American Journal of Applied Mathematics and Statistics, 2018, Vol. 6, No. 4, 141-148
Available online at http://pubs.sciepub.com/ajams/6/4/4

DOI:10.12691/ajams-6-4-4

Quick Switching System with Different Reference Plans

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Abstract A new sampling inspection system with normal single sampling plan and tightened double sampling plan is introduced. Advantages of this system are highlighted.

Keywords: *sampling plan, sampling system, single sampling plan, double sampling plan*

Cite This Article: Vennila J, and Devaraj Arumainayagam S, "Quick Switching System with Different Reference Plans." *American Journal of Applied Mathematics and Statistics*, vol. 6, no. 4 (2018): 141-148. doi: 10.12691/ajams-6-4-4.

1. Introduction

Sampling system is a procedure used to accept or reject the lots in the acceptance sampling [1]. Dodge [2] proposed a new sampling inspection system called "Quick Switching System (QSS-1)". It is operated as follows:

1. Adopt a normal plan (N) and a tightened plan (T), where plan T has a tighter OC Curve than plan N.
2. Use plan N for the first lot. It is also possible to start with plan T when addition protection in the first lot production is desired. The OC curve properties are the same for the both plans.
3. For each is lot inspected; if the lot is accepted, then use plan N for the next lot; and if the lot is rejected, then use plan T for the next lot.

Rombaski [3] studied the QSS-1 with single sampling plan as a reference plan. After comparing the switching rules of many systems, Rombaski [3] made certain modifications on the switching rules of QSS-1. The resulting systems are QSS-2 and QSS-3. These systems are having an operating characteristic curve (OC) which is more discriminating than the corresponding OC curves of normal and tightened plans. Also the sample size required for QSS is much lower than any comparable equivalent sampling plan and system.

2. Literature Review

Soundarajan and Arumainayagam [4-11] have analyzed QSS-r, r=1,2,3 with single sampling plan, double sampling plan, chain sampling plan and repetitive group sampling plan as reference plan. Arumainayagam and Uma [12,13,14,15] studied QSS-r, r=1, 2, 3 with three stage multiple sampling plan as a reference plan. Suresh and Jeyalakshmi [16,17,18] used multiple deferred sampling plans (MDS) as reference plan in QSS-1. Suresh and Kaviyarasu [19,20] have analyzed QSS-r with conditional repetitive group (CRGS) sampling plan, two stage CRGS plan and multiple repetitive groups sampling plan as a reference plans.

Arumainaygam and Vennila [21] have applied two different types of reference plans in QSS-1 and find that the resulting system is more advantages than the system using same reference plan for normal and tightened inspection. This paper extends this method to a system involving the switching roles of QSS-3.

3. Methodology

3.1. Quick Switching Single Double Sampling System (QSSDSS-3)

The new system incorporate the switching rules of QSS-3 with single sampling plan as normal plan and double sampling plan as the tightened plan. This system is called quick switching single double sampling system designated as QSSDSS – 3 (n; c; c_1, c_2). Here n and c are the parameters of the normal plan and n ($n=n_1=n_2$), c_1 and c_2 are the parameters of the tightened plan. The sample sizes of the normal plan and tightened plan are equal where as $c_1 < c_2 < c$.

3.2. Conditions for applications

a) The production is stable so that outcome on current and preceding lots are broadly investigative of a continuing process and proposed lots are expected to be effectively of the same quality.
b) Lots are submitted substantially in order of their production.
c) Inspection by attributes is considered with quality defined as fraction nonconforming p.

3.3. Operating Procedure of QSSDSS-3 (n; c; c_1, c_2)

Step 1: From a lot, take a random sample of size n at normal inspection level and count the number of defectives x.

i) If $x \leq c$, accept the lot and repeat step 1 for the next lot.
ii) If $x > c$, reject the lot and go to step 2.

Step 2: From the next lot, take a random sample of size n at tightened inspection level and count the number of defectives x_1

i) If $x_1 \leq c_1$, then accept the lot and repeat step 1 for the next lot
ii) If $x_1 > c_2$, then reject the lot and continue step 2 for the next lot.
iii) If $c_1 < x_1 \leq c_2$, then take a second random sample of size n form the same lot, and count the number of defectives x_2.
iv) If $x_1+x_2 \leq c_2$, then accept the lot and repeat step 1 for the next lot
v) If $x_1+x_2 > c_2$, then reject the lot and repeat step 2 for the next lot.

