FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 6 No. 6, December, 2022, pp 271 - 279
DOI: https://doi.org/10.33003/fjs-2022-0606-1131

ON PERFORMANCE OF ACCEPTANCE SAMPLING PLANS USING SEQUENTIAL PROBABILITY RATIO TEST BASED ON TRUNCATED LIFE TESTS

A.B Zoramawa, N.S Dauran, H. Usman, *Ibrahim Sylvester

Faculty of Physical and Computing Science, Department of Statistics, Usmanu Danfodiyu University Sokoto, Nigeria

*Corresponding authors' email: ibrahimsylvester2@gmail.com

ABSTRACT

Sequential sampling procedure constitute a powerful tool to achieve experimental efficiency a sequence of sample are taken from the lot and allow the number of samples to be determined entirely by the result of the sampling process, it forms the basis of numerous sequential technique for different applications which was the special case for multiple acceptance plans, the performance of sequential probability ratio test provides better detection for a wide range of source strength and useful in choosing the best statistical test, which take less time to make decision, was developed on the software reliability measure based on failure intensity for the life time random variable for a truncated life test. In this paper, we considered the performance of acceptance sampling plans using sequential probability ration (SPRT) based on truncated life tests on Maxwell distribution and exponential distribution function in terms of obtaining the minimum number of sample sizes necessary to obtain specified average life time under a given consumer's and producer's risk. The SPRT provide an alternative to fix the plans that can help diminish producer and consumer risk of reaching at a wrong decision.

Keywords: ASN, Exponential Distribution, Maxwell Distribution, Sequential Probability Ratio Test

INTRODUCTION

The Acceptance sampling is an important field of statistical quality control that was popularized by Dodge and Romig (1943) and originally applied by the U.S. military to the testing of bullets during World War II. If every bullet was tested in advance, no bullets would be left to ship. If, on the other hand, none were tested, malfunctions might occur in the field of battle, with potentially disastrous results. The purpose of acceptance sampling is to decide whether a lot satisfies predetermined standards (specifications) for important characteristics of the item. Lots that satisfy these standards are passed or accepted; those that do not are rejected. Acceptance sampling is an inspection method that are widely use in vast area of industrial application and implementations to inspect a large numbers of items in a short amount of time without decreasing the quality of the items or inspection precision. Shahbaz et al, (2018) considered double ASP based on truncated life tests for the inverse Rayleigh distribution, Zoramawa et al, (2019) proposed double ASP based on the Burr type X distribution, Gui and Lu, (2018) the generalized inverse Weibull distribution, the transmuted inverse Rayleigh distribution Al-Omari, (2016) the Sushila distribution, Al-Omari, (2018) double ASP for transmuted generalized inverse Weibull distribution, Al-Omari and Zamanzade, (2017) proposed the generalized exponential distribution, Aslam et al (2010) the Weibull product distribution, Braimah et al, (2016) the Gamma distribution, Gupta and Groll, (1961) the log-logistic model, kantam et al, (2001) the inverse-gamma distribution, Al-Masri, (2018) ASP for Akash distribution, Al-Omari, (2020) length-biased weighted Lomax distribution, Al-Omari et al, (2021) three-parameter Lindley distribution, Al-Omari et al, (2020) double ASP for Half-Normal distribution, Al-Omari et al, (2016) and exponentiated generalized inverse Rayleigh distribution. Al-Omari et al, (2017) Also, see a mixed double sampling plan based on Cpk, Balamurali et al, (2020) design of variables sampling plans based on the lifetime-performance index in the presence of hybrid censoring scheme, Bhattacharya and Aslam, (2019) determination of multiple dependent state repetitive group sampling plan based on the process capability index, Usman et al, (2019) introduce Burr X-topp leone distribution, Zakari and Usman et al, (2020) considered beta-topp leone distribution, Balamurali and Aslam (2019) and selecting better process based on difference statistic using double sampling plan the Weighted Exponential Distribution, Gui and Aslam, (2017) the three-parameter Kappa distribution, Al-Omari, (2014) the Birnbaum Saunders model, Baklizi and El Masri, (2004) the Garima distribution, Al-Omari AI, (2018) the transmuted generalized inverse Weibull distribution, Al-Omari, (2018) the extended Exponential distribution, Al-Omari and Al-Hadhrami, Ibrahim et al, (2021) on extension of double acceptance sampling plans based on truncated life tests on the inverse Rayleigh distribution, Butt et al, (2019) Also, other ASPs are suggested by some researchers considering different methods. Zoramawa and Charanchi (2021) considered the sequential probability sampling using Bur type XII distribution for a monitoring a resubmitted lots, Zoramawa and Gulumbe (2021) proposed a sequential probability ratio test for a truncated life test using Rayleigh distribution, which give using SPRT and obtained the minimum number of inspection units to warrant a good decision. We proposed the Sequential probability ratio test analysis (SPRT) using some distribution function which was the special case for multiple acceptance plans. Under sequential sampling, sample size is not fixed instead sample are taken one at time, until a decision is made on the lot or process sampled, after each item is taken a decision is made to accept, reject or continue sampling. To the best of our knowledge, there are no studies about the acceptance sampling plans (ASPs) for the Maxwell and exponential distribution using life truncated life test on sequential probability ratio test (SPRT). The specific structure of this paper is as follows. Section1 introduction, Section 2 introduces the SPRT method of the study distribution, Section 3.Average sample number section 4 results and discussion. Section 5. Conclusion. The structure suggested Acceptance Sampling Plan (ASP) for Maxwell distribution and Exponential distribution function also, to analyze the sample sizes.

