CERTAIN RESULTS ON TIGHTENED-NORMAL-TIGHTENED REPETITIVE DEFERRED SAMPLING SCHEME (TNTRDSS) INDEXED THROUGH BASIC QUALITY LEVELS

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Abstract ***- The present work, examines Tightened-Normal-Tightened Sampling Scheme with Repetitive Deferred Sampling plan as the reference plan, designated as (TNTRDSS)-(n; u_1, u_2; v_1, v_2; i) indexed through producer's risk and consumer's risk for specified Acceptable Quality Level (AQL) and Limiting Quality Level (LQL) using Poisson distribution. Unity values have been tabulated to facilitate the construction and selection of the scheme. Few illustrations were provided for the proposed work.***

Keywords: *Tightened-Normal-Tightened, Repetitive Deferred Sampling, Operating Characteristic curve, Acceptable Quality Level (AQL) and Limiting Quality Level (LQL).*

1. INTRODUCTION

Acceptance sampling is an effective Quality Control tool, which deals with the procedures in which decision to accept or reject lots or process based on their examination of samples. Acceptance sampling is playing a key role in improving the quality. The basic aim of any industries in the world is to improve the quality of their products. The high quality of products may have the high probability of acceptance. Accordingly sampling plans are widely used in manufacturing industries, pharmaceutical products and so on specifically in the areas of compliance and safety inspection of the products. According to Schilling (1982) the tightened-normal-tightened (TNT) sampling schemes are popularly used in compliance sampling.

2. TIGHTENED NORMAL TIGHTENED SAMPLING SCHEME

Tightened Normal Tightened (TNT) is a sampling scheme involving switching between two sampling plans. MIL-STD-105D contains a sampling scheme with a fixed sample size but with two different acceptance numbers. TNT sampling scheme can also be accomplished by maintaining the acceptance criteria and switching between two sample sizes. This approach is particularly appealing with zero acceptance number plans.

Calvin T.W (1977) has introduced Tightened Normal Tightened Sampling Scheme utilizing zero acceptance number in two single sampling plans with different sample sizes, namely, n_1 and n_2 ($< n_1$) together with the switching rules, which is designated as TNT-(n_1, n_2; 0). Soundararajan and Vijayaraghavan (1992) have developed TNT-(n_1, n_2; c) scheme for various entry parameters. Further they have proposed another type of TNT sampling scheme using one sample size and two acceptance numbers, designated as TNT-(n; c_1, c_2) scheme. This scheme utilizes the single sampling plan with tightened plan of sample size n and acceptance number c_1 as well as single sampling plan with normal plan of sample size n and acceptance number c_2. Radhakrishnan and Sivakumaran (2010) have proposed TNT-(n_1, n_2; c) indexed through Six Sigma Quality Level-1 (SSQL-1) and Six Sigma Quality Level-2 (SSQL 2). Further they have proposed TNT-(n_1, n_2; c) indexed through Producer's Nano Quality Level (PNQL) and Consumer's Nano Quality Level (CNQL). Subramani and Haridoss (2012) have proposed Tightened-Normal-Tightened system for given values of the Acceptable Quality Level and Limiting Quality Level using Weighted Poisson distribution.

3. REPETITIVE DEFERRED SAMPLING PLAN

In Repetitive Deferred Sampling plan, the acceptance or rejection of a lot in deferred state is dependent on the inspection results of the preceding or succeeding lots under Repetitive Group Sampling (RGS) inspection. RGS is the particular case of RDS plan.

Sankar and Mahopatra (1991) has developed the RDS plan which is an extension of the Multiple Deferred Sampling plan MDS-*(*c_1*,* c_2*)* which was proposed by Rambert Vaerst (1980). Lilly Christina (1995) has given the procedure for the selection of RDS plan with given acceptable quality levels and also compared RDS plan with RGS plan with respect to operating ratio (OR) and ASN curve. Suresh and Saminathan, (2010) present are construction and selection of Repetitive Deferred Sampling (RDS) plan through Acceptable and Limiting Quality Levels. Suresh and Vinitha Xavier (2014) presents a new procedure and tables for minimum sum of risk of a Generalized Two Plan system of type GTPS-*(n;* c_N*,* c_T*)* with Repetitive Deferred Sampling Plan as reference plan indexed through Acceptable Quality Level (AQL) and Limiting Quality Level (LQL).

4. Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)

Here, the construction and selection of Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS) for different parameter '*s*' and '*t*' are carried out under Poisson model. The sampling plan was indexed through Incoming and Outgoing Quality levels. Performance measures are indicated for Acceptable Quality Level (AQL), Limiting Quality Level (LQL) and Indifference Quality Level (IQL). Necessary tables and procedures were given for designing the scheme through various entries of plan parameters.

4.1. Designation

Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)-(n; u_1, u_2; v_1, v_2; i) refers to a Tightened-Normal-Tightened sampling inspection where the normal RDS plan has a sample size n and acceptance number u_1, u_2 ($u_1 < u_2$) and the tightened RDS plan has a sample size n and acceptance number v_1, v_2 ($v_1 < v_2$, $v_1 \le u_1$ and $v_2 \le u_2$).

4.2. Operating Procedure for TNTRDSS

The Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS) is carried out through the following steps.

Step 1: Draw a random sample of size n and test each unit for conformance for the specified requirements

Step 2: Inspect under tightened inspection using the Repetitive Deferred Sampling plan with sample size n and acceptance number v_1 and v_2 ($v_2 > v_1$). If '*t*' lots in a row are accepted under tightened inspection, switch to normal inspection (step 3).

Step 3: Inspect under normal inspection using the Repetitive Deferred Sampling plan with sample size n and acceptance number u_1 and u_2 ($u_2 > u_1$). Switch to tightened inspection, if an additional lots is rejected in the next '*s*'.

Thus, the Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS) has eight parameters. They are n; u_1, u_2; v_1, v_2, s, t and i.

When s = 4 and t = 5, the above procedure corresponds to MIL-STD-105D involving only tightened and normal inspection. When i =1 RDS plan reduces to Repetitive Group sampling plan.

4.3. Operating Characteristics Function

According to Calvin (1977) the expression for OC function of TNT is given by,

$$P_a(p) = \frac{P_T(1-P_N^s)(1-P_T^t)(1-P_N) + P_N P_T^t(1-P_T)(2-P_N^s)}{(1-P_N^s)(1-P_T^t)(1-P_N) + P_T^t(1-P_T)(2-P_N^s)} \quad (1)$$

Where,

P_T and P_N are probability of acceptance under tightened and normal inspections.

4.4. Designing TNTRDSS for given p_1, p_2, α and β

For construction and evaluation of the Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)-(n; u_1, u_2; v_1, v_2; i), the values presented in tables were derived under the procedure stated by Duncan [1965]. Tables are used to derive individual plan to meet specified values of fraction defectives and probability of acceptance.

Tables can be used to select Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)-(n; u_1, u_2; v_1, v_2; i) for given p_1, p_2, α and β by using the following steps.

Step 1: Specify p_1 - AQL, p_2 - LTPD, producer risk *(*α*)* and consumer risk *(*β*)*.
Step 2: Compute the operating ratio is OR = p_2 / p_1.

Step 3: Select the value p_2 / p_1 in Table 4 in the column for appropriate α and β that is nearly equal to the computed OR.

Step 4: Determine the plan parameters of u_1, u_2, v_1 and v_2 corresponding to the value of p_2 / p_1 located.

Step 5: Determine the value of np_1 from Table 1 corresponding to the parameters u_1, u_2, v_1 and v_2.

Step 6: The sample size of the scheme is then determined by np_1 by p_1.

Step 7: Thus, the values of n, u_1, u_2, v_1 and v_2 constitute the required TNTRDSS-(n; u_1, u_2; v_1, v_2; i) scheme.

4.5. Plotting the OC curve of TNTRDSS

Table 1 can be used to obtain eight values of p and $P_a(p)$ to plot the OC Curve of a given Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme TNTRDSS-(n; u_1, u_2; v_1, v_2).

Example 1:

Suppose a Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS) is desired with $P_a(p_1)$ = 0.95 for having p_1 = 0.01 and p_2 = 0.75 then, p_1 = 0.02, α = 0.05, p_2 = 0.08 and β = 0.10.

1. OR = p_1 / p_2 = 0.08 / 0.02 = 4.
2. The operating ratio is OR = 4 in the table 1 which is nearest to the desired ratio is 3.976.
3. Corresponding plan parameters are u_1 = 3, u_2 = 5, v_1 = 2, v_2 = 3 when, s = 4, t = 5 and i = 1 of computed OR.
4. The np_1 value in Table 1 corresponding to the parameters u_1, u_2, v_1 and v_2 is 1.3437.
5. The sample size n = np_1 / p_1 = 1.3437/ 0.02 = 67.185 ≈ 66.

