Programmable TI59 Specialty Pakettes Quality Assurance I/ Sampling Plan

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ACKNOWLEDGEMENT

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THE TI-59 PAKETTE STORY

Since the early days of handheld programmable calculators, Texas Instruments (TI) has been deeply involved in supplying not only calculators with exceptional power but also programs (software) to match. Many experts were put to work within their special fields of endeavor to design quality Software Libraries for TI calculator users. Among the Libraries produced by TI for the TI-59 are:

- Statistics
- Real Estate and Investment
- Surveying
- Navigation
- Farming
- Math/Utilities
- Aviation
- Leisure
- Business Decisions
- Securities Analysis
- Electrical Engineering
- RPN Simulator

Fully recognizing TI-59 users may require programs other than those included in TI-59 Libraries, a second program source was developed. This source, the Professional Program Exchange, gathers, compiles and redistributes programs **written by TI-59 users** who defined their own specific program needs and filled these needs by writing programs. These programs, now in Pakettes, add a new dimension to the software made available to TI-59 user. Combining some of the best TI originated programs with the most popular programs found in the Professional Program Exchange, Program Pakettes offer a true software value. Current TI Pakette offerings include:

- Securities
- Statistical Testing
- Civil Engineering
- Electronic Engineering
- Blackbody
- Oil/Gas/Energy
- Printer Utility
- Astrology
- Programming Aids
- 59 Fun
- 3-D Graphics
- Fluid Dynamics
- Mathematics
- Lab Chemistry
- Production Planning
- Marketing/Sales

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Submission Abstract

Program Title	Rev.
Operating Characteristics for Single Sampling Plans	

Abstract of Program

Computes the operating (performance) characteristics for single sampling plans. Three of the most common performance measures for single sampling plans are included, namely, the probability of acceptance, Pa; the average outgoing quality, AOQ; and when the lot size, N, is specified, the average total inspection, ATI.

A single sampling plan can be specified by two or three parameters, namely, the sample size, n; the acceptance number, c; and optionally, the lot size, N. A choice of probability functions used to obtain the probability of acceptance is also afforded the user, namely, the hypergeometric (requiring the specification of N), the binomial and the Poisson. Any one or combination of these functions may be used for a given sampling. The program allows for entry and subsequent computation of the performance measures for any number of fraction defective (nonconforming) values, p, for binomial and Poisson computation and number of defectives in the lot, D, values for hypergeometric computation.

User Benefits:

Provides comprehensive evaluation of single sampling plans via common performance measures with choice of probability functions.

Category Number 27	Required Progs.	Prog. Steps 666	PC-100A Needed ☒ Library Module ID 1 ☒

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Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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Program Description

Program Title: OC for Single Sampling Plans	Rev.

Method, Equations, Sketches, Limitations, References, Error Recovery:

The program first accepts input of the parameters of a single sampling plan, N (required for hypergeometric evaluation and for ATI computation, otherwise optional), n, and c. Then the choice of probability function is offered for the computation of the probability of acceptance, Pa, and associated performance measures. The functions include, hypergeometric, binomial, and Poisson probability computations.

The hypergeometric function requires a non-zero lot size, N. For a series of inputs of number of defectives (nonconformances) in the lot, D, values, the program computes, p=D/N, the fraction defective in the lot; Pa; and ATI; as follows,

$$Pa = \sum_{d=0}^{c} \left\{ \binom{D}{d} \binom{N-D}{n-d} \div \binom{N}{n} \right\}$$

$$ATI = n + (N-n)(1-Pa) = nPa + NPr$$

The binomial and Poisson functions may be chosen with or without the specification of the lot size, N. With N specified, ATI, as above, is computed; otherwise it is bypassed. For a series of inputs of fraction defective (nonconforming), p, values, the program computes Pa, AOQ, and ATI (with non-zero N), as follows,

$$Pa = \sum_{d=0}^{c} \binom{n}{d} p^{d} (1-p)^{n-d} \text{ , for the binomial}$$

$$Pa = \sum_{d=0}^{c} e^{-np} (np)^{d} \div d! \text{ , for the Poisson}$$

$$AOQ = p\,Pa\,(N-n)/N \quad \text{or} \quad p\,Pa \text{ , with or without N, respectively}$$

For certain values of the parameters and for the various functions, these computations may be very time consuming. Hypergeometric computations with large N should be avoided, for which case, the binomial or Poisson may be adequate approximations. Likewise, for large n, and in particular for $np > 5$, the Poisson may be an adequate approximation to the binomial. On the other hand, use of the Poisson for small n may give inaccurate results.

Storage Register Map

Knowledge of the stored values and their locations may enable the user to perform some operations of special interest to him or her.

See Continuation Sheet

Continued From: ☒ Program Description ☐ User Instructions ☐ Stmt. of Example

Program Title: OC for Single Sampling Plans	Rev.

Register	During Input(A)	Hypergeometric Computation	Binomial Computation	Poisson Computation
00	-	P and Pa	P	P
01	n	n	n	n
02	-	D	p	p
03	N	N	0 or N	0 or N
04	-	d	d	d
05	c	c	c	c
06		-	-	np
07		R and Pa	Pa	Pa
08		r	T	T
09		${}_{R}C_{r}$	p(1-p)	-
10		T	(1-p)	-
11		-	1 or (N-n)/N	1 or (N-n)/N
12		N(1-Pa)	N(1-Pa)	N(1-Pa)

Where P represents the partial sum of individual terms, T, to arrive at Pa; R and r, the elements of the combinatorial, ${}_{R}C_{r}$.