Sequential Probability Ratio Test for Maxwell and Exponential Distribution

Sequential probability ratio test (SPRT) treats the sample size for a particular procedure and aims to make it as small as possible and still make a decision. The ability to potentially reduce the sample size required to make a decision in an experiment has numerous applications because it leads to the conserving of resources, making funding easier to appropriate, Sequential probability ratio test was an extension of single and double sampling plan that determine the minimum number of observations required to terminate a sample, Opperman and Ning, (2019).

Assign formulas for the construction and evaluation of sequential plans values of $p_{1,} p_{2,} \alpha$ and β have derived by Wald (1947) and Statistical Research Group (1945) which are as follows:

$$h_1 = \frac{In\left(\frac{\beta}{1-\alpha}\right)}{\ln\left(\frac{p_2}{p_1}\right) - \ln\left(\frac{1-p_1}{1-p_2}\right)} \quad (1)$$

$$h_2 = \frac{\ln\left(\frac{1-\beta}{\alpha}\right)}{\ln\left(\frac{p_2}{p_1}\right) - \ln\left(\frac{1-p_1}{1-p_2}\right)} \quad (2)$$

$$s = \frac{\ln\left(\frac{1-p_1}{1-p_2}\right)}{\ln\left(\frac{p_2}{p_1}\right) - \ln\left(\frac{1-p_1}{1-p_2}\right)} > 0 \quad (3)$$

The acceptance and rejection line are determined as $Y_1 = -h_1 + sn$ (Acceptance line), $Y_2 = h_2 + sn$ (Rejection line)

Maxwell distribution it named after the famous Scottish physicist James Clerk Maxwell (1831 – 1879) the probability density function (pdf) of the distribution is given as:

$$f(x,\theta) = \frac{1}{\theta^3}\sqrt{\frac{2}{\pi}} x^2 e^{-\frac{x^2}{2\theta^2}} \quad (4)$$

Where the variable x with $x \geq 0$ and the parameter θ with θ>0 are real quantities, θ is simply the scale parameter

Assume we want to test if a component from a Maxwell distribution population with the parameter $u_1 = \theta_1$ or from a population with parameter u_2 and $\theta_2 (\theta_2 > \theta_1)$. The two likelihood functions given as:

$$\Phi_{\theta_1} = \prod_{1=i}^{n} \Phi_{\theta_1}(x_i) = \prod_{1=i}^{n} \left[\frac{1}{\theta_1^3}\sqrt{\frac{2}{\pi}} x^2 e^{-\frac{x^2}{2\theta_1^2}} \right] = \left(\frac{1}{\theta_1^3}\right)^n \prod_{1=i}^{n} e^{-\frac{x_i^2}{2\theta_1^2}}$$

$$\Phi_{\theta_2} = \prod_{1=i}^{n} \Phi_{\theta_2}(x_i) = \prod_{1=i}^{n} \left[\frac{1}{\theta_2^3}\sqrt{\frac{2}{\pi}} x^2 e^{-\frac{x^2}{2\theta_2^2}} \right] = \left(\frac{1}{\theta_2^3}\right)^n \prod_{1=i}^{n} e^{-\frac{x_i^2}{2\theta_2^2}} \quad (5)$$

The likelihood ratio is

$$R = In\left(\frac{\Phi_{\theta_2}}{\Phi_{\theta_1}}\right) = In\left(\frac{\prod_{1=i}^{n}\Phi_{\theta_2}}{\prod_{1=i}^{n}\Phi_{\theta_1}}\right) \quad (6)$$

$$= nIn\left(\frac{\theta_1^3}{\theta_2^3}\right) - \frac{\theta_1^2 + \theta_2^2}{2\theta_1^2\theta_2^2}\sum_{1=1}^{n} x_1^2$$

The decision equation for the log- likelihood ratio R is

$$L < R \; = -nIn\left(\frac{\theta_1^3}{\theta_2^3}\right) + \frac{\theta_1^2 + \theta_2^2}{2\theta_1^2\theta_2^2}\sum_{1=1}^{n} x_1^2 < V \quad (7)$$