The OC curve is obtained by dividing the values of np is given below $Pa(p)$.

Pa(p)	P
0.99	0.01213
0.95	0.02036
0.90	0.02496
0.75	0.03297
0.50	0.04399
0.25	0.06061
0.10	0.08089
0.05	0.09542
0.01	0.12709

The desired system is Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)-(66; 3, 5; 2, 3) when, s = 4, t = 5 and i = 1.

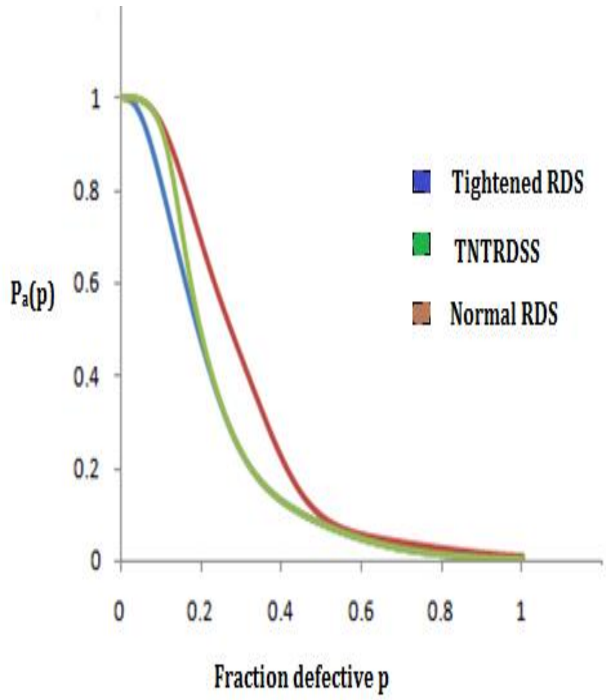

Figure 1: OC curve for TNTRDSS-(n; u_1, u_2; v_1, v_2) when, i = 1.

Figure 1 gives the OC curves of Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme TNTRDSS-(n; u_1, u_2; v_1, v_2; i) for the parameter (66, 3, 5; 2, 3) and s = 4, t = 5 when i = 1. From the figure, it is observed that the system utilizes the normal RDS plan when the quality of lot is good and the tightened RDS plan when the quality is poor. Further, it is observed that the incoming and outgoing quality of lot is good rather than the ordinary RDS.

5. CONSTRUCTION OF TABLES

The expression for probability of acceptance of Tightened-Normal-Tightened Repetitive Deferred Sampling Scheme (TNTRDSS)-(n; u_1, u_2; v_1, v_2; i), under the assumption of Poisson model, the composite OC function is given by equation (1) with

$$P_T = \frac{\sum_{r=0}^{v_1}\frac{e^{-x}x^r}{r!}\left(\sum_{r=0}^{v_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{v_1}\frac{e^{-x}x^r}{r!}\right)^i + \left(\sum_{r=0}^{v_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{v_1}\frac{e^{-x}x^r}{r!}\right)\left(\sum_{r=0}^{v_1}\frac{e^{-x}x^r}{r!}\right)^i}{\left(\sum_{r=0}^{v_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{v_1}\frac{e^{-x}x^r}{r!}\right)^i} \tag{2}$$

$$P_N = \frac{\sum_{r=0}^{u_1}\frac{e^{-x}x^r}{r!}\left(\sum_{r=0}^{u_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{u_1}\frac{e^{-x}x^r}{r!}\right)^i + \left(\sum_{r=0}^{u_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{u_1}\frac{e^{-x}x^r}{r!}\right)\left(\sum_{r=0}^{u_1}\frac{e^{-x}x^r}{r!}\right)^i}{\left(\sum_{r=0}^{u_2}\frac{e^{-x}x^r}{r!} - \sum_{r=0}^{u_1}\frac{e^{-x}x^r}{r!}\right)^i} \tag{3}$$

Respectively with $u_1 < u_2$ and $v_1 < v_2$, For given values of u_1, u_2, v_1, v_2, i and $P_a(p)$, the equation 1 can be solved after substituting the expressions P_T and P_N, to get np using the method of iteration for different values of '*s*' and '*t*'. Different '*s*' and '*t*', np values for given u_1, u_2, v_1, v_2, i and $P_a(p)$ are obtained and from the np values for assumed values of α and β, the OR = p_2 / p_1 are obtained and furnished in Table 1 to 3.

