frac{1 - e^{-t/\sigma}}{1 - \bar{\gamma} e^{-t/\sigma}}, \bar{\gamma} = 1 - \gamma \quad , t > 0 \qquad (3)$$

where σ is a scale parameter and γ is the shape parameter and it is fixed as 2.

(iv) Weibull Distribution:

The cumulative distribution function (cdf) of the Weibull distribution is given by

$$F(t,\sigma) = 1 - e^{-\left(\frac{t}{\sigma}\right)^{m}} \quad , \quad t > 0 \tag{4}$$

Where σ is a scale parameter and λ is the shape parameter and it is fixed as 2.

(v) Rayleigh distribution:

The cumulative distribution function (cdf) of the Rayleigh distribution is given by

$$F(t,\sigma) = 1 - e^{-\frac{1}{2}\left(\frac{t}{\sigma}\right)^{2}} \quad , \quad t > 0 \tag{5}$$

Where σ is a scale parameter.

(vi) Inverse Rayleigh Distribution:

The cumulative distribution function (cdf) of the Inverse Rayleigh distribution is given by

$$F(t,\sigma) = e^{-\frac{\sigma^{2}}{t^{2}}} \quad , t > 0 \tag{6}$$

Where σ is a scale parameter.

4. OPERATING PROCEDURE OF DOUBLE SAMPLING PLAN OF TYPE DSP(0,1)

According to Hald (1981), the operating procedure of DSP-(0,1) is as follows;

(i) From a lot, select a sample of size n_1, and observe the number of defectives, d_1.

(ii) If $d_1 = 0$, accept the lot;

If $d_1 > 1$,reject the lot;

(iii)If $d_1=1$, select a second sample of size n_2 and observe d_2.

(iv)If $d_2=0$, accept the lot, otherwise reject the lot

4.1 Operating Procedure Of Double Sampling Plan Of Type Dsp(0,1) For The Life Tests

(i) From a lot, select a sample of size n_1, and observe the number of defectives d_1, during the time t_0 .

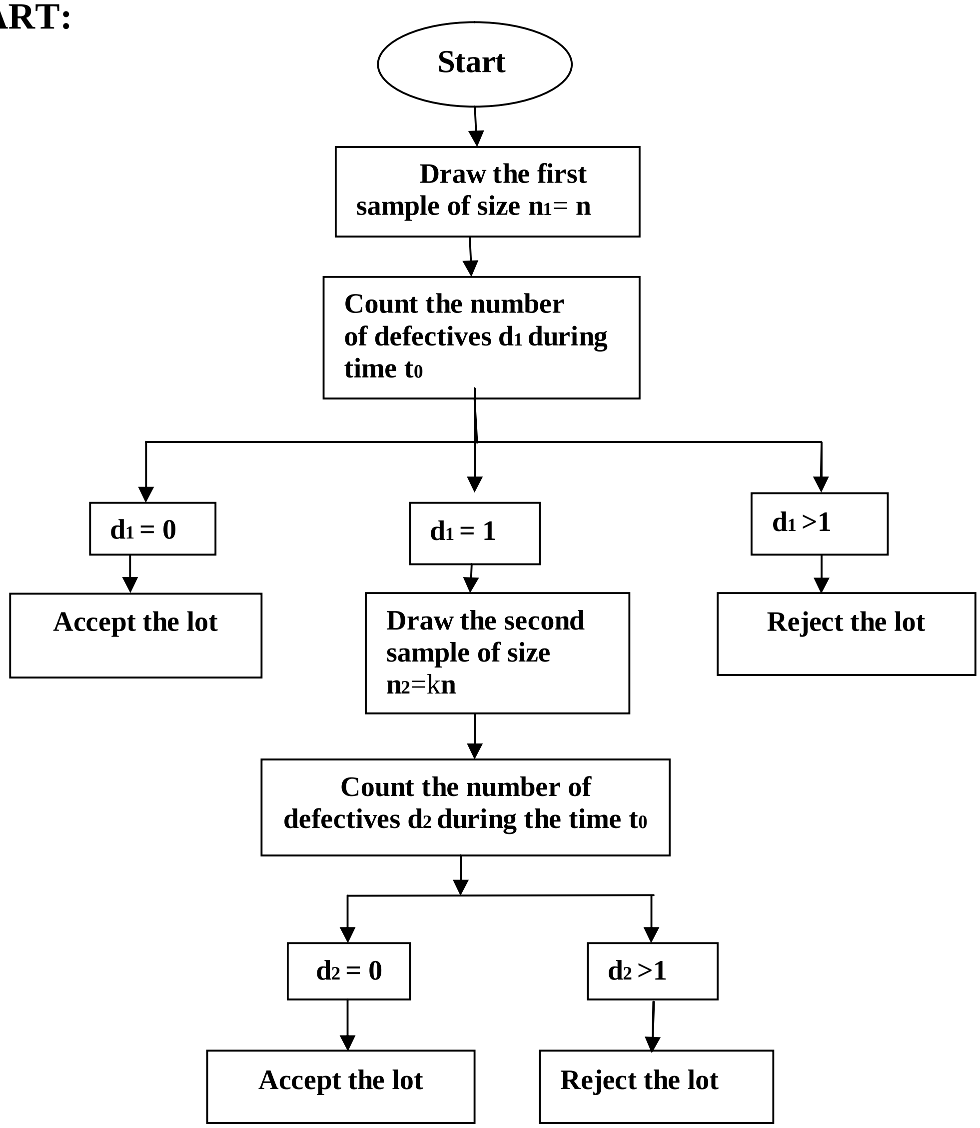
(ii) If $d_1 = 0$, accept the lot;

If $d_1 > 1$,reject the lot;

(iii)If $d_1=1$, select a second sample of size n_2 and observe d_2, during the time t_0.