Where L and V are the sequential probability ratio test function obtaining the decision regions

Equation becomes

$$=\frac{\theta_1^2+\theta_2^2}{2\theta_1^2\theta_2^2}\left[\left(\frac{\beta}{1-\alpha}\right)+nIn\left(\frac{\theta_1^3}{\theta_2^3}\right)\right]<\sum_{1=1}^{n}x_1^2<\frac{\theta_1^2+\theta_2^2}{2\theta_1^2\theta_2^2}\left[\left(\frac{1-\beta}{\alpha}\right)+nIn\left(\frac{\theta_1^3}{\theta_2^3}\right)\right] \quad (8)$$

The reliability function of the Maxwell distribution functions given by

$$R(x)=e^{-\frac{x^2}{2\theta^2}} \quad (9)$$

Therefore θ_1 and θ_2 are equals and the SPRT corresponding to the quantities of the θ_1 and θ_2 with β and α sampling plans satisfying the requirements regarding the tolerate probability risk testing strength with (β and α) for testing the hypothesis that $\theta=\theta_1$ against the alternative hypothesis $\theta=\theta_2$
equal slope will be given as:

$$S=\log\frac{\theta_1^3}{\theta_2^3}\left(\frac{1}{\theta_1^3}-\frac{1}{\theta_2^3}\right)^{-1} \quad (10)$$

and the intercept y_1 is equal to

$$h_1=\frac{\beta}{1-\alpha}\left(\frac{1}{\theta_1^3}-\frac{1}{\theta_2^3}\right)^{-1} \quad (11)$$

and the intercept y_2 is equal to

$$h_2=\frac{1-\beta}{\alpha}\left(\frac{1}{\theta_1^3}-\frac{1}{\theta_2^3}\right)^{-1} \quad (12)$$

The number of observation is measured along the horizontal axis since both h_1 and h_2 are linear function of n, will lie on a straight line y_1 and y_2 the two lines are parallel to each other. The probability density function (*pdf*) of the exponential distribution is:

$$f_{\Phi(y)}=\frac{1}{\Phi}e^{\left(-\frac{y}{\Phi}\right)} \quad (13)$$

For an observed failure time *t*, if it is from supplier M, then the “probability” of observing it is:

$$\Omega_\Phi=f_{\Phi(y)}\Delta y=\frac{1}{\Phi_M}e^{\left(-\frac{y}{\Phi_M}\right)}\Delta y \quad (14)$$

Where Δ*y* is a very small time duration around *y*.
If the observation is from supplier M, then the “probability” of observing it is:

$$\Omega_\Phi=f_{\Phi(y)}\Delta y=\frac{1}{\Phi_N}e^{\left(-\frac{y}{\Phi_N}\right)}\Delta y \quad (15)$$

The likelihood ratio of the above two probabilities are given by:

$$R=In\left[\frac{\prod_{i=1}^{n}\Delta\Phi_N}{\prod_{i=1}^{n}\Delta\Phi_M}\right]=In\left[\frac{\frac{1}{\Phi_N}e^{\left(-\frac{y}{\Phi_N}\right)}\Delta y}{\frac{1}{\Phi_M}e^{\left(-\frac{y}{\Phi_M}\right)}\Delta y}\right] \quad (16)$$

$$=\frac{\Phi_N-\Phi_M}{\Phi_N\Phi_M}\sum_{i=1}^{n}y_1^2-In\left[\frac{\Phi_N}{\Phi_M}\right]$$

Combining all the above equations, we get the decision formula for SPRT as the follows:

$$nIn\left[\frac{\Phi_1}{\Phi_2}\right]-\frac{\Phi_1-\Phi_2}{\Phi_2\Phi_1}\sum_{i=1}^{n}x_i^2$$

$$In\left(\frac{\beta}{1-\alpha}\right)<\frac{\Phi_N-\Phi_M}{\Phi_M\Phi_N}\sum_{i=1}^{n}x_i^2-nIn\left[\frac{\Phi_N}{\Phi_M}\right]<In\left(\frac{1-\beta}{\alpha}\right) \quad (13)$$

which is:

$$In\left(\frac{\beta}{1-\alpha}\right)+nIn\left[\frac{\Phi_N}{\Phi_M}\right]<\frac{\Phi_N-\Phi_M}{\Phi_M\Phi_N}\sum_{i=1}^{n}x_i^2<In\left(\frac{1-\beta}{\alpha}\right)+nIn\left[\frac{\Phi_N}{\Phi_M}\right] \quad (17)$$

The constant A and B are approximated by:

$$A \cong \frac{(1-\beta)}{\alpha}, B \cong \frac{\beta}{(1-\alpha)}$$

The result produce a linear equation that is a function of the number of success out of a given number of trials "n" and is bounded by a logarithm of the values A and B.