6. GLOSSARY OF SYMBOLS USED

$P_a(p)$	= Probability of accepting a lot quality p
p	= Fraction defective
p_1	= Acceptable quality level (AQL)
p_2	= Limiting quality level (LQL)
p_0	= Indifference Quality Level (IQL)
P_T	= Proportion of lots expected to be accepted using Tightened inspection.
P_N	= Proportion of lots expected to be accepted using Normal inspection.
OR	= Operating Ratio
d	= Defectives
α	= Producer's risk
β	= Consumer's risk

7. CONCLUSION

Acceptance sampling is an effective Quality Control tool, which deals with the procedures in which decision to accept or reject lots or process based on their examination of samples. The work presented in this paper mainly relates to the procedure for construction and selection of tables for Tightened-Normal-Tightened plan with Repetitive Deferred sampling plan as reference plan which is called as TNTRDSS indexed through consumer and producer quality levels. Sampling schemes determined by this method may have better sample size providing by the required information to accept or reject the lot for given quality levels (AQL, $1-\alpha$) and (LQL, β). The Operating Characteristic (OC) curve is also carried out for the proposed sampling scheme which is derived based on exact sampling distribution.

Based on OC curve comparison has made for normal, tightened and TNTRDSS for various '*s*' and '*t*', to find that under s = 4 and t = 5 will provide better discriminating OC curve. The proposed TNTRDSS considers various basic quality levels, it is beneficial for the practitioners to use it in the quality control environments. It is advantageous to apply this plan in industries for reducing the inspection cost and time, particularly in the area of compliance testing and especially for safety – related product.

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Table -1: Value of *np* Tabulated against '*s*' and '*t*' for Given $P_a(p)$ and Operating ratio Value for Given α & β for TNTRDSS-(n; u_1, u_2; v_1, v_2; i), When, i = 1