(iv)If $d_2=0$, accept the lot, otherwise reject the lot

5. FLOWCHART:



Flow Chart 1 - Operating procedure of DSP-(0,1) plan for the life tests in the form of a flow chart.

6. CONSTRUCTION OF TABLES:

The probability of acceptance can be regarded as a function of the deviation of specified average from the true average. This function is called operating characteristic (oc) function of the sampling plan. Once the minimum sample size is obtained one may be interested to find the probability of acceptance of a lot when the quality of the product is good enough. We assume that the lot size is large enough to use the binomial distribution to find the probability of acceptance. The probability of acceptance for the sampling plan is calculated as follows

$$P_a(p) = (1-p)^{n_1} + n_1 p(1-p)^{n_1+n_2-1} \qquad \text{---------------------------(7)}$$

where n_1 = n and n_2 = kn. The time termination ratio t/σ_0 are fixed as 0.628, 0.942, 1.257, 1.571, 2.356, 3.141, 4.712, the consumer's risk β as 0.25, 0.10, 0.05, 0.01 and the mean ratios σ/σ_0 are fixed as 2, 4, 6, 8, 10 and 12. These choices are consistent with Gupta and Groll [7], Gupta, Kantam et al[11] , Baklizi and EI Masri[1], Balakrishnan et Al [3]. For various time termination ratios and mean ratios the design parameter values n_1 = n and n_2 = kn are obtained and presented in Table 1 to Table 6.The probability of acceptance for DSP (0, 1) sampling plan are also calculated and are presented in Table 7 to Table 12 for different distributions.

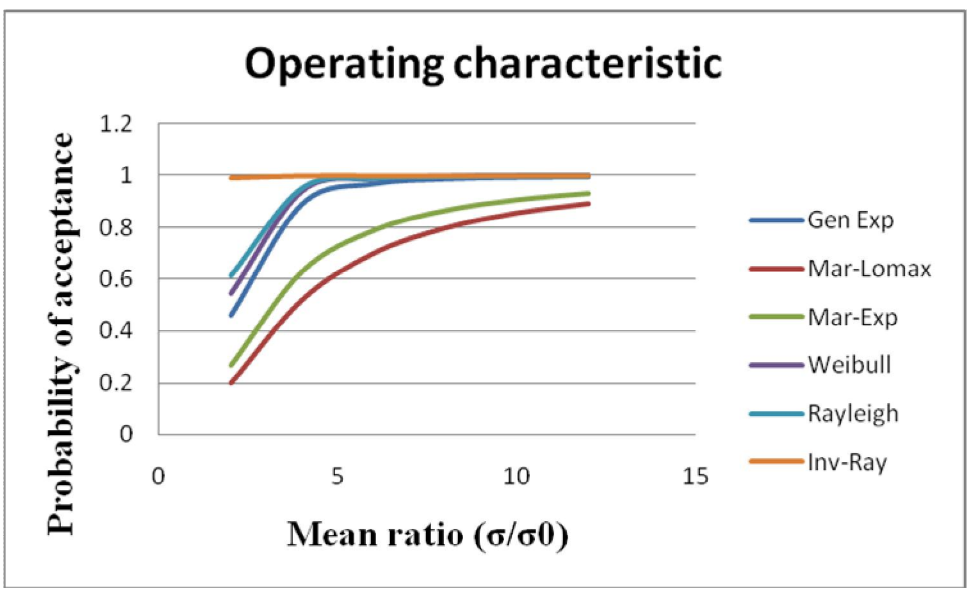


FIGURE 1: OC curve for Probability of acceptance against σ/σ0, for the DSP-(0,1) plan when the life time of an item follows different distributions

Table 1: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Weibull distribution

β	K	t/σ_0							
		0.628	**0.942**	**1.257**	**1.571**	**2.356**	**3.141**	**3.927**	**4.712**
0.25	**1**	7	3	2	1	1	1	1	1
	2	5	2	1	1	1	1	1	1
	3	4	2	1	1	1	1	1	1
	4	4	2	1	1	1	1	1	1
	5	4	2	1	1	1	1	1	1
0.10	**1**	10	4	3	2	1	1	1	1
	2	7	3	2	1	1	1	1	1
	3	6	3	2	1	1	1	1	1
	4	6	3	2	1	1	1	1	1
	5	6	3	2	1	1	1	1	1
0.05	**1**	12	5	3	2	1	1	1	1
	2	8	4	2	2	1	1	1	1
	3	8	4	2	2	1	1	1	1
	4	8	4	2	2	1	1	1	1
	5	8	4	2	2	1	1	1	1
0.01	**1**	17	8	4	3	1	1	1	1
	2	12	6	3	2	1	1	1	1
	3	12	6	3	2	1	1	1	1
	4	12	6	3	2	1	1	1	1
	5	12	6	3	2	1	1	1	1