Average sample number (ASN)

The function plots the average sample size required before the null hypothesis is either is accepted or rejected as the function of the true value parameter being tested; the ASN can be plotted from the following fixed points:

$$\text{ASN} = \frac{h_1}{s}, \qquad for\ p = 0$$

$$\text{ASN} = \frac{(1-\alpha)h_1 - \alpha h_2}{(s - p_1)}, \qquad for\ p = p_1$$

$$\text{ASN} = \frac{h_1 h_2}{s(1-s)}, \qquad for\ p = s$$

$$\text{ASN} = \frac{(1-\beta)h_2 - \beta h_1}{p_1 - s}, \qquad for\ p = p_2$$

$$\text{ASN} = \frac{h_2}{1-s}, \qquad for\ p = 1$$

Decision Regions

Acceptance region:

Accept if $R(n, y) \le B$

i.e. if $y_1 \le -h_1 + sn$ (18)

Rejection region:

i.e. if $y_2 \ge h_2 + sn$ (19)

Continue sampling:

Continue if $[B \le R(n, x) \le A]$

i.e. if $-h_1 + s_n < x < h_1 + sn$ (20)

RESULT AND DISCUSSION

In this research we considered Triwijoyo, *et al* (2017), software reliability measure based on failure intensity with estimate value mean function during the testing phase for module1 failure intensity for the life time random variable for a truncated life test. However, we assume β =0.2 α =0.05 respectively. H_1= p_1 =0.01 acceptance quality level (AQL) and H_2 = p_2=0.02 lot tolerance percentage defective (LTPD) with "n" number of item to be tested and taking decision at each stage either continue, reject or to continue sampling on the sequential probability ratio test for Maxwell and exponential distribution using interval time failure from the soft ware reliability time measure .

Results

Table1: Function Representation of SPRT Template Result

RESULT	LOWER PROPORTION	HIGHER PROPORTION	ALPHA ERROR	BETA ERROR
SPRT for Maxwell Function Representation				
$r_n = h_1 + sn = 1941.46 + 738.46n < y < -1091.44 + 738.46n = h_2 + sn$	98% $\theta_1 = 10.17$	99% $\theta_2 = 14.41$	0.05%	0.2%
SPRT For Exponential Distribution				
$r_n = h_1 + sn = 401.3732 + 70.356n > y > -225.57 + 70.356n = h_2 + sn$	98% $\Phi_2 = 207.786$	99% $\Phi_1 = 127.8229$	0.05%	0.2%

Table 2: SPRT Result Maxwell Function IFT Module2 at P_1= 0.9835, P_2= 0.9753 n =22

$$\beta = 0.2, \alpha = 0.05, \theta_1 = 10.17, \theta_2 = 14.41$$

$$r_n = h_2 + sn = 1941.46 + 738.46n < y < -1091.44 + 738.46n = -h_1 + sn$$

Stage	n.s	h_2	h_1	Accept	reject	Acceptance number of observation (an)	Reject number of observation (rn)
1	738.46	1941.12	-1091.44	-352.98	2679.58	0	1.209535
2	1476.92	1941.12	-1091.44	385.48	3418.04	0.522005	1.542868
3	2215.38	1941.12	-1091.44	1123.94	4156.5	1.522005	1.876202
4	2953.84	1941.12	-1091.44	1862.4	4894.96	2.522005	2.209535
5	3692.3	1941.12	-1091.44	2600.86	5633.42	3.522005	2.542868
6	4430.76	1941.12	-1091.44	3339.32	6371.88	4.522005	2.876202

7	5169.22	1941.12	-1091.44	4077.78	7110.34	5.522005	3.209535
8	5907.68	1941.12	-1091.44	4816.24	7848.8	6.522005	3.542868
9	6646.14	1941.12	-1091.44	5554.7	8587.26	7.522005	3.876202
10	7384.6	1941.12	-1091.44	6293.16	9325.72	8.522005	4.209535
11	8123.06	1941.12	-1091.44	7031.62	10064.18	9.522005	4.542868
12	8861.52	1941.12	-1091.44	7770.08	10802.64	10.52201	4.876202
13	9599.98	1941.12	-1091.44	8508.54	11541.1	11.52201	5.209535
14	10338.44	1941.12	-1091.44	9247	12279.56	12.52201	5.542868
15	11076.9	1941.12	-1091.44	9985.46	13018.02	13.52201	5.876202
16	11815.36	1941.12	-1091.44	10723.92	13756.48	14.52201	6.209535
17	12553.82	1941.12	-1091.44	11462.38	14494.94	15.52201	6.542868
18	13292.28	1941.12	-1091.44	12200.84	15233.4	16.52201	6.876202
19	14030.74	1941.12	-1091.44	12939.3	15971.86	17.52201	7.209535
20	14769.2	1941.12	-1091.44	13677.76	16710.32	18.52201	7.542868
21	15507.66	1941.12	-1091.44	14416.22	17448.78	19.52201	7.876202
22	16246.12	1941.12	-1091.44	15154.68	18187.24	20.52201	8.209535

Table2: Thus, for n=22, for Maxwell distribution function with SPRT for inter fault time, the acceptance number is 1 and the rejection number is 2, therefore the lot cannot be accepted until at least 2 units have been tested then we make decision to accept the lot.