s	t	u_1	u_2	v_1	v_2	Probability of Acceptance									OR					
															p_2/p_1 for α = 0.05			p_2/p_1 for α = 0.01		
						0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01	α=0.05 β=0.10	α=0.05 β=0.05	α=0.05 β=0.01	α=0.01 β=0.10	α=0.01 β=0.05	α=0.01 β=0.01
1	2	1	2	0	1	0.1528	0.3544	0.5344	0.8899	1.2943	1.7608	2.4289	3.0375	4.5172	6.8531	8.5703	12.745	15.899	19.883	29.569
		2	4	1	3	0.4336	0.825	1.1328	1.8284	2.601	3.2898	4.1316	4.8445	6.6144	5.0082	5.8724	8.0178	9.5276	11.172	15.253
		3	5	2	3	0.8052	1.3833	1.7793	2.5608	3.395	4.265	5.3947	6.3069	8.38	3.9	4.5594	6.0581	6.6999	7.8328	10.407
		4	5	1	2	1.2846	1.9158	2.2394	2.6851	3.1135	3.5968	4.2479	4.861	6.5793	2.2174	2.5374	3.4343	3.3068	3.784	5.1217
		4	6	3	4	1.2868	1.9883	2.4732	3.4011	4.3824	5.4264	6.7481	7.7465	9.9476	3.3938	3.896	5.003	5.2441	6.02	7.7305
		5	7	4	5	1.7998	2.6461	3.205	4.2459	5.3705	6.5665	8.0491	9.1671	11.582	3.0419	3.4644	4.3772	4.4722	5.0934	6.4354
2	4	1	2	0	1	0.1519	0.3402	0.4751	0.7193	1.0369	1.5569	2.3598	3.0138	4.5883	6.9372	8.8596	13.488	15.531	19.835	30.199
		2	4	1	3	0.4327	0.8146	1.0813	1.6422	2.3276	3.1059	4.0786	4.8278	6.6226	5.0072	5.9269	8.1302	9.4259	11.157	15.305
		3	5	2	3	0.8036	1.367	1.7153	2.3041	3.0067	4.0173	5.3423	6.2968	8.3859	3.908	4.6062	6.1344	6.6483	7.836	10.436
		4	5	1	2	1.2754	1.7337	1.9167	2.1746	2.4679	2.9435	3.9246	4.747	6.5895	2.2637	2.738	3.8008	3.0772	3.722	5.1668
		4	6	3	4	1.2866	1.969	2.4065	3.1386	3.988	5.1902	6.6996	7.7404	10.005	3.4026	3.9312	5.0811	5.2074	6.0163	7.7762
		5	7	4	5	1.7997	2.6164	3.127	3.9805	4.9726	6.3487	8.0037	9.1572	11.473	3.059	3.4999	4.3852	4.4473	5.0883	6.3753
4	5	1	2	0	1	0.1503	0.3186	0.4301	0.64	0.9638	1.5416	2.3595	3.014	4.5888	7.4064	9.461	14.404	15.7	20.055	30.534
		2	4	1	3	0.4309	0.7931	1.0263	1.5368	2.2586	3.0972	4.0717	4.8198	6.6098	5.1341	6.0775	8.3345	9.4494	11.186	15.34
		3	5	2	3	0.8005	1.3437	1.647	2.176	2.9035	4.0001	5.3426	6.2978	8.3879	3.976	4.6869	6.2423	6.674	7.8672	10.478
		4	5	1	2	1.2432	1.5987	1.7489	1.9694	2.2506	2.8334	3.9237	4.7484	6.605	2.4543	2.9702	4.1316	3.156	3.8193	5.3127
		4	6	3	4	1.2861	1.9393	2.3385	2.9985	3.8805	5.1734	6.6989	7.7366	9.999	3.4543	3.9893	5.1559	5.2088	6.0157	7.7749
		5	7	4	5	1.7994	2.5894	3.0554	3.8436	4.8687	6.3362	8.0058	9.1313	11.489	3.0918	3.5265	4.4371	4.4491	5.0746	6.385
6	8	1	2	0	1	0.1371	0.28	0.3611	0.5304	0.8969	1.5373	2.3614	3.0166	4.5188	8.435	10.775	16.141	17.224	22.003	32.96
		2	4	1	3	0.4261	0.7516	0.9374	1.3887	2.1999	3.0931	4.0804	4.8175	6.6059	5.4286	6.4093	8.7887	9.575	11.305	15.501
		3	5	2	3	0.8249	1.2971	1.5431	2.0091	2.8117	3.9957	5.3433	6.299	8.2937	4.1195	4.8563	6.3941	6.4774	7.636	10.054
		4	5	1	2	1.1739	1.4083	1.5143	1.6849	1.9723	2.7915	3.9191	4.7509	6.5377	2.7828	3.3734	4.6422	3.3385	4.047	5.5691
		4	6	3	4	1.2851	1.9	2.2223	2.8225	3.7931	5.1688	6.6989	7.7362	9.9983	3.5258	4.0717	5.2624	5.2127	6.0198	7.7801
		5	7	4	5	1.7991	2.5358	2.9391	3.6532	4.7815	6.3272	8.0055	9.1527	11.476	3.157	3.6094	4.5254	4.4497	5.0874	6.3785
8	10	1	2	0	1	0.1371	0.2558	0.3232	0.4815	0.8862	1.5341	2.3623	3.0179	4.5333	9.2333	11.796	17.719	17.231	22.012	33.066
		2	4	1	3	0.4207	0.7202	0.8862	1.3228	2.1963	3.0935	4.0727	4.8215	6.6139	5.6551	6.6949	9.1837	9.6805	11.46	15.721
		3	5	2	3	0.8233	1.2592	1.4822	1.9387	2.8012	3.9941	5.3436	6.2995	8.2989	4.2435	5.0026	6.5904	6.4905	7.6516	10.08
		4	5	1	2	1.0916	1.3064	1.397	1.554	1.8826	2.7911	3.9196	4.7514	6.5411	3.0003	3.637	5.0069	3.5907	4.3526	5.9921
		4	6	3	4	1.284	1.8565	2.1585	2.7436	3.7821	5.169	6.6989	7.7372	10	3.6083	4.1676	5.3864	5.217	6.0257	7.7879
		5	7	4	5	1.7991	2.4959	2.8697	3.5739	4.7709	6.3286	8.0026	9.1499	11.582	3.2063	3.666	4.6406	4.4482	5.0859	6.4379