3.4. Operating Characteristic Function

Based on Romboski [3], the OC function of QSSDSS -3 (n; c; c_1, c_2) is given below

$$Pa\,(p) = \frac{P_N P_T^{\,3} + P_T\,(1-P_N)(P_T^{\,2} + P_T + 1)}{P_T^{\,3} + (1-P_N)(P_T^{\,2} + P_T + 1)} \qquad (1)$$

Where

P_N = Probability of acceptance of normal single sampling plan

P_T = Probability of acceptance of tightened double sampling plan

4. Findings and Discussion

4.1. Properties of OC Curve

The properties of OC curve of QSSDSS-3 are given below

1. Figure 1 – Figure 3 give the normal, tightened and composite OC curve of QSSDSS - 3. The composite OC curve lies between normal and tightened OC curves. For good quality, the normal plan has more probability being applied in the system and hence it is closer to the composite OC curve. From these curves; it is observed that the relationship of the switching systems of composite OC curve is a weighted average of the normal and tightened OC curves. Incorporating the advantages of normal and tightened OC curve the composite OC curve attains more desirable form than the two OC curves.

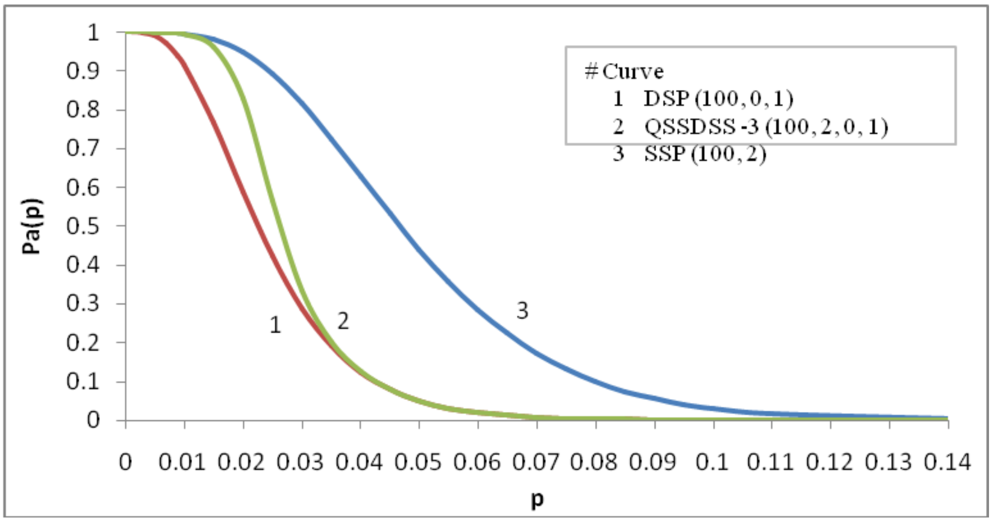

Figure 1. Normal, Tightened and Composite OC curves of QSSDSS – 3 (n; c; c_1, c_2), QSSDSS – 3 (100, 2, 0, 1)

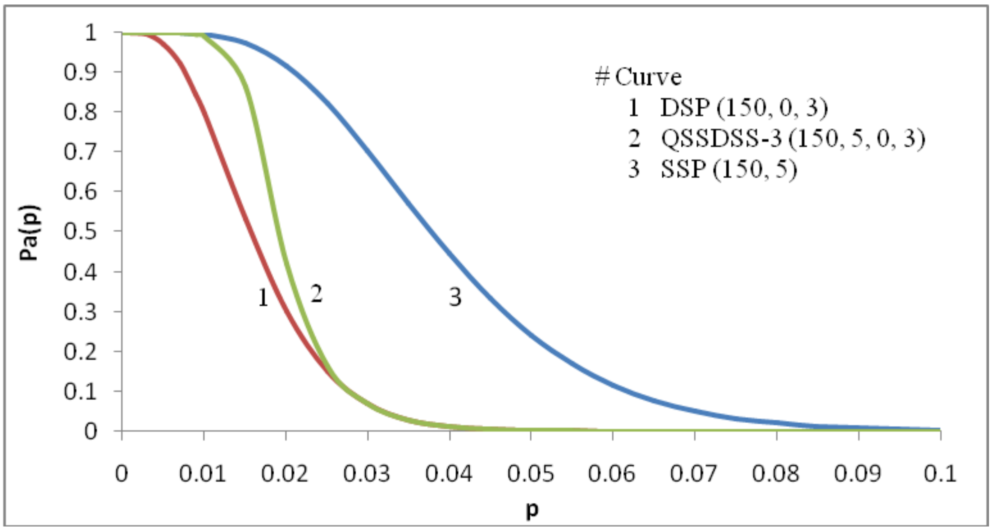

Figure 2. Normal, Tightened and Composite OC curves of QSSDSS – 3 (n; c; c_1, c_2), QSSDSS – 3 (150, 5, 0, 3)