Table 3: SPRT Result Exponential Function IFT Module1 At P_1= 0.9835, P_2= 0.9753 n =22

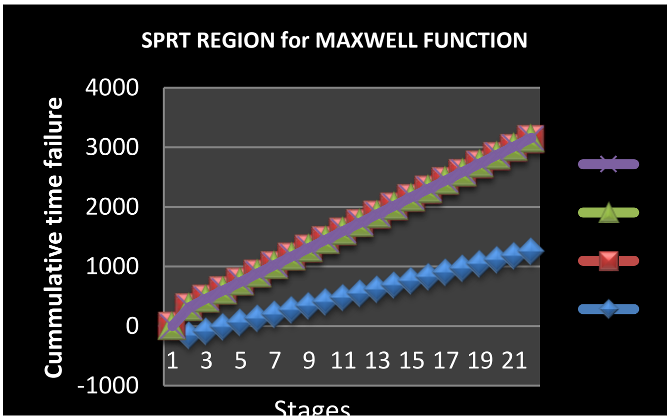
$\beta = 0.2, \alpha = 0.05, \theta_1 = 28.06, \theta_2 = 39.78$

TABLE 3: $r_n = h_2 + sn = 401.3732 + 70.356n > y > -225.57 + 70.356n = h_1 + sn$

Stage	n.s	h_2	h_1	Accept	Reject	Acceptance number of observation (an)	Acceptance number of observation (rn)
1	70.3567	401.373	-225.57	-155.21	471.73	0	2.234944
2	140.713	401.373	-225.57	-84.857	542.087	0	2.568278
3	211.07	401.373	-225.57	-14.5	612.443	0	2.901611
4	281.427	401.373	-225.57	55.8568	682.8	0.793909	3.234944
5	351.784	401.373	-225.57	126.214	753.157	1.793909	3.568278
6	422.14	401.373	-225.57	196.57	823.513	2.793909	3.901611
7	492.497	401.373	-225.57	266.927	893.87	3.793909	4.234944
8	562.854	401.373	-225.57	337.284	964.227	4.793909	4.568278
9	633.21	401.373	-225.57	407.64	1034.58	5.793909	4.901611
10	703.567	401.373	-225.57	477.997	1104.94	6.793909	5.234944
11	773.924	401.373	-225.57	548.354	1175.3	7.793909	5.568278

12	844.28	401.373	-225.57	618.71	1245.65	8.793909	5.901611
13	914.637	401.373	-225.57	689.067	1316.01	9.793909	6.568278
14	984.994	401.373	-225.57	759.424	1386.37	10.79391	6.568278
15	1055.35	401.373	-225.57	829.781	1456.72	11.79391	6.901611
16	1125.71	401.373	-225.57	900.137	1527.08	12.79391	7.234944
17	1196.064	401.373	-225.57	970.494	1597.44	13.79391	7.568278
18	1266.421	401.373	-225.57	1040.85	1667.79	14.79391	7.901611
19	1336.777	401.373	-225.57	1111.21	1738.15	15.79391	8.234944
20	1407.134	401.373	-225.57	1181.56	1808.51	16.79391	8.568278
21	1477.491	401.373	-225.57	1251.92	1878.86	17.79391	8.901611
22	1547.847	401.373	-225.57	1322.28	1949.22	18.79391	9.234944

Table3**:** Thus, for n=22, for exponential distribution function with SPRT for inter fault time, the acceptance number is 1 and the rejection number is 3, therefore the lot cannot be accepted until at least 4 units have been tested then we make decision to accept the lot.