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User Instructions

Program Title OC for Single Sampling Plans

Entry	Hyp.	Bin.	Poisson	

Partition (OP 17): 719.29
Parentheses Levels: 1
t Register: ☒
Angular Mode (if applicable):
SBR Levels: 1
Absolute Addresses: ☐
Library Module ID: 1
Disturbs Pending Operations: ☒

USER DEFINED KEYS

A	Parameter Entry
B	Hypergeometric
C	Binomial
D	Poisson
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS (INV DSZ)

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4

See Program Description

FLAGS	0	1	2	3	4	5	6	7	8	9

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
1	Branch to program start	-	A	Space, title prints, space, halts with 0 displayed--awaiting entry or not of lot size, N.
2	The option to enter N is offered,			
	.1 To enter N	N	R/S	Prints with label, halts with 3631 (SN Code) displayed--awaiting entry of n.
	.2 To omit N (Hypergeometric computations may not be used, and ATI computation is bypassed)	-	R/S	Halts with 3631 (SN Code) displayed--awaiting entry of n.
3	Enter n	n	R/S	Prints with label, halts with 15 (C Code) displayed--awaiting entry of c.
4	Enter c	c	R/S	Prints with label, space, halts with c displayed.
5	At this point the user is offered the choice of probability functions to be used in the computation of Pa and associated performance measures, namely, (.1) hypergeometric (B), (.2) binomial (C), or (.3) Poisson (D).			
	.1 To use the hypergeometric, requires entry of N in step 2, otherwise flashing 9's will be displayed.	-	B	Heading: HYPERGEOMETRIC prints with space, halts with 16 (D Code) displayed--awaiting entry of D.
	.1.1 Enter D	D	R/S	Prints with label, computation of p=D/N, p prints with label and is

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☒ See Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: OC for Single Sampling Plans	Rev.

Step	Procedure	Enter	Press	Output/Mode
				briefly displayed, computation of Pa (may be long), Pa prints with label, halts with Pa displayed.
	.1.2 After Pa is displayed	-	R/S	Computation of ATI, ATI prints with label and is briefly displayed, halts with 16 (D Code) displayed--awaiting entry of next D value. (Note: SBR PRT may be executed manually for a display of ATI with a halt)
	.1.3 User can repeat steps 5.1.1 and 5.1.2 for as many D values as desired, return to step 1 for entry of a new problem or execute options 5.2 and/or 5.3 for binomial and/or Poisson computations for the same sampling plan.			
	.2 To use the binomial,	-	C	Heading: BINOMIAL prints with space, halts with 33 (P Code) displayed--awaiting entry of p.
	.2.1 Enter p	p	R/S	Prints with label, computation of Pa (may be long), Pa prints with label, halts with Pa displayed.
	.2.2 After Pa is displayed	-	R/S	Computation of AOQ, AOQ prints with label and is briefly displayed.
	.2.3 Computation of ATI is made or bypassed as N is specified or not, respectively.			
	.2.3.1 N specified			Computation of ATI, ATI prints with label and is briefly displayed, space, halts with 33 (P Code) displayed--awaiting entry of next p value.
	.2.3.2 N not specified (N=0)			Computation of ATI is bypassed, space after AOQ, halts with 33 (P Code) displayed--awaiting entry of next p value.
	.2.4 User can repeat steps 5.2.1 - 5.2.3 for as many p values as desired, return to			

Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: OC for Single Sampling Plans	Rev.

Step	Procedure	Enter	Press	Output/Mode
	step 1 for entry of a new problem or execute options 5.1 (with N specified) and/ or 5.3 for the same sampling plan.			
	.3 To use the Poisson	-	D	Heading: POISSON prints with space, halts with 33 (P Code) displayed--awaiting entry of p.
	.3.1 - .3.4 same as for binomial option, 5.2.1 - 5.2.4.			

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Sample Problem

Statement of Examples

1. Single sampling plan with parameters, N = 100, n = 40, c = 1, with hypergeometric computations.

2. Single sampling plan with parameters, N = 1000, n = 60, c = 2, with binomial computations.

3. Single sampling plan with parameters, n = 150, c = 4, with Poisson computations.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
Sample Problem 1			
-	A	SINGLE SAMPLING PLAN CHARACTERISTICS	0 displayed
100	R/S	100. LN	3631 displayed
40	R/S	40. SN	15 displayed
1	R/S	1. C	1 displayed
-	B	HYPERGEOMETRIC	16 displayed
1	R/S	1. D	
		0.01 P	Briefly displayed
		1. PA	Requires 4 min. 50
-	R/S	40. ATI	sec., halts with Pa value displayed.
2	R/S	2. D	ATI briefly dis-
		0.02 P	played, halts with
		.8424242424 PA	16 displayed.
-	R/S	49.45454545 ATI	(ditto for D=2)
(etc.)	(etc.)		

Modes: n* — Printed only (n) — Displayed Briefly (Pause)
(n)* — Printed and displayed

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ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
Sample Problem 2				
-	A	SINGLE SAMPLING PLAN CHARACTERISTICS		0 displayed
1000	R/S	1000.	LN	3631 displayed
60	R/S	60.	SN	15 displayed
2	R/S	2.	C	2 displayed
-	C	BINOMIAL		33 displayed
.01	R/S	0.01	P	
		.9775798352	PA	Halts with Pa
-	R/S	.0091892505	AOQ	Briefly displayed
		81.0749549	ATI	'' ''
				33 displayed
.02	R/S	0.02	P	
		.8812579749	PA	(ditto)
-	R/S	.0165676499	AOQ	
		171.6175036	ATI	
.03	R/S	0.03	P	
		.7314661098	PA	(ditto)
-	R/S	.0206273443	AOQ	
		312.4218568	ATI	
Sample Problem 3				
-	A	SINGLE SAMPLING PLAN CHARACTERISTICS		0 displayed
-	R/S			3631 displayed
150	R/S	150.	SN	15 displayed
4	R/S	4.	C	4 displayed
-	D	POISSON		33 displayed
.01	R/S	0.01	P	
		.9814240638	PA	Halts with Pa
-	R/S	.0098142406	AOQ	Briefly displayed
				33 displayed
.02	R/S	0.02	P	
		.8152632445	PA	(ditto)
-	R/S	.0163052649	AOQ	
.025	R/S	0.025	P	
		.6775476361	PA	
-	R/S	.0169386909	AOQ	