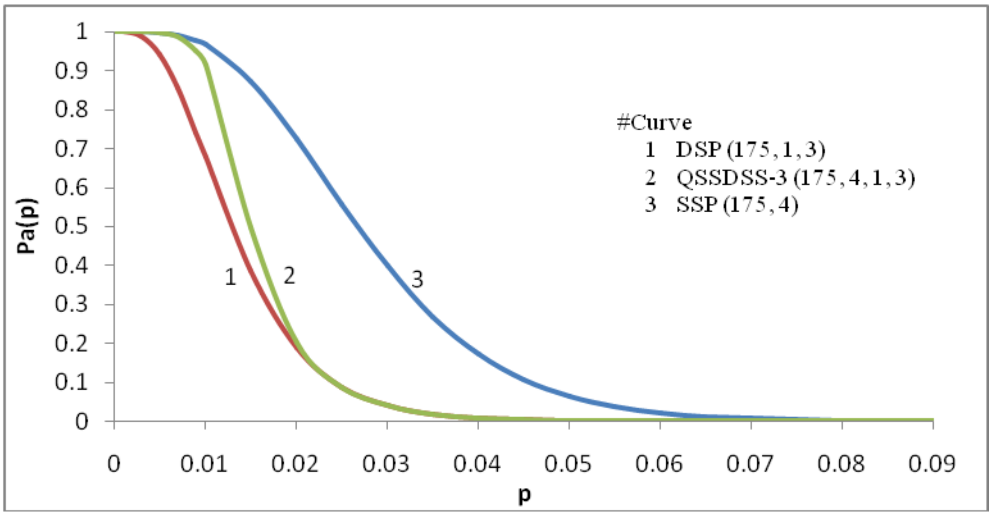

Figure 3. Normal, Tightened and Composite OC curves of QSSDSS – 3 (n; c; c_1, c_2), QSSDSS – 3 (175, 4, 1, 3)

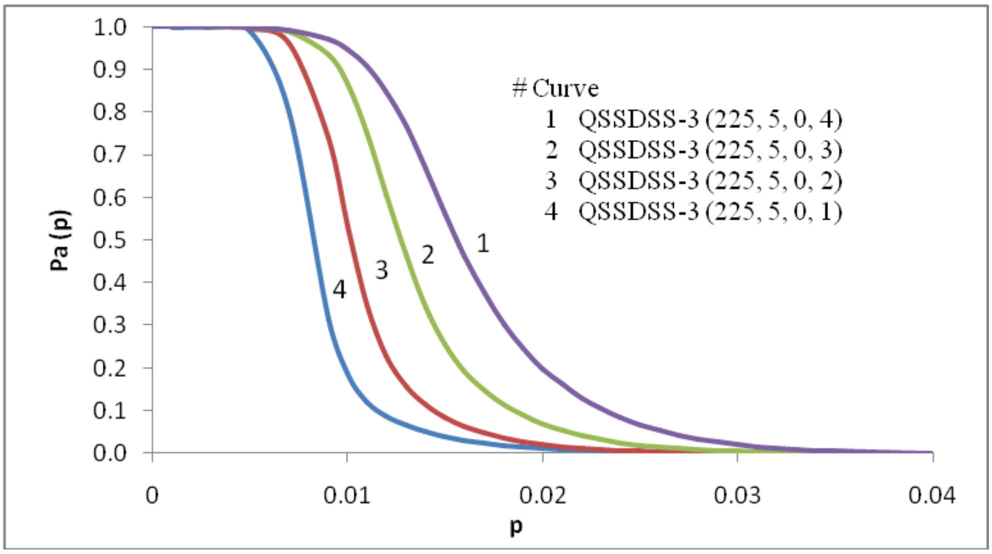

Figure 4. Composite OC curves of (QSSDSS-3) (n; c; c_1,c_2); 1.QSSDSS-3 (225, 5, 0, 4); 2.QSSDSS-3 (225, 5, 0, 3); 3.QSSDSS-3 (225, 5, 0, 2); 4. QSSDSS-3 (225, 5, 0, 1)

2. Figure 4 give a set of composite OC curves of the QSSDSS. In these curves, the normal plan is fixed and in the tightened plan acceptance number is allowed to decrease. That is tightening is made severe. It is observed that as the value of p increases, the OC curve approaches to the shape of an ideal OC curve.