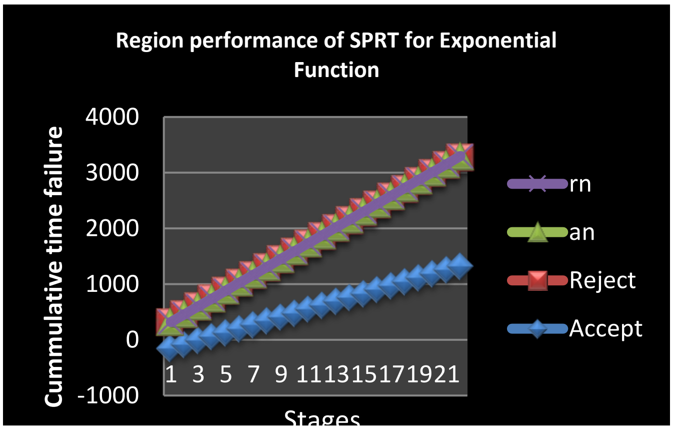


Figure 1: Region of SPRT for Maxwell and Exponential Performance IFT Module2

Figure 1: show the graphical performance of SPRT for Maxwell distribution function, (LHS) and the process show to stop and accept the process at second stage of the experiment and for exponential distribution (RHS) to stop the process at third stage and terminate the experiment and make decision to accept the lot.

Result comparison for Maxwell distribution and exponential distribution function

We observed that for Maxwell distribution function for n=22, with SPRT for inter fault time, the acceptance number is 1 and the rejection number is 2, therefore the lot cannot be accepted until at least 2 units have been tested then we make decision to accept the lot, thus using exponential distribution function for n=22, with SPRT for inter fault time, the acceptance number is 1 and the rejection number is 3, therefore the lot cannot be accepted until at least 4 units have been tested then we make decision to accept the lot, therefore Maxwell distribution function has a minimum number of observation to make decision in accepting a lot.

Table 4: Average Sample Size (ASN) for Maxwell Functions IFT Module's

P	IFT MODULE MDF	IFT MODULE3 EDF	Decision for Maxwell distribution function	Decision Exponential distribution function
			$n \ge \frac{h_2}{1-s}$ *Reject* $n \ge \frac{h_1}{s}$ *Accept*	$n \ge \frac{h_2}{1-s}$ *Reject* $n \ge \frac{h_1}{s}$ *Accept*
ASN	**ASN P=0** $\frac{h_1}{s}$	**ASN P=0** $\frac{h_1}{s}$	**P**	**P**
P=0	2.63	5.705	0	0
ASN	ASN P=P1 $\frac{(1-\alpha)\left(h_1-\alpha h_2\right)}{S-P_1}$	ASN P=P1 $\frac{(1-\alpha)\left(h_1-\alpha h_2\right)}{S-P_1}$	P	P
P=P1	1.798	5.648	0.05	0.05
ASN	$\frac{h_1 h_2}{S(1-S)}$	$\frac{h_1 h_2}{S(1-S)}$	P	P
P=S	3.89	18.55	738.46	70.3567
ASN	$\frac{(1-\beta)(h_2-\beta h_1)}{P_1-S}$	$\frac{(1-\beta)(h_2-\beta h_1)}{P_1-S}$	P	P
P=P2	2.006	3.53	0.20	0.20
ASN	P=1 $\frac{h_2}{1-S}$	P=1 $\frac{h_2}{1-S}$	P	P
P=1	1.48	3.253	1	1

Table (4) show the five point compute value of ASN for the study distribution function i.e. ASN for Maxwell distribution function (LHS) and ASN for Exponential distribution (RHS)

$$n \ge \frac{h_2}{1-s}\ Reject = 2.63 \square\ 3 \quad n \ge \frac{h_2}{1-s}\ Reject = 5.705 \square\ 6$$

$$n \ge \frac{h_1}{s}\ Accept = 1.48 \square\ 2 \quad n \ge \frac{h_1}{s}\ Accept = 3.252 \square\ 3$$