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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	11	A	
002	98	ADV	
003	98	ADV	
004	47	CMS	
005	03	3	
006	06	6	
007	02	2	
008	04	4	
009	03	3	
010	01	1	
011	02	2	
012	02	2	
013	02	2	
014	07	7	
015	69	□P	
016	01	01	
017	01	1	
018	07	7	
019	00	0	
020	00	0	
021	03	3	
022	06	6	
023	01	1	
024	03	3	
025	03	3	
026	00	0	
027	69	□P	
028	02	02	
029	03	3	
030	03	3	
031	02	2	
032	07	7	
033	02	2	
034	04	4	
035	03	3	
036	01	1	
037	02	2	
038	02	2	
039	69	□P	
040	03	03	
041	03	3	
042	03	3	
043	02	2	
044	07	7	
045	01	1	
046	03	3	
047	03	3	
048	01	1	
049	69	□P	
050	04	04	
051	69	□P	
052	05	05	
053	01	1	
054	05	5	
055	02	2	
056	03	3	
057	69	□P	
058	01	01	
059	01	1	
060	03	3	
061	03	3	
062	05	5	
063	01	1	
064	03	3	
065	01	1	
066	05	5	
067	03	3	
068	07	7	
069	69	□P	
070	02	02	
071	01	1	
072	07	7	
073	03	3	
074	05	5	
075	02	2	
076	04	4	
077	03	3	
078	06	6	
079	03	3	
080	07	7	
081	69	□P	
082	03	03	
083	02	2	
084	04	4	
085	01	1	
086	05	5	
087	03	3	
088	06	6	
089	00	0	
090	00	0	
091	00	0	
092	00	0	
093	69	□P	
094	04	04	
095	69	□P	
096	05	05	
097	98	ADV	
098	98	ADV	
099	02	2	
100	07	7	
101	03	3	
102	01	1	
103	69	□P	
104	04	04	
105	25	CLR	
106	91	R/S	
107	42	STO□	
108	03	03	
109	67	EQ	
110	98	ADV	
111	69	□P	
112	06	06	
113	76	LBL	
114	98	ADV	
115	03	3	
116	06	6	
117	03	3	
118	01	1	
119	69	□P	
120	04	04	
121	91	R/S	
122	42	STO□	
123	01	01	
124	69	□P	
125	06	06	
126	01	1	
127	05	5	
128	69	□P	
129	04	04	
130	91	R/S	
131	42	STO□	
132	05	05	
133	69	□P	
134	06	06	
135	98	ADV	
136	29	CP	
137	91	R/S	
138	76	LBL	
139	12	B	
140	43	RCL	
141	03	03	
142	22	INV	
143	67	EQ	
144	22	INV	
145	35	1/X	
146	91	R/S	
147	76	LBL	
148	22	INV	
149	69	□P	
150	00	00	
151	02	2	
152	03	3	
153	04	4	
154	05	5	
155	03	3	
156	03	3	
157	01	1	
158	07	7	
159	69	□P	
160	01	01	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

LOC	CODE	KEY	COMMENTS
161	03	3	
162	05	5	
163	02	2	
164	02	2	
165	01	1	
166	07	7	
167	03	3	
168	02	2	
169	03	3	
170	00	0	
171	69	□P	
172	02	02	
173	01	1	
174	07	7	
175	03	3	
176	07	7	
177	03	3	
178	05	5	
179	02	2	
180	04	4	
181	01	1	
182	05	5	
183	69	□P	
184	03	03	
185	69	□P	
186	05	05	
187	98	ADV	
188	76	LBL	
189	24	CE	
190	98	ADV	
191	01	1	
192	06	6	
193	69	□P	
194	04	04	
195	91	R/S	
196	42	STO	
197	02	02	
198	69	□P	
199	06	06	
200	03	3	
201	03	3	
202	69	□P	
203	04	04	
204	43	RCL	
205	02	02	
206	55	÷	
207	43	RCL	
208	03	03	
209	95	=	
210	69	□P	
211	06	06	
212	66	PAU	
213	66	PAU	
214	00	0	
215	42	STO	
216	00	00	
217	42	STO	
218	04	04	
219	76	LBL	
220	25	CLR	
221	43	RCL	
222	02	02	
223	42	STO	
224	08	08	
225	43	RCL	
226	04	04	
227	71	SBR	
228	38	SIN	
229	43	RCL	
230	09	09	
231	42	STO	
232	10	10	
233	43	RCL	
234	03	03	
235	75	-	
236	43	RCL	
237	02	02	
238	95	=	
239	42	STO	
240	08	08	
241	43	RCL	
242	01	01	
243	75	-	
244	43	RCL	
245	04	04	
246	95	=	
247	71	SBR	
248	38	SIN	
249	43	RCL	
250	09	09	
251	49	PRD	
252	10	10	
253	43	RCL	
254	03	03	
255	42	STO	
256	08	08	
257	43	RCL	
258	01	01	
259	71	SBR	
260	38	SIN	
261	43	RCL	
262	09	09	
263	22	INV	
264	49	PRD	
265	10	10	
266	43	RCL	
267	10	10	
268	44	SUM	
269	00	00	
270	43	RCL	
271	05	05	
272	75	-	
273	43	RCL	
274	04	04	
275	95	=	
276	67	EQ	
277	23	LNX	
278	69	□P	
279	24	24	
280	61	GTO	
281	25	CLR	
282	76	LBL	
283	23	LNX	
284	03	3	
285	03	3	
286	01	1	
287	03	3	
288	69	□P	
289	04	04	
290	43	RCL	
291	00	00	
292	69	□P	
293	06	06	
294	91	R/S	
295	42	STO	
296	07	07	
297	71	SBR	
298	99	PRT	
299	61	GTO	
300	24	CE	
301	76	LBL	
302	13	C	
303	69	□P	
304	00	00	
305	01	1	
306	04	4	
307	02	2	
308	04	4	
309	03	3	
310	01	1	
311	69	□P	
312	01	01	
313	03	3	
314	02	2	
315	03	3	
316	00	0	
317	02	2	
318	04	4	
319	01	1	
320	03	3	
321	02	2	