Table 2: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Generalised Exponential distribution

β	K	t/σ_0							
		0.628	**0.942**	**1.257**	**1.571**	**2.356**	**3.141**	**3.927**	**4.712**
0.25	**1**	11	6	4	3	2	1	1	1
	2	7	4	3	2	1	1	1	1
	3	6	4	3	2	1	1	1	1
	4	6	4	2	2	1	1	1	1
	5	6	3	2	2	1	1	1	1
0.10	**1**	16	8	5	4	2	2	1	1
	2	11	6	4	3	2	1	1	1
	3	10	5	4	3	2	1	1	1
	4	10	5	4	3	2	1	1	1
	5	10	5	4	3	2	1	1	1
0.05	**1**	19	10	7	5	3	2	2	1
	2	13	7	5	4	2	2	1	1
	3	13	7	5	4	2	2	1	1
	4	13	7	5	4	2	2	1	1
	5	13	7	5	4	2	2	1	1
0.01	**1**	27	14	9	7	4	3	2	2
	2	19	10	7	5	3	2	2	2
	3	19	10	7	5	3	2	2	2
	4	19	10	7	5	3	2	2	2
	5	19	10	7	5	3	2	2	2

Table 3: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Generalised Rayleigh distribution

β	K	t/σ_0							
		0.628	**0.942**	**1.257**	**1.571**	**2.356**	**3.141**	**3.927**	**4.712**
0.25	**1**	14	6	3	2	1	1	1	1
	2	9	4	3	2	1	1	1	1
	3	8	4	2	2	1	1	1	1
	4	8	4	2	2	1	1	1	1
	5	8	4	2	2	1	1	1	1
0.10	**1**	20	9	5	3	2	1	1	1
	2	13	6	4	2	1	1	1	1
	3	12	6	3	2	1	1	1	1
	4	12	6	3	2	1	1	1	1
	5	12	6	3	2	1	1	1	1
0.05	**1**	24	11	6	4	2	1	1	1
	2	16	7	4	3	2	1	1	1
	3	16	7	4	3	2	1	1	1
	4	16	7	4	3	2	1	1	1
	5	16	7	4	3	2	1	1	1
0.01	**1**	34	15	8	5	3	2	1	1
	2	24	11	6	4	2	1	1	1
	3	24	11	6	4	2	1	1	1
	4	24	11	6	4	2	1	1	1
	5	24	11	6	4	2	1	1	1

Table 4: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Inv Rayleigh distribution

β	K	t/σ_0							
		0.628	**0.942**	**1.257**	**1.571**	**2.356**	**3.141**	**3.927**	**4.712**
0.25	**1**	33	7	4	3	2	1	1	1
	2	21	5	3	2	1	1	1	1
	3	18	4	2	2	1	1	1	1
	4	18	4	2	2	1	1	1	1
	5	17	4	2	2	1	1	1	1
0.10	**1**	47	10	5	4	2	2	2	1
	2	31	7	4	3	2	2	1	1
	3	29	6	4	3	2	1	1	1
	4	28	6	4	3	2	1	1	1
	5	28	6	4	3	2	1	1	1
0.05	**1**	57	12	6	4	3	2	2	2
	2	38	8	5	3	2	2	2	1
	3	37	8	4	3	2	2	2	1
	4	37	8	4	3	2	2	2	1
	5	37	8	4	3	2	2	2	1
0.01	**1**	80	17	9	6	4	3	3	2
	2	57	12	7	5	3	2	2	2
	3	56	12	7	5	3	2	2	2
	4	56	12	7	5	3	2	2	2
	5	56	12	7	5	3	2	2	2

Table 5: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Marshall – Olkin extended Lomax distribution

β	K	t/σ_0							
		0.628	**0.942**	**1.257**	**1.571**	**2.356**	**3.141**	**3.927**	**4.712**
0.25	**1**	5	3	3	2	2	1	1	1
	2	3	2	2	2	1	1	1	1
	3	3	2	2	2	1	1	1	1
	4	3	2	2	2	1	1	1	1
	5	3	2	2	1	1	1	1	1
0.10	**1**	7	5	4	3	2	2	2	2
	2	5	3	3	2	2	2	1	1
	3	4	3	3	2	2	2	1	1
	4	4	3	3	2	2	2	1	1
	5	4	3	3	2	2	2	1	1
0.05	**1**	8	6	4	4	3	2	2	2
	2	6	4	3	3	2	2	2	2
	3	5	4	3	3	2	2	2	2
	4	5	4	3	3	2	2	2	2
	5	5	4	3	3	2	2	2	2
0.01	**1**	11	8	6	5	4	3	3	3
	2	8	6	6	5	3	3	2	2
	3	8	6	5	4	3	3	2	2
	4	8	6	5	4	3	3	2	2
	5	8	6	5	4	3	3	2	2

Table 6: Minimum sample size for DSP (0, 1) plan when the life time of the item follows Marshall – Olkin extended exponential distribution