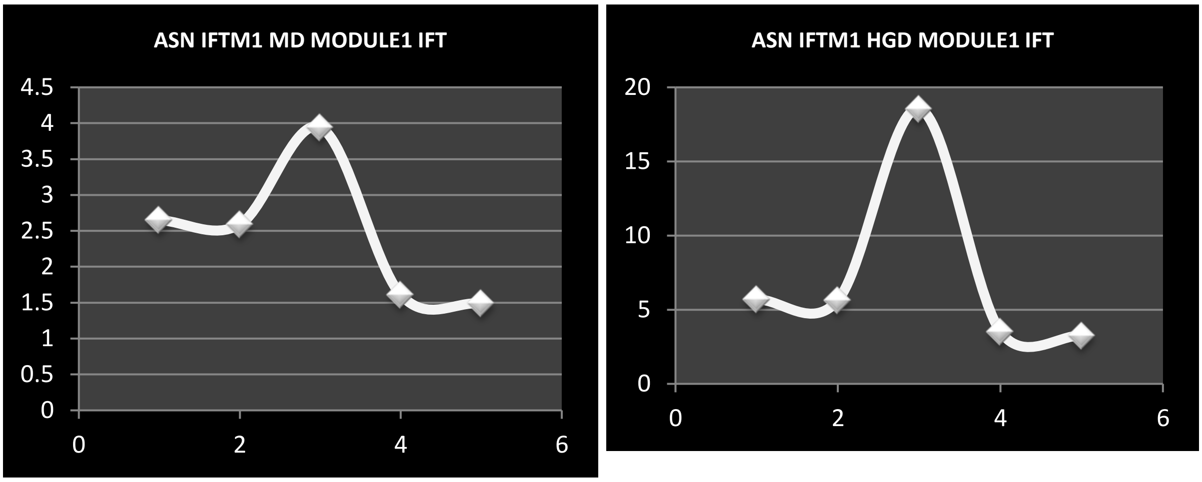


Figure 2: Average Sample Number (ASN) for Maxwell (LHS) and Exponential (RHS) Distribution

From figure (2), we show the five-point average sample number for each of the study distribution was plot.

CONCLUSION

We determine the Sequential probability ratio test (SPRT) using Maxwell distribution and exponential function. Under sequential sampling plan sample size is not fixed instead sample are taken one at time, until a decision is made on the lot or process sampled, after each item is taken a decision is made to accept, reject or continue sampling. The Proposed plan yields the minimum efficient average sample number to accept the process. The SPRT provide an alternative to fix the plans that can help diminish producer and consumer risk of reaching at a wrong decision. We show the SPRT graphical performance; five points average sample number was plots, the sequential hypothesis testing procedure constitute a powerful tools to achieve experimental efficiency fewer item required to make decision than the double sampling procedure.

REFERENCES

Al-Masri AA (2018) Acceptance sampling plans based on truncated life tests in the inverse-gamma model. *Electron J Appl Stat Anal* ; 11(2): 397–404.

Al-Nasser AD, Gogah F. (2017) On using the median ranked set sampling for developing reliability test plans under generalized exponential distribution. *Pak J Stat Oper Res* 4: 757–774.

Al-Nasser AD, Gogah FS (2018) Median ranked acceptance sampling plans for exponential distribution. *Afrika Matematika* 229(3–4): 477–497.

Al-Omari AI (2014) Acceptance sampling plans based on truncated lifetime tests for transmuted inverse Rayleigh distribution. *Econ Qual Control* 31(2): 85–92.

Al-Omari AI (2014) Acceptance sampling plan based on truncated life tests for three parameter Kappa distribution. *Econ Qual Control* ; 29(1): 53–62.

Al-Omari AI (2015) Time truncated accepance sampling plans for generalized inverted exponential distribution. *Electron J Appl Stat Anal* 8(1): 1–12.

Al-Omari AI (2018) Improved acceptance sampling plans based on truncated life tests for Garima distribution. *Int J Syst Assur Eng Manage* 9(6): 1287–1293.

Al-Omari AI (2018) The transmuted generalized inverse Weibull distribution in acceptance sampling plans based on life tests. *Trans Inst Meas Controll* 40(16): 4432–4443.

Al-Omari AI (2018) Acceptance sampling plans based on truncated life tests for Sushila distribution. *J Math Fundam Sci* 50(1): 72–83.

Al-Omari AI, Al-Hadhrami SA (2018) Acceptance sampling plans based on truncated life tests for Extended Exponential distribution. *Kuwait J* 2018; 45(2): 89–99.

Al-Omari AI, Almanjahie IM, Kravchuk O (2021) Acceptance sampling plans with truncated life tests for the length-biased weighted Lomax distribution. *Comput Mater Cont* ; 67(1): 385–301.

Al-Omari AI, Al-Nasser AD, Ciavolino E (2020) Economic design of acceptance sampling plans for truncated life tests using three-parameter Lindley distribution. *J Mod Appl Stat Meth* 18(2): 1–15.

Al-Omari AI, Al-Nasser AD, Gogah FS (2016) Double acceptance sampling plan for time truncated life tests based on half-normal distribution. *Econ Qual Control* 31(2): 93–99.

Al-Omari AI, Al-Nasser AD, Gogah FS, et al. (2017) On exponentiated generalized inverse Rayleigh distribution based on truncated life tests in double acceptance sampling plan. *Econ Qual Control* ; 32(1): 37–47.

Al-Omari AI, Koyuncu N, Al-anzi ARA (2020) New acceptance sampling plans based on truncated life tests for Akash distribution with an application to electric carts data. *IEEE Access* ; 8: 201393–201403.

Al-Omari AI, Santiago A, Sautto A, et al (2018) New Weibull-Pareto distribution in acceptance sampling plans based on truncated life tests. *Am J Math Stat* (5): 144–150.

Al-Omari AI, Zamanzade E (2017) Double acceptance sampling plan for time truncated life tests based on transmuted generalized inverse Weibull distribution. *J Stat Appl Prob* 6(1): 1–6.