Table -2: Value of *np* Tabulated against '*s*' and '*t*' for Given $P_a(p)$ and Operating ratio Value for Given α & β for TNTRDSS-(n; u_1, u_2; v_1, v_2; i), When, i = 2

s	t	u_1	u_2	v_1	v_2	Probability of Acceptance									OR					
															p_2 / p_1 for α = 0.05			p_2 / p_1 for α = 0.01		
						0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01	α =0.05 β =0.10	α =0.05 β=0.05	α =0.05 β =0.01	α =0.01 β =0.10	α =0.01 β =0.05	α =0.01 β =0.01
1	2	1	2	0	1	0.1528	0.3544	0.5344	0.8899	1.2943	1.7608	2.4289	3.0375	4.5172	6.8531	8.5703	12.745	15.899	19.883	29.569
		2	4	1	3	0.4336	0.825	1.1328	1.8284	2.601	3.2898	4.1316	4.8445	6.6144	5.0082	5.8724	8.0178	9.5276	11.172	15.253
		3	5	2	3	0.8052	1.3833	1.7793	2.5608	3.395	4.265	5.3947	6.3069	8.38	3.9	4.5594	6.0581	6.6999	7.8328	10.407
		4	5	1	2	1.2846	1.9158	2.2394	2.6851	3.1135	3.5968	4.2479	4.861	6.5793	2.2174	2.5374	3.4343	3.3068	3.784	5.1217
		4	6	3	4	1.2868	1.9883	2.4732	3.4011	4.3824	5.4264	6.7481	7.7465	9.9476	3.3938	3.896	5.003	5.2441	6.02	7.7305
		5	7	4	5	1.7998	2.6461	3.205	4.2459	5.3705	6.5665	8.0491	9.1671	11.582	3.0419	3.4644	4.3772	4.4722	5.0934	6.4354
2	4	1	2	0	1	0.1519	0.3402	0.4751	0.7193	1.0369	1.5569	2.3598	3.0138	4.5883	6.9372	8.8596	13.488	15.531	19.835	30.199
		2	4	1	3	0.4327	0.8146	1.0813	1.6422	2.3276	3.1059	4.0786	4.8278	6.6226	5.0072	5.9269	8.1302	9.4259	11.157	15.305
		3	5	2	3	0.8036	1.367	1.7153	2.3041	3.0067	4.0173	5.3423	6.2968	8.3859	3.908	4.6062	6.1344	6.6483	7.836	10.436
		4	5	1	2	1.2754	1.7337	1.9167	2.1746	2.4679	2.9435	3.9246	4.747	6.5895	2.2637	2.738	3.8008	3.0772	3.722	5.1668
		4	6	3	4	1.2866	1.969	2.4065	3.1386	3.988	5.1902	6.6996	7.7404	10.005	3.4026	3.9312	5.0811	5.2074	6.0163	7.7762
		5	7	4	5	1.7997	2.6164	3.127	3.9805	4.9726	6.3487	8.0037	9.1572	11.473	3.059	3.4999	4.3852	4.4473	5.0883	6.3753
4	5	1	2	0	1	0.1503	0.3186	0.4301	0.64	0.9638	1.5416	2.3595	3.014	4.5888	7.4064	9.461	14.404	15.7	20.055	30.534