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62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
322	07	7	
323	69	DP	
324	02	02	
325	69	DP	
326	05	05	
327	76	LBL	
328	42	STO	
329	98	ADV	
330	03	3	
331	03	3	
332	69	DP	
333	04	04	
334	91	R/S	
335	42	STO	
336	02	02	
337	69	DP	
338	06	06	
339	71	SBR	
340	39	COS	
341	03	3	
342	03	3	
343	01	1	
344	03	3	
345	69	DP	
346	04	04	
347	43	RCL	
348	07	07	
349	69	DP	
350	06	06	
351	91	R/S	
352	71	SBR	
353	44	SUM	
354	43	RCL	
355	03	03	
356	67	EQ	
357	42	STO	
358	71	SBR	
359	99	PRT	
360	61	GTO	
361	42	STO	
362	76	LBL	
363	14	D	
364	69	DP	
365	00	00	
366	03	3	
367	03	3	
368	03	3	
369	02	2	
370	69	DP	
371	01	01	
372	02	2	
373	04	4	
374	03	3	
375	06	6	
376	03	3	
377	06	6	
378	03	3	
379	02	2	
380	03	3	
381	01	1	
382	69	DP	
383	02	02	
384	69	DP	
385	05	05	
386	76	LBL	
387	52	EE	
388	98	ADV	
389	03	3	
390	03	3	
391	69	DP	
392	04	04	
393	91	R/S	
394	42	STO	
395	02	02	
396	69	DP	
397	06	06	
398	71	SBR	
399	30	TAN	
400	03	3	
401	03	3	
402	01	1	
403	03	3	
404	69	DP	
405	04	04	
406	43	RCL	
407	07	07	
408	69	DP	
409	06	06	
410	91	R/S	
411	71	SBR	
412	44	SUM	
413	43	RCL	
414	03	03	
415	67	EQ	
416	52	EE	
417	71	SBR	
418	99	PRT	
419	61	GTO	
420	52	EE	
421	76	LBL	
422	38	SIN	
423	42	STO	
424	07	07	
425	01	1	
426	42	STO	
427	09	09	
428	43	RCL	
429	07	07	
430	67	EQ	
431	70	RAD	
432	76	LBL	
433	97	DSZ	
434	43	RCL	
435	08	08	
436	49	PRD	
437	09	09	
438	69	DP	
439	38	38	
440	43	RCL	
441	07	07	
442	22	INV	
443	49	PRD	
444	09	09	
445	97	DSZ	
446	07	07	
447	97	DSZ	
448	76	LBL	
449	70	RAD	
450	92	RTN	
451	76	LBL	
452	39	COS	
453	01	1	
454	75	-	
455	43	RCL	
456	02	02	
457	95	=	
458	42	STO	
459	10	10	
460	45	Y^x	
461	43	RCL	
462	01	01	
463	95	=	
464	42	STO	
465	08	08	
466	42	STO	
467	07	07	
468	43	RCL	
469	05	05	
470	67	EQ	
471	80	GRD	
472	00	0	
473	42	STO	
474	04	04	
475	42	STO	
476	00	00	
477	43	RCL	
478	02	02	
479	55	÷	
480	43	RCL	
481	10	10	
482	95	=	

MERGED CODES

62 Pgm Ind
63 Exc Ind
64 Prd Ind
72 STO Ind
73 RCL Ind
74 SUM Ind
83 GTO Ind
84 Op Ind
92 INV SBR

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LOC	CODE	KEY	COMMENTS
483	42	STO	
484	09	09	
485	76	LBL	
486	34	fX	
487	69	OP	
488	24	24	
489	43	RCL	
490	01	01	
491	75	-	
492	43	RCL	
493	04	04	
494	85	+	
495	01	1	
496	95	=	
497	55	÷	
498	43	RCL	
499	04	04	
500	65	×	
501	43	RCL	
502	09	09	
503	65	×	
504	43	RCL	
505	08	08	
506	95	=	
507	44	SUM	
508	00	00	
509	42	STO	
510	08	08	
511	43	RCL	
512	05	05	
513	75	-	
514	43	RCL	
515	04	04	
516	95	=	
517	22	INV	
518	67	EQ	
519	34	fX	
520	43	RCL	
521	00	00	
522	44	SUM	
523	07	07	
524	76	LBL	
525	80	GRD	
526	92	RTN	
527	76	LBL	
528	30	TAN	
529	43	RCL	
530	01	01	
531	65	×	
532	43	RCL	
533	02	02	
534	95	=	
535	42	STO	
536	06	06	
537	94	+/-	
538	22	INV	
539	23	LNX	
540	42	STO	
541	07	07	
542	43	RCL	
543	05	05	
544	67	EQ	
545	60	DEG	
546	01	1	
547	42	STO	
548	00	00	
549	42	STO	
550	08	08	
551	00	0	
552	42	STO	
553	04	04	
554	76	LBL	
555	35	1/X	
556	69	OP	
557	24	24	
558	43	RCL	
559	08	08	
560	65	×	
561	43	RCL	
562	06	06	
563	55	÷	
564	43	RCL	
565	04	04	
566	95	=	
567	44	SUM	
568	00	00	
569	42	STO	
570	08	08	
571	43	RCL	
572	05	05	
573	75	-	
574	43	RCL	
575	04	04	
576	95	=	
577	22	INV	
578	67	EQ	
579	35	1/X	
580	43	RCL	
581	00	00	
582	49	PRD	
583	07	07	
584	76	LBL	
585	60	DEG	
586	92	RTN	
587	76	LBL	
588	44	SUM	
589	01	1	
590	42	STO	
591	11	11	
592	43	RCL	
593	03	03	
594	67	EQ	
595	43	RCL	
596	75	-	
597	43	RCL	
598	01	01	
599	95	=	
600	55	÷	
601	43	RCL	
602	03	03	
603	95	=	
604	42	STO	
605	11	11	
606	76	LBL	
607	43	RCL	
608	01	1	
609	03	3	
610	03	3	
611	02	2	
612	03	3	
613	04	4	
614	69	OP	
615	04	04	
616	43	RCL	
617	07	07	
618	65	×	
619	43	RCL	
620	02	02	
621	65	×	
622	43	RCL	
623	11	11	
624	95	=	
625	69	OP	
626	06	06	
627	66	PAU	
628	66	PAU	
629	92	RTN	
630	76	LBL	
631	99	PRT	
632	01	1	
633	03	3	
634	03	3	
635	07	7	
636	02	2	
637	04	4	
638	69	OP	
639	04	04	
640	43	RCL	
641	03	03	
642	65	×	
643	53	(	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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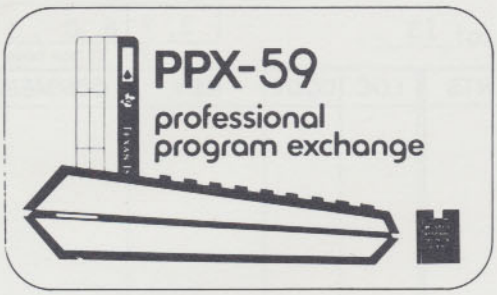
LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
644	01	1									
645	75	-									
646	43	RCL									
647	07	07									
648	54	)									
649	95	=									
650	42	STO									
651	12	12									
652	43	RCL									
653	07	07									
654	65	×									
655	43	RCL									
656	01	01									
657	85	+									
658	43	RCL									
659	12	12									
660	95	=									
661	69	OP									
662	06	06									
663	66	PAU									
664	66	PAU									
665	92	RTN									