Al-Omari AI. (2016) Time truncated acceptance sampling plans for Generalized Inverse Weibull distribution. *J Stat Manage Syst* ; 19(1): 1–19.

Aslam M, Kundu D, Ahmad M (2010) Time truncated acceptance sampling plans for generalized exponential distribution. *J Appl Stat* 37(4): 555–556.

Baklizi A, El Masri A (2004) Acceptance sampling based on truncated life tests in the Birnbaum Saunders model. *Risk Anal* ; 24(6): 1453–1457.

Balamurali S, Aslam M (2019) Determination of multiple dependent state repetitive group sampling plan based on the process capability index. *Seq Anal* 38(3): 385–399.

Balamurali S, Aslam M, Ahmad L, et al (2020) A mixed double sampling plan based on Cpk. *Commun Stat Theory Meth* ; 49(8): 1840–1857.

Bhattacharya R, Aslam M (2019) Design of variables sampling plans based on lifetime performance index in presence of hybrid censoring scheme. *J Appl Stat* ; 46(16): 2975–2986.

Braimah OJ, Osanaiye PA, Edokpa IW (2016) Improved single truncated acceptance sampling plans for Weibull product life distributions. *J Natl Assoc Math Phys* ; 38: 451–460.

Butt KA, Aslam M, Wang FK. (2019) Selecting better process based on difference statistic using double sampling plan. *Commun Stat Theory Meth* 48(11): 2641–2656.

Dodge H.F. (1943) A sampling inspection plan for continuous production. *Annals of Mathematical Statistics*, 14, 264-279.

Gui W, Aslam M (2017) Acceptance sampling plans based on truncated life tests for weighted exponential distribution. *Commun Stat Simul Comput* 46(3): 2138–2151.

Gui W, Lu X (2018) Double acceptance sampling plan based on the Burr type X distribution under truncated life tests. *Int J Ind Syst Eng* 28(3): 319–330.

Gupta SS, Groll PA (1961) Gamma distribution in acceptance sampling based on life tests. *J Am Stat Assoc* ; 56: 942–970.

Ibrahim, Sylvester, A.B. Zoramawa, N.S Dauran, M.M Hamza, David saiki Suru, (2021) a study on extension of double acceptance sampling plans based on truncated life tests on the inverse Rayleigh distribution"Iconic and engineering journals 5(5):2456-8880

Joseph BO, Asanaiye OP (2017) Truncated hybrid double acceptance sampling plan for Weibull product life distribution. *Am J Manage Sci Eng*; 2(5): 80–88.

Kantam RRL, Rosaiah K, Rao GS (2001) Acceptance sampling based on life tests: log-logistic model. *J Appl Stat* ; 28: 121–128.

Malathi D, Muthulakshmi S (2017) Economic design of acceptance sampling plans for truncated life test using Frechet distribution. *J Appl Stat* ; 44(2): 376–384.

Opperman, L. and Ning, W. (2019) Sequential probability ratio test for skew normal distribution. *Communications In Statistics Simulation and Computation* h ttps://doi.org/10.1080/03610918.2019.1614623

Shahbaz SH, Khan K, Shahba MQ (2018) Acceptance sampling plans for finite and infinite lot size under power Lindley distribution. *Symmetry* 10(10): 496: 1–13.

Triwijoyo, Bambang Krismono; Gaol, Ford Lumban; Soewito, Benfano; Warnars, Harco Leslie Hendric Spits (2017). *[IEEE 2017 3rd International Conference on Science in Information Technology (ICSITech) - Bandung (2017.10.25-2017.10.26)] 2017 3rd International Conference on Science in Information Technology (ICSITech) - Software reliability measurement base on failure intensity. , (), 176–181.* doi:10.1109/ICSITech.2017.8257106

Usman, U., Musa, Y., Muhammed, A.B. and Zakari, Y.(2019) On the burr X-topp leone distribution. Annels of Computer science series, 17(1), 57-69.

Wald, A. (1947). *Sequential Analysis*. John Wiley and Sons.

Zakari, Y, Usman U (2020) Contruction of beta-topp leone distribution. FUW trends in science & technology Journal, 5(1) 306-309

Zoramawa A.B., Musa Y, Usman U. (2019) Double acceptance sampling plans based on truncated life tests for the inverse Rayleigh distribution. *Cont J Appl Sci* 13(2): 18–28.

Zoramawa, A. B., Gulumbe S. U, (2021) On sequential probability sampling plan for a truncated life test using inverse Rayleigh distribution 15(1):1-7, 2021;doi: 10.9734/AJPAS/2021/v15il30339

Zoramawa, A.B, Charanchi, A.S (2021) A study on sequential probability sampling for monitoring a resubmitted lots under Bur XII distribution, continental. Applied science doi:10.528//zenodo.5540382