4.2. Designing the System

4.2.1. Designing Systems Given p_1, p_2, α and β

Table 3 can be used to design QSSDSS – 3 (n, c, c_1, c_2) for given p_1, p_2, α and β by the following steps:

1. Find the value of p_2/p_1.
2. Determine the value of p_2/p_1 in Table 4 in the column for appropriate α and β that is closer to the computed p_2/p_1.
3. Find the values of c, c_1 and c_2 corresponding to the ratio located.
4. Corresponding to the selected c, c_1 and c_2, from Table 3, find the value of np_1
5. The sample size of the system is found by dividing np_1 by p_1.

Example:

To obtain QSSDSS – 3 (n, c, c_1, c_2) for the given values of p_1 = 0.03, α = 0.05, p_2 = 0.04 and β = 0.10, the following steps are to be followed:

1. Compute p_2/p_1 = 0.04 / 0.03 = 1.33
2. The value of p_2/p_1 which is nearly equal to 1.3 in Table 4 under the column of α = 0.05 and β = 0.10 is 1.3429
3. The value of c, c_1 and c_2 corresponding to 1.3429 are c = 10, c_1= 0, c_2 = 2.
4. For c = 10, c_1= 0, c_2 = 2, value of np_1 obtained from Table 3 is 2.8306.
5. The sample size is determined as n = np_1 / p_1 = 2.8306 / 0.03 = 94.
6. The designed system is QSSDSS – 3 (94; 10, 0, 2).

4.2.2. Calculating AOQL for the given system

Table 5 provides the np_m and nAOQL values for QSSDSS – 3 (n, c, c_1, c_2). This table can be used to determine np_m and nAOQL of a system.

Example:

Determine the p_m and AOQL of QSSDSS – 3 (94, 4, 0, 2). From Table 5, corresponding to c = 10, c_1 = 0 and c_2 = 2, nAOQL = 4.3333 and np_m = 4.7960. so AOQL = nAOQL / n = 4.3333 / 94 = 0.046% and p_m = np_m / n = 4.7960 / 94 = 0.05%.

4.2.3. Designing Systems Given AQL and AOQL

Table 5 can be used to design QSSDSS - 3 (n, c, c_1, c_2) for specified values of AQL and AOQL.

Example

To determine a QSSDSS - 3 (n; c; c_1, c_2), having AQL (α = 0.05) = 0.06 and AOQL = 0.08, compute AOQL/p_1 = 0.08 / 0.06 = 1.3. From Table 5, under the column headed AOQL/p_1, value closer to the desired value is 1.3119, which corresponds to a value of c = 9, c_1 = 0 and c_2 = 3. Corresponding to these parameters, value of np_1 obtained from Table 5 is 3.0601. The normal single sampling plan sample size is obtained by n = np_1 / p_1 = 3.0601 / 0.06 = 51. The designed system is QSSDSS - 3 (51; 9 ;0 ,3).

4.2.4. Designing Systems Given Indifference Quality Level (IQL)

Table 5 can be used to design QSSDSS – 3 (n; c; c_1, c_2) indexed by point of control and point of control (h_0) Hamaker [22]

Example

If one wants to design a QSSDSS-3 having p_0 = 0.03 and h_0 = 2.6, from Table 3, under the column headed h_0 find the value which is closer to the desired value. The value is 2.5782 which has associated with it a value of c = 3, c_1 = 0 and c_2 = 2. Corresponding to these parameters, value of np_0 is 1.9059. The sample size of normal double sampling plan is obtained as n = np_0 / n = 1.9059 / 0.03 = 63.53 ≈ 64. The designed system is QSSDSS - 3 (64; 3; 0, 2).

4.2.5. Conversion of One Set of Parameters to Other

For QSSDSS – 3 (n; c; c_1, c_2), if p_1=0.02, p_2=0.04, α=0.05 and β=0.10, the system satisfying the requirements can be obtained from Table 5 as n = 94, c = 10, c_1 = 0 and c_2 = 2. Corresponding to c = 10, c_1 = 0 and c_2 = 2, from Tables 3, one can get the following:

np_1 = 2.8306, np_m = 4.7960, nAOQL = 4.3330

np_0 = 3.3278 and h_0 = 4.8118.

So, AOQL = nAOQL/n = 4.3330/94 = 0.0461

p_0 = np_0 / n = 3.3278/94 = 0.0354.