		2	4	1	3	0.4309	0.7931	1.0263	1.5368	2.2586	3.0972	4.0717	4.8198	6.6098	5.1341	6.0775	8.3345	9.4494	11.186	15.34
		3	5	2	3	0.8005	1.3437	1.647	2.176	2.9035	4.0001	5.3426	6.2978	8.3879	3.976	4.6869	6.2423	6.674	7.8672	10.478
		4	5	1	2	1.2432	1.5987	1.7489	1.9694	2.2506	2.8334	3.9237	4.7484	6.605	2.4543	2.9702	4.1316	3.156	3.8193	5.3127
		4	6	3	4	1.2861	1.9393	2.3385	2.9985	3.8805	5.1734	6.6989	7.7366	9.999	3.4543	3.9893	5.1559	5.2088	6.0157	7.7749
		5	7	4	5	1.7994	2.5894	3.0554	3.8436	4.8687	6.3362	8.0058	9.1313	11.489	3.0918	3.5265	4.4371	4.4491	5.0746	6.385
6	8	1	2	0	1	0.1371	0.28	0.3611	0.5304	0.8969	1.5373	2.3614	3.0166	4.5188	8.435	10.775	16.141	17.224	22.003	32.96
		2	4	1	3	0.4261	0.7516	0.9374	1.3887	2.1999	3.0931	4.0804	4.8175	6.6059	5.4286	6.4093	8.7887	9.575	11.305	15.501
		3	5	2	3	0.8249	1.2971	1.5431	2.0091	2.8117	3.9957	5.3433	6.299	8.2937	4.1195	4.8563	6.3941	6.4774	7.636	10.054
		4	5	1	2	1.1739	1.4083	1.5143	1.6849	1.9723	2.7915	3.9191	4.7509	6.5377	2.7828	3.3734	4.6422	3.3385	4.047	5.5691
		4	6	3	4	1.2851	1.9	2.2223	2.8225	3.7931	5.1688	6.6989	7.7362	9.9983	3.5258	4.0717	5.2624	5.2127	6.0198	7.7801
		5	7	4	5	1.7991	2.5358	2.9391	3.6532	4.7815	6.3272	8.0055	9.1527	11.476	3.157	3.6094	4.5254	4.4497	5.0874	6.3785
8	10	1	2	0	1	0.1371	0.2558	0.3232	0.4815	0.8862	1.5341	2.3623	3.0179	4.5333	9.2333	11.796	17.719	17.231	22.012	33.066
		2	4	1	3	0.4207	0.7202	0.8862	1.3228	2.1963	3.0935	4.0727	4.8215	6.6139	5.6551	6.6949	9.1837	9.6805	11.46	15.721
		3	5	2	3	0.8233	1.2592	1.4822	1.9387	2.8012	3.9941	5.3436	6.2995	8.2989	4.2435	5.0026	6.5904	6.4905	7.6516	10.08
		4	5	1	2	1.0916	1.3064	1.397	1.554	1.8826	2.7911	3.9196	4.7514	6.5411	3.0003	3.637	5.0069	3.5907	4.3526	5.9921
		4	6	3	4	1.284	1.8565	2.1585	2.7436	3.7821	5.169	6.6989	7.7372	10	3.6083	4.1676	5.3864	5.217	6.0257	7.7879
		5	7	4	5	1.7991	2.4959	2.8697	3.5739	4.7709	6.3286	8.0026	9.1499	11.582	3.2063	3.666	4.6406	4.4482	5.0859	6.4379