β	K	t/σ_0							
		0.628	0.942	1.257	1.571	2.356	3.141	3.927	4.712
0.25	1	7	5	3	3	2	1	1	1
	2	5	3	2	2	1	1	1	1
	3	5	3	2	2	1	1	1	1
	4	4	3	2	2	1	1	1	1
	5	4	3	2	2	1	1	1	1
0.10	1	11	7	5	4	2	2	1	1
	2	7	5	3	3	2	1	1	1
	3	7	5	3	3	2	1	1	1
	4	7	4	3	3	2	1	1	1
	5	7	4	3	3	2	1	1	1
0.05	1	13	8	6	5	3	2	2	1
	2	9	6	4	3	2	2	1	1
	3	9	6	4	3	2	2	1	1
	4	9	6	4	3	2	1	1	1
	5	9	6	4	3	2	2	1	1
0.01	1	18	12	8	6	4	3	2	2
	2	13	9	6	5	3	2	2	2
	3	13	8	6	5	3	2	2	2
	4	13	8	6	5	3	2	2	2
	5	13	8	6	5	3	2	2	2

Table 7: Probability of acceptance for DSP (0, 1) plan when the life time of item follows Weibull distribution

β	n	t/σ 0	σ/σ0					
			2	**4**	**6**	**8**	**10**	**12**
0.25	**5**	**0.628**	0.785949	0.979190	0.995522	0.998539	0.999393	0.999705
	2	**0.942**	0.805507	0.981443	0.996021	0.998704	0.999462	0.999739
	1	**1.257**	0.821771	0.983147	0.996391	0.998825	0.999512	0.999763
	1	**1.571**	0.673600	0.962055	0.991510	0.997192	0.998826	0.999427
	1	**2.356**	0.296419	0.853329	0.962083	0.986770	0.994327	0.997194
	1	**3.141**	0.091478	0.673855	0.898854	0.962098	0.983177	0.991521
	1	**3.927**	0.021605	0.471422	0.799494	0.918118	0.962072	0.980420
	1	**4.712**	0.003900	0.296419	0.673770	0.853329	0.928605	0.962083
0.10	**7**	**0.628**	0.66678	0.962216	0.991604	0.997230	0.998843	0.999436
	3	**0.942**	0.671699	0.962762	0.991722	0.997269	0.998859	0.999444
	2	**1.257**	0.588258	0.947471	0.988016	0.996008	0.998326	0.999182
	1	**1.571**	0.673600	0.962055	0.991510	0.997192	0.998826	0.999427
	1	**2.356**	0.296419	0.853329	0.962083	0.986770	0.994327	0.997194
	1	**3.141**	0.091478	0.673855	0.898854	0.962098	0.983177	0.991521
	1	**3.927**	0.021605	0.471422	0.799494	0.918118	0.962072	0.980420
	1	**4.712**	0.003900	0.296419	0.673770	0.853329	0.928605	0.962083
0.05	**8**	**0.628**	0.609500	0.952334	0.989238	0.996429	0.998505	0.999270
	4	**0.942**	0.546656	0.939516	0.986070	0.995345	0.998044	0.999043
	2	**1.257**	0.588258	0.947471	0.988016	0.996008	0.998326	0.999182
	2	**1.571**	0.369166	0.888797	0.972607	0.990616	0.996011	0.998037
	1	**2.356**	0.296419	0.853329	0.962083	0.986770	0.994327	0.997194
	1	**3.141**	0.091478	0.673855	0.898854	0.962098	0.983177	0.991521
	1	**3.927**	0.021605	0.471422	0.799494	0.918118	0.962072	0.980420
	1	**4.712**	0.003900	0.296419	0.673770	0.853329	0.928605	0.962083
0.01	**12**	**0.628**	0.412026	0.905649	0.977329	0.992306	0.998505	0.998401
	6	**0.942**	0.347527	0.883326	0.971203	0.990129	0.998044	0.997934
	3	**1.257**	0.397244	0.899578	0.975627	0.991697	0.998326	0.998270
	2	**1.571**	0.369166	0.888797	0.972607	0.990616	0.996011	0.998037
	1	**2.356**	0.296419	0.853329	0.962083	0.986770	0.994327	0.997194
	1	**3.141**	0.091478	0.673855	0.898854	0.962098	0.983177	0.991521
	1	**3.927**	0.021605	0.471422	0.799494	0.918118	0.962072	0.980420
	1	**4.712**	0.003900	0.296419	0.673770	0.853329	0.928605	0.962083

Table 8 : Probability of acceptance for DSP (0, 1) plan when the life time of the item follows Generalised Exponential distribution