So, when p_1=0.02, α = 0.05, p_2 = 0.04 and β = 0.10, the other similar sets of parameters are given by

1. p_1 = 0.02 (α = 0.05) and AOQL = 0.0461
2. p_0 = 0.0354 and h_0 = 4.8118.

4.3. Plotting the OC Curve

Table 1 can be used to plot the operating characteristic curve of the given QSSDSS – 3 (n; c; c_1, c_2). This can be done by dividing each entry for given acceptance numbers, by the value of n. The result of each division is the proportion nonconforming p for which the proportion of lots expected to be accepted P_a (p) is shown in the corresponding column heading.

Example

For QSSDSS – 3 (60; 3; 0, 1), division of entries opposite to c=3, c_1=0 and c_2=1 in Table 3 by 100 leads to the following Table-A for plotting the OC curve of QSSDSS-3.

Table 1. Values for OC curve of (QSSDSS - 3) (n; c; c_1; c_2) (n=n_1=n_2) (60, 3, 0, 1)

Pa(p)	0.99	0.95	0.75	0.50	0.25	0.10	0.05	0.01
P	0.0103	0.0141	0.0195	0.0239	0.0304	0.0418	0.0521	0.0775

5. Conclusion

5.1. Comparison

The last three columns of below Table 2 respectively give the values obtained by dividing the $np_{0.95}$ values of SSP (n; c_N, c_T) (values are taken from Cameron J.M., [23]), DSP (n; c_N, c_T) (Duncun A.J., [24]), (US Chemical Corps Agency [25]) and QSS-3 (n; c_N, c_T) (Romboski L.D. [3] respectively) by the $np_{0.95}$ value of the matched QSSDSS-3 (n; c, c_1; c_2). Six single sampling plans, double sampling plan, and QSS – 3 their equivalent QSSDSS-3 (n, c, c1, c2) values are presented in the below table. From this, one can observe the following, On comparing the $np_{0.95}$ values of different systems included in various sets, it is observed that the sample size of QSSDSS-3 (n; c, c_1; c_2) requires lesser sample sizes than those of the corresponding matched SSP (n; c_N, c_T), DSP (n; c_N, c_T) and QSS-3 (n; c_N, c_T). However, in some cases, QSSDSS-3 (n; c, c_1; c_2) requires a smaller sample size than that of QSS-3 (n; c_N, c_T).

Table 2. Single, Double and QSSDSS – 3 Comparison Values

SSP			DSP				QSS-3				QSSDSS-3					*E1	*E2	*E3
c	OR	np0.95	a1	a2	OR	np0.95	cn	ct	OR	np0.95	c	c1	c2	OR	np0.95			
6	3.21	3.29	3	7	3.21	2.15	5	4	3.22	2.49	3	0	2	3.17	1.00	3.28	2.15	2.49
7	2.96	3.98	2	8	2.93	2.36	5	3	2.93	2.88	3	0	1	2.96	0.85	4.70	2.78	3.40
8	2.77	4.70	5	10	2.76	3.40	7	6	2.74	3.86	4	1	2	2.78	1.58	2.97	2.15	2.44
10	2.47	6.17	5	12	2.44	4.00	4	0	2.47	0.96	5	0	4	2.44	2.22	2.77	1.80	0.43
12	2.31	7.69	5	13	2.32	4.35	9	7	2.31	5.11	5	1	2	2.31	1.18	6.53	3.69	4.34
14	2.22	10.04	5	14	5.14	2.22	6	2	2.26	2.36	5	1	4	2.22	2.14	4.70	1.04	1.11

Where

*E1 = np0.95 of SSP / np0.95 of QSSDSS-3
*E2 = np0.95 of DSP / np0.95 of QSSDSS-3
*E3 = np0.95 of QSS-3 / np0.95 of QSSDSS-3

Table 3. Values of np tabulated against c, c_1 & c_2 for give Pa(p) for QSSDSS – 3 (n, c, c_1, c_2)