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR



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TEXAS INSTRUMENTS
Calculator Products Division

Submission Abstract

Program Title	Rev.
Single Sampling Plan Design	

Abstract of Program

Facilitates the design of single sampling plans, determination of the sample size, n, for a given acceptance number, c, and n&c combination whose operating characteristic (OC) curve comes nearest to satisfying two chosen points given by, p_1, α; p_2, β. Permits the determination of the standard operating ratios (p_2/p_1) for various values of α and β , based on the Poisson probability function.

User Benefits:

Provides for the design of single sampling plans to meet user specified criteria on the operating characteristic (OC) curve.

Category Number 27	Required Progs.	Prog. Steps 333	PC-100A Needed Library Module ID 1 Opt. ☐ x ☐ x

Submittal Agreement

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Name TEXAS INSTRUMENTS Mbr. No. _____

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City _____ State _____ Zip _____

Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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TEXAS INSTRUMENTS
Calculator Products Division

Program Description

Program Title:	Rev.
Single Sampling Plan Design	

Method, Equations, Sketches, Limitations, References, Error Recovery:

The operating characteristic (OC) curve, a plot of the expected probability of acceptance, Pa, versus the process fraction defective, p is often used as a measure of the performance of a sampling plan. Conversely, sampling plans can be derived which match desired points on the operating characteristic curve. This program can be used to derive single sampling plans (sample size, n, and acceptance number, c) whose operating characteristic curve satisfies two chosen points given by $(p_1, \alpha); (p_2, \beta)$, where,

p_1 = process fraction defective, usually associated with good quality (AQL)
α = producer's risk, i.e., the probability of rejection of product with p_1 fraction defective. Hence, the probability of acceptance, Pa, of product with this quality is $1-\alpha$.
p_2 = process fraction defective, usually associated with poor quality (LQL)
β = consumer's risk, i.e., the probability of acceptance of product with p_2 fraction defective.

The Poisson probability function is used. The probability of acceptance, Pa, for a sampling plan is given by the following cumulative Poisson probability function,

$$Pa = P\{d \leq c\} = \sum_{d=0}^{c} (e^{-np}(np)^d)/d! = e^{-np} \sum_{d=0}^{c} (np)^d/d!$$

In order to derive a sampling plan giving the above operating characteristics, it is necessary to solve this function for np for given Pa and c. Since this cannot be done algebraically, an iterative procedure is used.

To determine the sample size, n_1, matching the first point on the OC Curve, Pa is taken as $1-\alpha$ for a given c. The value of np_1 obtained from the iteration is divided by p_1 to obtain n_1. To determine n_2 matching the second point on the OC Curve, Pa is taken as β for the given c. The value of np_2 obtained from the iteration is divided by p_2 to derive n_2.

Depending on the desired values of p_1, α; p_2, β and c, it is entirely possible that the sample sizes derived to meet the two OC Curve points may differ considerably -- indicating that the given plan will not meet the desired criteria simultaneously. It is usually possible to choose an acceptance number c for which the derived sample sizes associated with the two OC Curve points will be close together. For this reason, the program is designed to return to allow new values of c to be entered after computing np for each of the two OC Curve points.

A guide to the choice of c is given by the ratio of the desired values of p_2 and p_1, often referred to as the operating ratio of the sampling plan. Cameron (see Reference) compiles such standard ratios for six combinations of α and β for c values ranging from 0 to 49. To facilitate use of such

☒See Continuation Sheet

Continued From: ☑ Program Description ☐ User Instructions ☐ Stmt. of Example

Program Title: Single Sampling Plan Design	Rev.

tabulations, the program computes the desired p_2 and p_1 ratio after input of the basic parameters. If a tabulation is available for the desired α and β values, the c value associated with the standard p_2/p_1 ratio closest to the desired ratio will yield the sample size (sampling plan) best matching the desired parameters. This is illustrated by a sample problem.