β	n	t/σ_0	σ/σ_0					
			2	**4**	**6**	**8**	**10**	**12**
0.25	**7**	**0.628**	0.766849	0.970876	0.993047	0.997607	0.998973	0.999490
	4	**0.942**	0.711396	0.958027	0.989386	0.996239	0.998358	0.999175
	3	**1.257**	0.628407	0.936011	0.982767	0.993699	0.997197	0.998575
	2	**1.571**	0.640938	0.935218	0.982019	0.993303	0.996985	0.998453
	1	**2.356**	0.651007	0.929267	0.978929	0.991806	0.996203	0.998013
	1	**3.141**	0.459759	0.850767	0.949403	0.978936	0.989825	0.994523
	1	**3.927**	0.311381	0.753952	0.905844	0.958122	0.978924	0.988337
	1	**4.712**	0.207339	0.651007	0.850729	0.929267	0.962947	0.978929
0.10	**11**	**0.628**	0.588446	0.936026	0.983901	0.994347	0.997551	0.998777
	6	**0.942**	0.537957	0.917157	0.977887	0.991998	0.996470	0.998216
	4	**1.257**	0.496627	0.898344	0.971394	0.989356	0.995224	0.997559
	3	**1.571**	0.456909	0.877850	0.963878	0.986195	0.993703	0.996746
	2	**2.356**	0.342011	0.806826	0.935259	0.973523	0.987408	0.993308
	1	**3.141**	0.459759	0.850767	0.949403	0.978936	0.989825	0.994523
	1	**3.927**	0.311381	0.753952	0.905844	0.958122	0.978924	0.988337
	1	**4.712**	0.207339	0.651007	0.850729	0.929267	0.962947	0.978929
0.05	**13**	**0.628**	0.508229	0.915354	0.97814	0.992248	0.996625	0.998310
	7	**0.942**	0.462296	0.893741	0.970876	0.989351	0.995278	0.997607
	5	**1.257**	0.386383	0.856476	0.957841	0.984038	0.992775	0.99629
	4	**1.571**	0.316968	0.813182	0.941267	0.976976	0.989362	0.994463
	2	**2.356**	0.342011	0.806826	0.935259	0.973523	0.987408	0.993308
	2	**3.141**	0.163057	0.641154	0.856026	0.935279	0.967429	0.982038
	1	**3.927**	0.311381	0.753952	0.905844	0.958122	0.978924	0.988337
	1	**4.712**	0.207339	0.651007	0.850729	0.929267	0.962947	0.978929
0.01	**19**	**0.628**	0.317357	0.845001	0.956829	0.984235	0.993038	0.996487
	10	**0.942**	0.285872	0.816378	0.945635	0.979498	0.990769	0.995282
	7	**1.257**	0.228259	0.766387	0.925461	0.970798	0.986554	0.993027
	5	**1.571**	0.217093	0.745670	0.915184	0.965909	0.984047	0.991635
	3	**2.356**	0.170149	0.673612	0.877922	0.947581	0.974426	0.986205
	2	**3.141**	0.163057	0.641154	0.856026	0.935279	0.967429	0.982038
	2	**3.927**	0.074998	0.478354	0.753453	0.878441	0.935242	0.962910
	2	**4.712**	0.034364	0.342011	0.641082	0.806826	0.891171	0.935259

Table 9:Probability of acceptance for DSP (0, 1) plan when the life time of item follows Rayleigh distribution

β	n	t/σ 0	σ/σ0					
			2	4	6	8	10	12
0.25	9	0.628	0.819921	0.983317	0.996465	0.998845	0.999521	0.999767
	4	0.942	0.814584	0.982641	0.996293	0.998794	0.999500	0.999757
	3	1.257	0.717319	0.969793	0.993370	0.997822	0.999092	0.999558
	2	1.571	0.694114	0.966102	0.992500	0.997530	0.998969	0.999498
	1	2.356	0.624566	0.953318	0.989398	0.996474	0.998522	0.999278
	1	3.141	0.351502	0.877895	0.969305	0.989402	0.995478	0.997770
	1	3.927	0.163574	0.763457	0.932822	0.975696	0.989395	0.994705
	1	4.712	0.065969	0.624566	0.877854	0.953318	0.979079	0.989398
0.10	13	0.628	0.700394	0.967536	0.992855	0.997651	0.999021	0.999523
	6	0.942	0.680435	0.964370	0.992110	0.997401	0.998915	0.999471
	4	1.257	0.60149	0.950598	0.988806	0.996281	0.998442	0.999239
	2	1.571	0.694114	0.966102	0.992500	0.997530	0.998969	0.999498
	1	2.356	0.624566	0.953318	0.989398	0.996474	0.998522	0.999278
	1	3.141	0.351502	0.877895	0.969305	0.989402	0.995478	0.997770
	1	3.927	0.163574	0.763457	0.932822	0.975696	0.989395	0.994705
	1	4.712	0.065969	0.624566	0.877854	0.953318	0.979079	0.989398
0.05	16	0.628	0.613322	0.953143	0.989439	0.996498	0.998534	0.999285
	7	0.942	0.615577	0.953416	0.989499	0.996518	0.998542	0.999289
	4	1.257	0.601490	0.950598	0.988806	0.996281	0.998442	0.999239
	3	1.571	0.521417	0.933627	0.984575	0.994828	0.997824	0.998935
	2	2.356	0.312023	0.866000	0.966128	0.988284	0.994997	0.997532
	1	3.141	0.351502	0.877895	0.969305	0.989402	0.995478	0.997770
	1	3.927	0.163574	0.763457	0.932822	0.975696	0.989395	0.994705
	1	4.712	0.065969	0.624566	0.877854	0.953318	0.979079	0.989398
0.01	24	0.628	0.414631	0.906646	0.977605	0.992404	0.996786	0.998422
	11	0.942	0.395829	0.900552	0.975957	0.991822	0.996535	0.998298
	6	1.257	0.406252	0.903428	0.976714	0.992086	0.996649	0.998354
	4	1.571	0.381110	0.894743	0.974333	0.991241	0.996283	0.998173
	2	2.356	0.312023	0.866000	0.966128	0.988284	0.994997	0.997532
	1	3.141	0.351502	0.877895	0.969305	0.989402	0.995478	0.997770
	1	3.927	0.163574	0.763457	0.932822	0.975696	0.989395	0.994705
	1	4.712	0.065969	0.624566	0.877854	0.953318	0.979079	0.989398