			Pa(p) - Probability of Acceptance							
c	c_1	c_2	0.99	0.95	0.75	0.5	0.25	0.1	0.05	0.01
2	0	1	0.3747	0.5921	0.9406	1.2460	1.7327	2.4980	3.1257	4.6487
3	0	1	0.6202	0.8475	1.1718	1.4311	1.8242	2.5110	3.1277	4.6488
	0	2	0.7401	1.0663	1.5351	1.9059	2.4396	3.1994	3.7820	5.1167
4	0	2	1.0447	1.3598	1.7775	2.0891	2.5266	3.2122	3.7841	5.1167
	0	3	1.1811	1.6190	2.2211	2.6789	3.3113	4.1616	4.7839	6.1260
	1	2	1.0685	1.4173	1.9119	2.3130	2.9330	3.9438	4.7664	6.6427
	1	3	1.1643	1.5832	2.1644	2.6192	3.2802	4.2411	4.9911	6.7348
5	0	1	1.0984	1.3284	1.6269	1.8404	2.1202	2.5975	3.1424	4.6489
	0	2	1.3301	1.6311	2.0135	2.2857	2.6487	3.2388	3.7885	5.1168
	0	3	1.5361	1.9484	2.4793	2.8656	3.3939	4.1732	4.7858	6.1261
	0	4	1.6776	2.2263	2.9646	3.5149	4.2574	5.2197	5.9054	7.3463
	1	2	1.3760	1.7189	2.1813	2.5354	3.0549	3.9619	4.7690	4.7690
	1	4	1.6387	2.1368	2.7944	3.2842	3.9620	4.9047	5.6140	7.1930
6	0	1	1.3307	1.5609	1.8527	2.0545	2.3047	2.6953	3.1663	4.6491
	0	3	1.8643	2.2506	2.7303	3.0662	3.5088	4.1955	4.7895	6.1261
	0	4	2.0749	2.5871	3.2371	3.7046	4.3357	5.2301	5.9071	7.3464
	1	2	1.6718	2.0086	2.4478	2.7694	3.2131	3.9966	4.7741	6.6428
7	0	1	1.5600	1.7907	2.0781	2.2721	2.5024	2.8312	3.2171	4.6496
	0	2	1.8551	2.1333	2.4715	2.6974	2.9696	3.3738	3.8196	5.1171
	0	4	2.4414	2.9176	3.5022	3.9091	4.4442	5.2489	5.9102	7.3464
	0	6	2.7883	3.5504	4.5521	5.2803	6.2316	7.4036	8.2128	9.8745
8	0	4	2.7811	3.2261	3.7608	4.1227	4.5810	5.2825	5.9160	7.3465
	1	6	3.1466	3.7715	4.5406	5.0812	5.7994	6.8172	7.5895	9.2161
	1	7	3.3113	4.0778	5.0522	5.7517	6.6762	7.8663	8.7043	10.4272
9	0	1	2.0137	2.2461	2.5293	2.7142	2.9215	3.1804	3.4366	4.6531
	0	3	2.7304	3.0601	3.4494	3.7021	3.9957	4.4061	4.8434	6.1268
	0	6	3.6809	4.3367	5.1306	5.6797	6.3992	7.4265	8.2165	9.8746
	1	5	3.2713	3.7422	4.3031	4.6794	5.1508	5.8723	6.5418	8.0882
	1	6	3.5411	4.1210	4.8183	5.2959	5.9155	6.8380	7.5929	9.2162
	1	7	3.7633	4.4741	5.3452	5.9553	6.7612	7.8775	8.7061	10.4272
	1	8	3.9285	4.7871	5.8739	6.6496	7.6650	8.9471	9.8387	11.6571
10	0	2	2.5734	2.8306	3.1344	3.3278	3.5408	3.8013	4.0509	5.1216
	0	3	2.9926	3.3092	3.6801	3.9170	4.1843	4.5352	4.8994	6.1275
	0	5	3.7657	4.2595	4.8407	5.2253	5.6981	6.4087	7.0759	8.6124
	0	7	4.3311	5.0739	5.9686	6.5855	7.3913	8.5171	9.3636	11.1225
	1	2	2.7837	3.1043	3.4954	3.7537	4.0528	4.4612	4.9201	6.6441
	1	3	2.9645	3.2918	3.6843	3.9413	4.2389	4.6490	5.1067	6.7360
	1	4	3.2629	3.6330	4.0700	4.3545	4.6876	5.1611	5.6739	7.1937
	1	6	3.9081	4.4494	5.0901	5.5190	6.0577	6.8728	7.5989	9.2162
	1	8	4.4037	5.2009	6.1743	6.8537	7.7466	8.9575	9.8403	11.6571