And since this program is capable of computing np for any Pa, an additional application is to obtain the standard ratios for any values of α and β for any range of c values. This is also illustrated by a sample problem.

Reference: Cameron, J.M., Tables for Constructing and for Computing the Operating Characteristics of Single-Sampling Plans, Industrial Quality Control, July, 1952, pp. 37-39.

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User Instructions

Program Title Single Sampling Plan Design

Begin				

Partition (OP 17): 479.59
Parentheses Levels: 1
t Register: xx
Angular Mode (if applicable):
SBR Levels: 1
Absolute Addresses: ☐
Library Module ID: 1
Disturbs Pending Operations: xx

USER DEFINED KEYS

A	Begin new problem
B	
C	
D	
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS (INV) (DSZ)

0	Series Sum
1	n
2	-
3	-
4	i
5	c
6	np
7	DSZ
8	Series Term
9	ε
10	δ
11	-
12	Pa'-Pa
13	Indirect (Pa)
14	-
15	Indirect (p)
16	p_1
17	α
18	p_2
19	β
20	1-α
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	

FLAGS	0	1	2	3	4	5	6	7	8	9

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
1	Branch to program start	-	A	Space, program title prints, space, 3302 (P1 Code) displayed-- awaiting entry of p_1
2	Enter p_1	p_1	R/S	Prints with label, 13 (A Code) displayed--awaiting entry of α
3	Enter α	α	R/S	Prints with label, 3303 (P2 Code) displayed--awaiting entry of p_2
4	Enter p_2	p_2	R/S	Prints with label, 14 (B Code) displayed--awaiting entry of β
5	Enter β, compute OR	β	R/S	Prints with label, space, computation, $OR=p_2/p_1$ prints with label (displayed briefly), space 15, (C Code) displayed--awaiting entry of c
6	Enter c, compute np_1	c	R/S	Prints with label, computation (may be long), np_1 prints with label and is displayed
7	Compute n_1, continue with np_2	-	R/S	Computation, n_1 prints with label (displayed briefly), space, computation (may be long), np_2 prints with label and is displayed
8	Compute n_2	-	R/S	Computation, n_2 prints with label (displayed briefly), space, 15 (C Code) displayed--awaiting entry of next c
9	Steps 6,7, and 8 may be repeated as often as desired for a series of c values or return to Step 1 to begin a new problem.			

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☐ See Continuation Sheet

TEXAS INSTRUMENTS
Calculator Products Division

Sample Problem

Statement of Example

Several examples are presented for different values of the design parameters, p_1, α; p_2, β, to illustrate (1) use of the program with a series of c values to locate the "best" matching sampling plan, (2) use of OR tabulations to determine the best plan with minimum number of iterations, (3) computation for consecutive c values for an α and β set to obtain the standard p_2/p_1 ratios, and (4) use of the derived ratios to derive another sampling plan based on the same α and β.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
Sample Problem 1 - trial and error with a series of c values				
-	A	SINGLE SAMPLING PLAN DESIGN		3302 displayed
.01	R/S	0.01	P1	13 displayed
.05	R/S	0.05	A	3303 displayed
.05	R/S	0.05	P2	14 displayed
.10	R/S	0.1	B	
		5.	DR	Displayed briefly 15 displayed
1	R/S	1.	C	Lengthy computation
		0.355	NP	Displayed
-	R/S	36.	N	Displayed briefly Lengthy computation
		3.89	NP	Displayed
-	R/S	78.	N	Displayed briefly 15 displayed
(etc.)	(etc.)	2.	C	(ditto)
		0.818	NP	
		82.	N	

Mode

☒ Over

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
(cont'd)	(cont'd)	5.321 NP 106. N	(cont'd)
		3. C 1.366 NP 137. N	
		6.68 NP 134. N	
		4. C 1.97 NP 197. N	
		7.992 NP 160. N	

A single sampling plan with n between 134 and 137 and with c = 3 will match the desired points on the operating characteristic curve reasonably well. Note that the standard operating ratios for the specified α and β may be obtained by the division, np_2/np_1, for each c value. These agree with the tabulated values from the Reference (see Program Description), which for the first seven c values are as follows:

c	0	1	2	3	4	5	6
OR	45.10	10.96	6.50	4.89	4.06	3.55	3.21

The computed ratio, $p_2/p_1 = 5$, for the sample problem is closest to the standard ratio for c = 3, for which the best match is obtained. This technique is utilized in Sample Problem 2.

Sample Problem 2 - use of standard OR to derive the "best" plan directly

-	A	SINGLE SAMPLING PLAN DESIGN		3302 displayed
.02	R/S	0.02	P1	13 displayed
.05	R/S	0.05	A	3303 displayed
.07	R/S	0.07	P2	14 displayed
.10	R/S	0.1	B	
		3.5	OR	Displayed briefly 15 displayed, c=5 chosen based on above standard OR values for the same α and β

Modes n* — Printed only (n) — Displayed Briefly (Pause)
(n)* — Printed and displayed

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
5	R/S	5. C	Lengthy computation
		2.612 NP	Displayed
-	R/S	131. N	Displayed briefly
			Lengthy computation
		9.273 NP	Displayed
-	R/S	132. N	

A single sampling plan with n = 131 or 132 and with c = 5 will match the desired OC curve points very well, since the computed ratio of 3.5 is very close to the standard operating ratio of 3.55 for c = 5 and for the same α and β.