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Table -3: Value of *np* Tabulated against '*s*' and '*t*' for Given $P_a(p)$ and Operating ratio Value for Given α & β for TNTRDSS-(n; u_1, u_2; v_1, v_2; i), When, i = 3

s	t	u_1	u_2	v_1	v_2	Probability of Acceptance									OR					
															p_2/p_1 for α = 0.05			p_2/p_1 for α = 0.01		
						0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01	α =0.05 β =0.10	α =0.05 β=0.05	α =0.05 β =0.01	α =0.01 β =0.10	α =0.01 β =0.05	α =0.01 β =0.01
1	2	1	2	0	1	0.085	0.1836	0.2587	0.4065	0.6088	0.8848	1.3321	2.1576	4.4142	7.2549	11.751	24.041	15.675	25.389	51.941
		2	4	1	3	0.291	0.5319	0.6961	1.0226	1.5403	2.1208	2.6375	3.0783	6.1685	4.9589	5.7877	11.598	9.0641	10.579	21.199
		3	5	2	3	0.5856	0.9696	1.2136	1.6835	2.2931	3.0928	4.5385	5.8836	8.2415	4.6806	6.0677	8.4995	7.75	10.047	14.073
		4	5	1	2	0.9991	1.4467	1.6544	1.9401	2.2427	2.6428	3.4	4.3339	6.4942	2.3502	2.9958	4.4891	3.4032	4.338	6.5003
		4	6	3	4	0.979	1.4786	1.7987	2.3996	3.1812	4.2068	5.982	7.3727	9.9522	4.0457	4.9862	6.7308	6.1101	7.5305	10.165
		5	7	4	5	1.4131	2.0355	2.4236	3.1539	4.0887	5.325	7.3491	8.7939	11.489	3.6104	4.3203	5.6443	5.2005	6.2229	8.13
2	4	1	2	0	1	0.0841	0.1676	0.2198	0.3128	0.4672	0.7915	1.2997	2.1252	4.4005	7.7531	12.678	26.251	15.455	25.272	52.329
		2	4	1	3	0.2902	0.5143	0.6443	0.8743	1.3046	2.0055	2.5985	3.0632	6.0818	5.052	5.9556	11.824	8.9529	10.554	20.954
		3	5	2	3	0.5847	0.9523	1.1696	1.533	2.046	2.9194	4.5252	5.8756	8.2124	4.752	6.17	8.6239	7.7389	10.048	14.044
		4	5	1	2	0.9537	1.2494	1.3589	1.5162	1.697	1.991	2.9438	4.2326	6.4725	2.3561	3.3876	5.1803	3.0868	4.4382	6.7869
		4	6	3	4	0.9783	1.4638	1.752	2.2457	2.9311	4.0564	5.9555	7.3775	9.9416	4.0685	5.04	6.7917	6.0875	7.5412	10.162
		5	7	4	5	1.4116	2.0223	2.3815	3	3.849	5.2009	7.3434	8.8194	11.472	3.6313	4.3612	5.6728	5.2023	6.2479	8.127
4	5	1	2	0	1	0.0823	0.152	0.1922	0.2673	0.4203	0.785	1.2933	2.1335	4.4124	8.5078	14.035	29.027	15.72	25.933	53.632
		2	4	1	3	0.2888	0.491	0.6005	0.795	1.2304	2.0009	2.5984	3.0643	6.091	5.2921	6.2409	12.405	8.9964	10.609	21.088
		3	5	2	3	0.5831	0.9392	1.1225	1.4509	1.9811	2.9086	4.525	5.8748	8.2076	4.8181	6.2554	8.7393	7.7599	10.075	14.075
		4	5	1	2	0.9192	1.1357	1.2198	1.3529	1.5195	1.8626	2.937	4.2314	6.4605	2.5861	3.7259	5.6886	3.1952	4.6035	7.0285
		4	6	3	4	0.9769	1.4422	1.7051	2.1588	2.8695	4.0473	5.9573	7.3788	9.9433	4.1306	5.1162	6.8944	6.0983	7.5534	10.179
		5	7	4	5	1.4087	2.0016	2.3346	2.9101	3.7832	5.1938	7.3432	8.8193	11.471	3.6687	4.4061	5.7307	5.2128	6.2607	8.1428
6	8	1	2	0	1	0.0731	0.1269	0.1528	0.2065	0.3674	0.7831	1.2962	2.142	4.4286	10.213	16.876	34.891	17.732	29.303	60.582
		2	4	1	3	0.2853	0.4545	0.5344	0.6905	1.1595	1.9985	2.598	3.0677	6.1191	5.7167	6.7504	13.465	9.1064	10.753	21.448
		3	5	2	3	0.5926	0.8986	1.0504	1.337	1.9255	2.9055	4.5251	5.8756	8.2114	5.0356	6.5385	9.1378	7.6353	9.9142	13.855
		4	5	1	2	0.8283	0.9654	1.0258	1.1249	1.2785	1.7975	2.9381	4.2327	6.4745	3.0434	4.3844	6.7066	3.5469	5.1098	7.8162
		4	6	3	4	0.9733	1.4074	1.6263	2.0379	2.8146	4.0446	5.9597	7.3805	9.9457	4.2345	5.244	7.0666	6.1231	7.5829	10.218
		5	7	4	5	1.4098	1.9687	2.2534	2.7851	3.7333	5.1916	7.3433	8.8194	11.471	3.73	4.4798	5.8268	5.2088	6.2558	8.1368
8	10	1	2	0	1	0.0731	0.1127	0.134	0.1804	0.3567	0.7816	1.2974	2.144	4.3424	11.509	19.019	38.522	17.748	29.329	59.404
		2	4	1	3	0.2817	0.4287	0.4997	0.6449	1.1495	1.9982	2.5986	3.0536	6.1226	6.0616	7.1231	14.282	9.2256	10.841	21.737
		3	5	2	3	0.5889	0.869	1.0067	1.287	1.9187	2.9056	4.5252	5.8766	8.2174	5.2071	6.7622	9.4557	7.684	9.9788	13.953
		4	5	1	2	0.7684	0.8821	0.9334	1.0216	1.1828	1.7977	2.941	4.2075	6.4961	3.3342	4.7699	7.3646	3.8275	5.4757	8.4542
		4	6	3	4	0.9693	1.3779	1.5789	1.9862	2.8101	4.0424	5.9607	7.3812	9.8311	4.3259	5.3568	7.1348	6.1498	7.6154	10.143
		5	7	4	5	1.4156	1.9429	2.1986	2.7324	3.7279	5.1916	7.3435	8.8195	11.472	3.7797	4.5394	5.9048	5.1876	6.2302	8.1043