Table 4. Values of p_2/p_1 tabulated against c, c_1&c_2 for given α and β for QSSDSS-3 (n,c,c_1,c_2)

c	c_1	c_2	p_2/p_1 for α=0.05 β=0.10	p_2/p_1 for α=0.05 β=0.05	p_2/p_1 for α=0.05 β=0.01	np_1 for α=0.05	p_2/p_1 for α=0.01 β=0.10	p_2/p_1 for α=0.01 β=0.05	p_2/p_1 for α=0.01 β=0.01	np_1 for α=0.01
2	0	1	4.2191	5.2791	7.8515	0.5921	6.6672	8.3423	12.4072	0.3747
3	0	1	2.9627	3.6903	5.4851	0.8475	4.0485	5.0429	7.4954	0.6202
	0	2	3.0003	3.5467	4.7984	1.0663	4.3229	5.1102	6.9136	0.7401
4	0	2	2.3624	2.7829	3.7630	1.3598	3.0747	3.6220	4.8976	1.0447
	0	3	2.5705	2.9549	3.7838	1.6190	3.5234	4.0502	5.1865	1.1811
	1	2	2.7826	3.3629	4.6868	1.4173	3.6908	4.4606	6.2166	1.0685
	1	3	2.6788	3.1525	4.2538	1.5832	3.6425	4.2866	5.7842	1.1643
5	0	1	1.9553	2.3655	3.4995	1.3284	2.3647	2.8608	4.2323	1.0984
	0	2	1.9856	2.3227	3.1370	1.6311	2.4350	2.8483	3.8469	1.3301
	0	3	2.1419	2.4563	3.1441	1.9484	2.7167	3.1155	3.9880	1.5361
	0	4	2.3445	2.6525	3.2998	2.2263	3.1115	3.5203	4.3792	1.6776
	1	2	2.3048	2.7744	2.7744	1.7189	2.8793	3.4658	3.4658	1.3760
	1	4	2.2953	2.6273	3.3662	2.1368	2.9931	3.4260	4.3896	1.6387
6	0	1	1.7267	2.0285	2.9784	1.5609	2.0255	2.3795	3.4938	1.3307
	0	3	1.8642	2.1281	2.7220	2.2506	2.2505	2.5691	3.2860	1.8643
	0	4	2.0216	2.2833	2.8396	2.5871	2.5207	2.8470	3.5406	2.0749
	1	2	1.9898	2.3768	3.3072	2.0086	2.3907	2.8557	3.9735	1.6718
7	0	1	1.5811	1.7966	2.5965	1.7907	1.8149	2.0623	2.9805	1.5600
	0	2	1.5815	1.7905	2.3987	2.1333	1.8186	2.0590	2.7584	1.8551
	0	4	1.7990	2.0257	2.5179	2.9176	2.1500	2.4208	3.0091	2.4414
	0	6	2.0853	2.3132	2.7812	3.5504	2.6553	2.9455	3.5415	2.7883
8	0	4	1.6374	1.8338	2.2772	3.2261	1.8994	2.1272	2.6416	2.7811
	1	6	1.8076	2.0123	2.4436	3.7715	2.1665	2.4119	2.9289	3.1466
	1	7	1.9290	2.1345	2.5571	4.0778	2.3756	2.6287	3.1490	3.3113
9	0	1	1.4160	1.5300	2.0716	2.2461	1.5794	1.7066	2.3107	2.0137
	0	3	1.4399	1.5828	2.0022	3.0601	1.6137	1.7738	2.2439	2.7304
	0	6	1.7125	1.8946	2.2770	4.3367	2.0176	2.2322	2.6827	3.6809
	1	5	1.5692	1.7481	2.1613	3.7422	1.7951	1.9998	2.4725	3.2713
	1	6	1.6593	1.8425	2.2364	4.1210	1.9311	2.1442	2.6026	3.5411
	1	7	1.7607	1.9459	2.3306	4.4741	2.0932	2.3134	2.7708	3.7633
	1	8	1.8690	2.0552	2.4351	4.7871	2.2775	2.5044	2.9673	3.9285
10	0	2	1.3429	1.4311	1.8094	2.8306	1.4771	1.5741	1.9902	2.5734
	0	3	1.3705	1.4805	1.8517	3.3092	1.5155	1.6372	2.0476	2.9926
	0	5	1.5046	1.6612	2.0219	4.2595	1.7019	1.8790	2.2871	3.7657
	0	7	1.6786	1.8454	2.1921	5.0739	1.9665	2.1619	2.5680	4.3311
	1	2	1.4371	1.5849	2.1403	3.1043	1.6026	1.7675	2.3868	2.7837
	1	3	1.4123	1.5513	2.0463	3.2918	1.5682	1.7226	2.2722	2.9645
	1	4	1.4206	1.5618	1.9801	3.6330	1.5817	1.7389	2.2047	3.2629
	1	6	1.5447	1.7078	2.0713	4.4494	1.7586	1.9444	2.3582	3.9081
	1	8	1.7223	1.8921	2.2414	5.2009	2.0341	2.2346	2.6471	4.4037