Sample Problem 3 - design of plan and derivation of standard OR values

(as above)	(as above)	SINGLE SAMPLING PLAN DESIGN	(as above)
		0.01 P1	
		0.025 A	
		0.1 P2	
		0.05 B	
		10. OR	
		0. C	
		0.025317808 NP	
		3. N	
		2.995732274 NP	
		30. N	
		1. C	
		0.242 NP	
		24. N	
		4.742 NP	
		47. N	
		2. C	
		0.618 NP	
		62. N	
		6.294 NP	
		63. N	

Modes: n* — Printed only (n) — Displayed Briefly (Pause)
(n)* — Printed and displayed

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
(cont'd)	(cont'd)	3. C 1.09 NP 109. N 7.751 NP 78. N 4. C 1.622 NP 162. N 9.151 NP 92. N 5. C 2.2 NP 220. N 10.51 NP 105. N	(cont'd)

A single sampling plan with n = 62 or 63 and with c = 2 will match the specified OC curve points very well. The standard OR values for the designated α and β are as follows, obtained by $np_{.05}/np_{.975}$,

c	0	1	2	3	4	5
OR	118.33	19.60	10.18	7.11	5.64	4.78

From this table we see that the ratio, p_2/p_1 = .10/.01 = 10.0 is best met by c = 2 and confirms the above sampling plan selection. These derived ratios are used for the sampling plan of Sample Problem 4.

Sample Problem 4 - direct derivation of plan using derived OR values

(as above)	(as above)	SINGLE SAMPLING PLAN DESIGN		(as above)
		0.005	P1	
		0.025	A	
		0.03	P2	
		0.05	B	
		6.	OR	c = 4 chosen based on derived OR values
		4.	C	
		1.622	NP	
		324.	N	n = 324 to 305 with c = 4 may be used, though exact match is not possible.
		9.151	NP	
		305.	N	

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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	11	A	
002	98	ADV	
003	98	ADV	
004	29	CP	
005	47	CMS	
006	69	□P	
007	00	00	
008	03	3	
009	06	6	
010	02	2	
011	04	4	
012	03	3	
013	01	1	
014	02	2	
015	02	2	
016	02	2	
017	07	7	
018	69	□P	
019	01	01	
020	01	1	
021	07	7	
022	00	0	
023	00	0	
024	03	3	
025	06	6	
026	01	1	
027	03	3	
028	03	3	
029	00	0	
030	69	□P	
031	02	02	
032	03	3	
033	03	3	
034	02	2	
035	07	7	
036	02	2	
037	04	4	
038	03	3	
039	01	1	
040	02	2	
041	02	2	
042	69	□P	
043	03	03	
044	69	□P	
045	05	05	
046	03	3	
047	03	3	
048	02	2	
049	07	7	
050	01	1	
051	03	3	
052	69	□P	
053	01	01	
054	03	3	
055	01	1	
056	00	0	
057	00	0	
058	01	1	
059	06	6	
060	01	1	
061	07	7	
062	03	3	
063	06	6	
064	69	□P	
065	02	02	
066	02	2	
067	04	4	
068	02	2	
069	02	2	
070	03	3	
071	01	1	
072	00	0	
073	00	0	
074	00	0	
075	00	0	
076	69	□P	
077	03	03	
078	69	□P	
079	05	05	
080	98	ADV	
081	98	ADV	
082	03	3	
083	03	3	
084	00	0	
085	02	2	
086	69	□P	
087	04	04	
088	91	R/S	
089	42	STO	
090	16	16	
091	69	□P	
092	06	06	
093	01	1	
094	03	3	
095	69	□P	
096	04	04	
097	91	R/S	
098	42	STO	
099	17	17	
100	69	□P	
101	06	06	
102	75	-	
103	01	1	
104	95	=	
105	94	+/-	
106	42	STO	
107	20	20	
108	98	ADV	
109	03	3	
110	03	3	
111	00	0	
112	03	3	
113	69	□P	
114	04	04	
115	91	R/S	
116	42	STO	
117	18	18	
118	69	□P	
119	06	06	
120	01	1	
121	04	4	
122	69	□P	
123	04	04	
124	91	R/S	
125	42	STO	
126	19	19	
127	69	□P	
128	06	06	
129	98	ADV	
130	03	3	
131	02	2	
132	03	3	
133	05	5	
134	69	□P	
135	04	04	
136	43	RCL	
137	18	18	
138	55	÷	
139	43	RCL	
140	16	16	
141	95	=	
142	66	PAU	
143	66	PAU	
144	69	□P	
145	06	06	
146	98	ADV	
147	76	LBL	
148	57	ENG	
149	01	1	
150	05	5	
151	69	□P	
152	04	04	
153	91	R/S	
154	42	STO	
155	05	05	
156	69	□P	
157	06	06	
158	02	2	
159	00	0	
160	42	STO	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
161	13	13	
162	02	2	
163	42	STO	
164	07	07	
165	01	1	
166	06	6	
167	42	STO	
168	15	15	
169	76	LBL	
170	69	OP	
171	43	RCL	
172	05	05	
173	67	EQ	
174	58	FIX	
175	71	SBR	
176	59	INT	
177	61	GTO	
178	50	I×I	
179	76	LBL	
180	58	FIX	
181	73	RC*	
182	13	13	
183	23	LNX	
184	94	+/-	
185	42	STO	
186	06	06	
187	76	LBL	
188	50	I×I	
189	03	3	
190	01	1	
191	03	3	
192	03	3	
193	69	OP	
194	04	04	
195	43	RCL	
196	06	06	
197	69	OP	
198	06	06	
199	91	R/S	
200	55	÷	
201	73	RC*	
202	15	15	
203	85	+	
204	93	.	
205	05	5	
206	95	=	
207	59	INT	
208	42	STO	
209	01	01	
210	03	3	
211	01	1	
212	69	OP	
213	04	04	
214	43	RCL	
215	01	01	
216	69	OP	
217	06	06	
218	66	PAU	
219	66	PAU	
220	98	ADV	
221	01	1	
222	22	INV	
223	44	SUM	
224	13	13	
225	02	2	
226	44	SUM	
227	15	15	
228	97	DSZ	
229	07	07	
230	69	OP	
231	98	ADV	
232	61	GTO	
233	57	ENG	
234	76	LBL	
235	59	INT	
236	01	1	
237	42	STO	
238	10	10	
239	42	STO	
240	06	06	
241	93	.	
242	00	0	
243	00	0	
244	00	0	
245	01	1	
246	42	STO	
247	09	09	
248	76	LBL	
249	65	×	
250	01	1	
251	42	STO	
252	00	00	
253	42	STO	
254	08	08	
255	00	0	
256	42	STO	
257	04	04	
258	76	LBL	
259	35	1/X	
260	69	OP	
261	24	24	
262	43	RCL	
263	08	08	
264	65	×	
265	43	RCL	
266	06	06	
267	55	÷	
268	43	RCL	
269	04	04	
270	95	=	
271	44	SUM	
272	00	00	
273	42	STO	
274	08	08	
275	43	RCL	
276	05	05	
277	75	-	
278	43	RCL	
279	04	04	
280	95	=	
281	22	INV	
282	67	EQ	
283	35	1/X	
284	43	RCL	
285	00	00	
286	65	×	
287	53	(	
288	43	RCL	
289	06	06	
290	94	+/-	
291	22	INV	
292	23	LNX	
293	54	)	
294	95	=	
295	75	-	
296	73	RC*	
297	13	13	
298	95	=	
299	42	STO	
300	12	12	
301	50	I×I	
302	75	-	
303	43	RCL	
304	09	09	
305	95	=	
306	77	GE	
307	34	fX	
308	92	RTN	
309	76	LBL	
310	34	fX	
311	43	RCL	
312	12	12	
313	77	GE	
314	97	DSZ	
315	43	RCL	
316	10	10	
317	22	INV	
318	44	SUM	
319	06	06	
320	01	1	
321	00	0	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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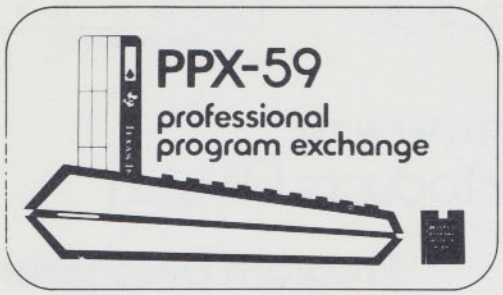
LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
322	22	INV									
323	49	PRD									
324	10	10									
325	76	LBL									
326	97	DSZ									
327	43	RCL									
328	10	10									
329	44	SUM									
330	06	06									
331	61	GTO									
332	65	×									