Table 10 : Probability of acceptance for DSP (0, 1) plan when the life time of the item follows Inverse Rayleigh distribution

β	n	t/σ_0	σ/σ_0					
			2	4	6	8	10	12
0.25	21	0.628	0.999998959	1	1	1	1	1
	5	0.942	0.995419	1	1	1	1	1
	3	1.257	0.924989	1	1	1	1	1
	2	1.571	0.807422	0.999984	1	1	1	1
	1	2.356	0.641846	0.993905	0.999995	1	1	1
	1	3.141	0.407383	0.929656	0.998664	0.999995	1	1
	1	3.927	0.268744	0.793386	0.982143	0.999507	0.999995	1
	1	4.712	0.187559	0.641846	0.92961	0.993905	0.999756	0.999995
0.10	31	0.628	0.999997744	1	1	1	1	1
	7	0.942	0.991414	1	1	1	1	1
	4	1.257	0.881781	1	1	1	1	1
	3	1.571	0.674477	0.999965	1	1	1	1
	2	2.356	0.331407	0.980081	0.999984	1	1	1
	2	3.141	0.127557	0.807747	0.995469	0.999984	1	1
	1	3.927	0.268744	0.793386	0.982143	0.999507	0.999995	1
	1	4.712	0.187559	0.641846	0.92961	0.993905	0.999756	0.999995
0.15	38	0.628	0.999996619	1	1	1	1	1
	8	0.942	0.988997	1	1	1	1	1
	5	1.257	0.834372	1	1	1	1	1
	3	1.571	0.674477	0.999965	1	1	1	1
	2	2.356	0.331407	0.980081	0.999984	1	1	1
	2	3.141	0.127557	0.807747	0.995469	0.999984	1	1
	2	3.927	0.056403	0.540051	0.944539	0.998307	0.999984	1
	1	4.712	0.187559	0.641846	0.929610	0.993905	0.999756	0.999995
0.01	57	0.628	0.999992421	1	1	1	1	1
	12	0.942	0.976834	1	1	1	1	1
	7	1.257	0.734312	1	1	1	1	1
	5	1.571	0.441485	0.999907	1	1	1	1
	3	2.356	0.162213	0.960128	0.999965	1	1	1
	2	3.141	0.127557	0.807747	0.995469	0.999984	1	1
	2	3.927	0.056403	0.540051	0.944539	0.998307	0.999984	1
	2	4.712	0.028413	0.331407	0.807638	0.980081	0.999159	0.999984

Table 11 : Probability of acceptance for DSP (0, 1) plan when the life time of the item follows Marshall – Olkin extended exponential distribution

β	n	t/σ_0	σ/σ_0					
			2	4	6	8	10	12
0.25	5	0.628	0.572245	0.838297	0.917319	0.950105	0.966690	0.976208
	3	0.942	0.597524	0.854406	0.926967	0.956388	0.971076	0.979434
	2	1.257	0.626568	0.870873	0.936468	0.962459	0.975267	0.982493
	2	1.571	0.507200	0.813558	0.905631	0.943480	0.962470	0.973300
	1	2.356	0.588129	0.859558	0.932130	0.960379	0.974113	0.981787
	1	3.141	0.422015	0.772969	0.885762	0.932143	0.955250	0.968335
	1	3.927	0.291862	0.680254	0.831797	0.898131	0.932119	0.951661
	1	4.712	0.197978	0.588129	0.772931	0.859558	0.905348	0.932130
0.10	7	0.628	0.407687	0.739948	0.859231	0.912493	0.940510	0.956985
	5	0.942	0.351861	0.704620	0.838297	0.898966	0.931119	0.950105
	3	1.257	0.440224	0.7707234	0.880045	0.926865	0.950896	0.964800
	3	1.571	0.313281	0.683427	0.827246	0.892447	0.926886	0.947156
	2	2.356	0.273683	0.657982	0.813621	0.884364	0.921633	0.943502
	1	3.141	0.422015	0.772969	0.885762	0.932143	0.955250	0.968335
	1	3.927	0.291862	0.680254	0.831797	0.898131	0.932119	0.951661
	1	4.712	0.197978	0.588129	0.772931	0.859558	0.905348	0.932130
0.05	9	0.628	0.284532	0.642257	0.795719	0.869345	0.909600	0.933849
	6	0.942	0.265531	0.630859	0.789550	0.865640	0.907170	0.932147
	4	1.257	0.301051	0.668539	0.816302	0.884585	0.921072	0.942716
	3	1.571	0.313281	0.683427	0.827246	0.892447	0.926886	0.947156
	2	2.356	0.273683	0.657982	0.813621	0.884364	0.921633	0.943502
	2	3.141	0.136962	0.507380	0.710531	0.813653	0.870977	0.905683
	1	3.927	0.291862	0.680254	0.831797	0.898131	0.932119	0.951661
	1	4.712	0.197978	0.588129	0.772931	0.859558	0.905348	0.932130
0.01	13	0.628	0.135567	0.468394	0.665760	0.774529	0.838676	0.879203
	9	0.942	0.112084	0.437481	0.642257	0.757355	0.825851	0.869345
	6	1.257	0.136851	0.484292	0.682980	0.789299	0.850776	0.889086
	5	1.571	0.113686	0.452712	0.659292	0.772207	0.838134	0.879438
	3	2.356	0.121663	0.477106	0.683520	0.792314	0.854305	0.892486
	2	3.141	0.136962	0.507380	0.710531	0.813653	0.870977	0.905683
	2	3.927	0.066141	0.377443	0.606111	0.736678	0.813596	0.861762
	2	4.712	0.031479	0.273683	0.50732	0.657982	0.752363	0.813621