Table 5. Parametric values for QSSDSS-3 (n,c,c_1,c_2)

c	c_1	c_2	n_{pm}	nAOQL	nAOQL/p_1	np_1 for 0.05	h_0	np*
2	0	1	0.9204	0.5562	0.9394	0.5921	1.2596	1.3207
3	0	1	0.9365	0.7055	0.8324	0.8475	1.8403	1.4416
	0	2	1.0813	0.8937	0.8381	1.0663	2.5782	1.9607
4	0	2	1.439	1.1624	0.8548	1.3598	2.422	2.0946
	0	3	1.2633	1.0941	0.6758	1.619	3.4061	2.7277
	1	2	1.6109	1.3802	0.9738	1.4173	3.2276	2.3034
	1	3	2.0418	1.6998	1.0736	1.5832	2.803	2.6412
5	0	1	1.7484	1.4666	1.1040	1.3284	2.6635	1.8415
	0	2	1.9876	1.6565	1.0156	1.6311	2.7095	2.2831
	0	3	1.4591	1.2993	0.6669	1.9484	4.2736	2.8648
	0	4	1.808	1.6025	0.7198	2.2263	4.1408	3.5595
	1	2	2.235	1.9461	1.1322	1.7189	3.6058	2.5135
	1	4	2.7	2.2885	1.0710	2.1368	3.0866	3.2952
6	0	1	2.1871	1.9035	1.2195	1.5609	3.4652	2.0582
	0	3	2.5327	2.1699	0.9641	2.2506	3.2237	3.0567
	0	4	2.0139	1.8244	0.7052	2.5871	5.1154	3.696
	1	2	2.4499	2.1937	1.0922	2.0086	4.5229	2.7505
7	0	1	3.3932	2.9126	1.6265	1.7907	3.3267	2.2783
	0	2	3.1548	2.7442	1.2864	2.1333	3.5702	2.6993
	0	4	1.8673	1.3701	0.4696	2.9176	6.0172	3.8903
	0	6	2.6723	2.1032	0.5924	3.5504	5.5164	5.3192
8	0	4	3.6195	2.8703	0.8897	3.2261	4.084	4.1064
	1	6	2.8967	2.6786	0.7102	3.7715	6.5555	5.0485
	1	7	3.6286	3.3057	0.8107	4.0778	5.3083	5.7385
9	0	1	4.0737	3.664	1.6313	2.2461	4.6266	2.7242
	0	3	4.5384	4.0144	1.3119	3.0601	4.0215	3.7034
	0	6	2.6417	2.4769	0.5711	4.3367	8.1229	5.6407
	1	5	4.117	3.7838	1.0111	3.7422	5.9112	4.6591
	1	6	3.4512	3.2077	0.7784	4.121	6.9175	5.2614
	1	7	3.8757	3.5792	0.8000	4.4741	6.2956	5.9132
	1	8	4.3297	3.9604	0.8273	4.7871	5.5317	6.6303
10	0	2	4.796	4.333	1.5308	2.8306	4.8118	3.3369
	0	3	2.4991	2.3514	0.7106	3.3092	8.5085	3.922
	0	5	2.8502	2.6901	0.6316	4.2595	9.1031	5.2057
	0	7	3.8597	3.6136	0.7122	5.0739	7.8445	6.5366
	1	2	5.8482	5.26	1.6944	3.1043	4.6471	3.7568
	1	3	6.3418	5.6112	1.7046	3.2918	4.1265	3.9413
	1	4	3.1597	2.9554	0.8135	3.633	7.5421	4.3507
	1	6	3.3373	3.1315	0.7038	4.4494	7.9697	5.4908
	1	8	4.1231	3.8468	0.7396	5.2009	7.3284	6.8025

5.2. Construction of Table 3, Table 4 and Table 5

Under the assumption of poisson model, the OC function of QSSDSS -3 (n; c; c_1, c_2) is given by

$$Pa(p) = \frac{P_N P_T^{\,3} + P_T(1-P_N)(P_T^{\,2} + P_T + 1)}{P_T^{\,3} + (1-P_N)(P_T^{\,2} + P_T + 1)}. \quad (1)$$

Under the assumption of the poisson model Pa(p) is solved for using the equation (1) in MATLAB program and we get the different np values. The values are presented in Table 3. Using Table 3, for assumed values of α and β, the operating ratio p_2/p_1 is calculated and the values are presented in Table 4. Using the np_0 values given in Table 3, the relative slope h_0 is evaluated and these values are provided in Table 5 for specified values of QSSDSS – 3 (n, c, c_1, c_2).

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