Table 12 : Probability of acceptance for DSP (0, 1) plan when the life time of the item follows Marshall – Olkin extended Lomax distribution

β	n	t/σ_0	σ/σ_0					
			2	4	6	8	10	12
0.25	3	0.628	0.519187	0.795393	0.889917	0.931706	0.953612	0.966473
	2	0.942	0.517087	0.790328	0.886266	0.929145	0.951752	0.96507
	2	1.257	0.381290	0.692030	0.822888	0.886122	0.920917	0.941978
	2	1.571	0.282403	0.599813	0.757181	0.839129	0.886151	0.915378
	1	2.356	0.427238	0.706659	0.828341	0.888553	0.922150	0.942663
	1	3.141	0.313845	0.596831	0.746481	0.828367	0.876836	0.907583
	1	3.927	0.237704	0.503780	0.668259	0.766719	0.828320	0.868865
	1	4.712	0.185358	0.427238	0.596788	0.706659	0.779015	0.828341
0.10	5	0.628	0.272428	0.608927	0.767551	0.847774	0.893044	0.920887
	3	0.942	0.323027	0.649925	0.795393	0.867257	0.907288	0.931706
	3	1.257	0.200855	0.518804	0.697177	0.795159	0.853081	0.889776
	2	1.571	0.282403	0.599813	0.757181	0.839129	0.886151	0.915378
	2	2.356	0.140414	0.411600	0.599906	0.716352	0.790203	0.83918
	2	3.141	0.076158	0.282536	0.467306	0.599953	0.692213	0.757286
	1	3.927	0.237704	0.503780	0.668259	0.766719	0.828320	0.868865
	1	4.712	0.185300	0.427238	0.596788	0.706659	0.779015	0.828341
0.05	6	0.628	0.194551	0.524150	0.704119	0.801255	0.858086	0.893854
	4	0.942	0.197204	0.521253	0.700600	0.798219	0.855614	0.891849
	3	1.257	0.200855	0.518804	0.697177	0.795159	0.853031	0.889776
	3	1.571	0.127500	0.409980	0.603845	0.721526	0.795206	0.843645
	2	2.356	0.140414	0.411600	0.599906	0.716352	0.790203	0.839180
	2	3.141	0.076158	0.282536	0.467306	0.599953	0.692213	0.757286
	2	3.927	0.044580	0.197007	0.362615	0.497695	0.599869	0.676225
	2	4.712	0.027785	0.140414	0.282491	0.411600	0.516888	0.599060
0.01	8	0.628	0.098779	0.380924	0.582618	0.706041	0.783552	0.834599
	6	0.942	0.072797	0.321817	0.524150	0.656499	0.742905	0.801255
	6	1.257	0.028952	0.19424	0.379481	0.523760	0.628267	0.703812
	5	1.571	0.026449	0.179698	0.358774	0.502495	0.608640	0.686385
	3	2.356	0.045706	0.225961	0.410084	0.549725	0.649746	0.721604
	3	3.141	0.018901	0.12759	0.275329	0.410136	0.519034	0.603988
	2	3.927	0.044580	0.197007	0.362615	0.497695	0.599869	0.676225
	2	4.712	0.027785	0.140414	0.282491	0.411600	0.516888	0.599060

7. EXAMPLES:

Suppose that the experimenter is interested in establishing that the true unknown average life is at least 1000 hours when the mean ratio $\sigma / \sigma_0 = 2$, with β= 0.05. Following are the results obtained when the lifetime of the test items follows the Rayleigh, Generalized Exponential distribution, Weibull distribution, Inverse-Rayleigh Distribution, Marshall – Olkin Extended Exponential Distribution and Marshall – Olkin Extended Lomax distribution.

7.1 Weibull Distribution : Let the distribution followed be Weibull, then we get the sample size as n = 4 for k = 2. The lot is accepted at given mean ratio $\sigma / \sigma_0 = 2$, during 942 hours with the plan parameters (4,8) satisfying the consumer's risk. From the Table 7, one can observe that the probability of acceptance for this sampling is 0.546656 .For the same measurements and plan parameters, the probability of acceptance is 0.999043 when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio $\sigma/\sigma_0 = 2$ is 0.003900,with the parameters (1,2) . Thus it is clear that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases .

7.2 Generalized Exponential Distribution: Let the distribution followed be Generalized Exponential **,** then we get the sample size as n = 7 for k = 2. The lot is accepted at given mean ratio $\sigma / \sigma_0 = 2$, during 942 hours with the plan parameters (7,14) satisfying the consumer's risk.. From the Table 8, one can observe that the probability of acceptance for this sampling is 0.462296. For the same measurements and plan parameters, the probability of acceptance is 0.997607, when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio $\sigma/\sigma_0 = 2$ is 0.207339, with the parameters (1,2) , Thus it is clear that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases.

7.3 Rayleigh Distribution*:* Let the distribution followed be Rayleigh**,** then we get the sample size as n = 7 for k = 2. The lot is accepted at given mean ratio $\sigma / \sigma_0 = 2$, during 942 hours, with the plan parameters (7,14) satisfying the consumer's risk. From the Table 9, one can observe that the probability of acceptance for this sampling is 0.615577 . For the same measurements and plan parameters the probability of acceptance is 0.999289, when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio σ/σ_0 = 2 is 0.065969, with the parameters (1,2) ,thus it is clear that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases.

7.4 Inverse-Rayleigh Distribution: Let the distribution followed be Inverse-Rayleigh**,** then we get the sample size as n = 8 for k = 2. The lot is accepted at given mean ratio σ/σ_0 = 2 , during 942 hours with the plan parameters (8,16) satisfying the consumer's risk. From the Table 10, one can observe that the probability of acceptance for this sampling is 0.988997. For the same measurements and plan parameters the probability of acceptance is1, when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio σ/σ_0 = 2 is 0.187559, with the parameters (1,2) , thus it is clear that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases.

7.5 Marshall – Olkin Extended Exponential Distribution : Let the distribution followed be Marshall – Olkin Extended Exponential , then we get the sample size as n = 6 for k = 2. The lot is accepted at given mean ratio σ/σ_0 = 2 , during 942 hours with the plan parameters (6,12) satisfying the consumer's risk. From the Table 11, one can observe that the probability of acceptance for this sampling from Table is 0.265531. For the same measurements and plan parameters the probability of acceptance is0.932147 when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio σ/σ_0 = 2 is 0.197978, with the parameters (1,2) , thus it is clear that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases.

7.6 Marshall – Olkin Extended Lomax Distribution : Let the distribution followed be Marshall – Olkin Extended Lomax**,** then we get the sample size as n = 4 for k = 2. The lot is accepted at given mean ratio σ/σ_0 = 2, during 942 hours with the plan parameters (4,8) satisfying the consumer's risk. From the Table 12, one can observe that the probability of acceptance for this sampling is 0.197204. For the same measurements and plan parameters the probability of acceptance is 0.891849, when the ratio of the unknown average life is 12. For the same conditions when the time of experiment is 4712 hours, the probability of acceptance for ratio σ/σ_0 = 2 is 0.027785, with the parameters (2,4) , which shows that as the time of experiment increases, the probability of acceptance for DSP(0,1) plan decreases.

8. COMPARISON OF THE RESULTS FOR DIFFERENT LIFETIME DISTRIBUTIONS AT VARIOUS QUALITY LEVELS ARE TABULATED:

Table No 13- comparison of the results for different lifetime distributions at various quality levels are tabulated:

Lifetime distribution	*n*	σ/σ_0					
		2	**4**	**6**	**8**	**10**	**12**
Generalized Exponential distribution	7	0.462296	0.893741	0.970876	0.989351	0.995278	0.997607
Marshall – Lomax extended Exponential distribution	4	0.197204	0.521253	0.700600	0.798219	0.855614	0.891849
Marshall – Olkin Extended Exponential distribution	6	0.265531	0.630859	0.789550	0.865640	0.907170	0.932147
Weibull distribution	4	0.546656	0.939516	0.986070	0.995345	0.998044	0.999043
Rayleigh distribution	7	0.615577	0.953416	0.989499	0.996518	0.998542	0.999289
Inverse Rayleigh distribution	8	0.988997	1	1	1	1	1

9. CONCLUSIONS:

In this paper,designing a special purpose Double sampling plan of Type DSP-(0,1) for the truncated life test is presented. The minimum sample size and the acceptance number are calculated, for various values of the mean ratios and different experiment times assuming that the lifetime of an item follows different distributions. When all the above tables (Table 6 to Table 12) are compared though ,the Lomax and weibull distributions are comparatively better than the other life time distributions in case of sample sizes, it is observed that the operating characteristic values of Inverse Rayleigh distribution increases disproportionately and reaches the maximum value 1 when σ/σ_0 is greater than 2 with the minimum sample size of (8,16). Obviously,from the figure 1 we can conclude that the operating characteristic values increases when the quality improves and can be used conveniently in practical situations to save the time and cost of life test experiments.

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