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR



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TEXAS INSTRUMENTS
Calculator Products Division

Submission Abstract

Program Title	Rev.
AOQL Single Sampling Plans	

Abstract of Program

Facilitates the design of single sampling plans of the Average Outgoing Quality Limit (AOQL) type useful in rectification type sampling inspection. Under a Flag 1 option, either the AOQL is obtained (Flag 1 off or not set) or the sample size is obtained (Flag 1 on or set) for input of the remaining parameters of single sampling plans. The lot size, N, is optional (entered or not). Then for Flag 1 not set, the AOQL is obtained for input of the desired sample size, n, and one or more values of the acceptance number, c. For Flag 1 set, the sample size, n, is obtained for input of the desired AOQL, and one or more values of c.

User Benefits:

Provides comprehensive design of single sampling plans of the AOQL type.

Category Number 27	Required Progs.	Prog. Steps 396	PC-100A Needed Library Opt. ☒ Module ID 1 ☒

Submittal Agreement

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Name TEXAS INSTRUMENTS Mbr. No. _____

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Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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Program Description

Program Title: AOQL Single Sampling Plans	Rev.

Method, Equations, Sketches, Limitations, References, Error Recovery:

The Average Outgoing Quality Limit (AOQL) is a common performance measure (and design parameter) for sampling plans used under the rectification principle. It is the maximum of the Average Outgoing Quality (AOQ) over the process fraction defective, p. The following equation applies to AOQL single sampling plans,

AOQL = y/n - y/N , where y is a function of the acceptance number, c, and is based on the Poisson distribution function.

Dodge (see Reference) determines and tabulates values of y as follows,

c	y	c	y	c	y	c	y	c	y	c	y
0	.3679	7	4.472	14	9.398	21	14.66	28	20.12	35	25.71
1	.8400	8	5.146	15	10.13	22	15.43	29	20.91	36	26.52
2	1.371	9	5.831	16	10.88	23	16.20	30	21.70	37	27.33
3	1.942	10	6.528	17	11.62	24	16.98	31	22.50	38	28.14
4	2.544	11	7.233	18	12.37	25	17.76	32	23.30	39	28.96
5	3.168	12	7.948	19	13.13	26	18.54	33	24.10	40	29.77
6	3.812	13	8.670	20	13.89	27	19.33	34	24.90	41	33.35*

* added to the tabulation to complete sets of three for split register storage

The program uses the above formula, for AOQL, and re-solved for n in terms of AOQL, together with the above tabulation of y values, to facilitate the design of AOQL single sampling plans. Computation for the range of $0 \leq c \leq 41$ is allowed. The lot size, N, may be entered or omitted, in which case, the formulas are adjusted for infinite lot size (e.g. AOQL = y/n). Flag 1 is used to permit the option to determine AOQL for given N, n, and c (off or not set) or n for given N, AOQL, and c (on or set). The program returns to allow entry of different c values for the same set of N and n or N and AOQL, but branching to program start allows for changing the basic parameters as well as changing the Flag setting.

The y values are stored in registers 11-23 by means of a split register technique, three values to each register, beginning with c = 3. For c = 0,1, and 2, the y values are incorporated in the program. The following format is used, making use of the 13 digit capability of the computer,

Register	Combined y's	Register	Combined y's	Register	Combined y's
11	19422544.3168	15	10131088.1162	19	19332012.2091
12	38124472.5146	16	12371313.1389	20	21702250.2330
13	58316528.7233	17	14661543.1620	21	24102490.2571
14	79488670.9398	18	16981776.1854	22	26522733.2814
				23	28962977.3335

The following sequence can be used to load the registers: enter the first eight digits XXXXXXXX, depress +, enter the next four digits with decimal point .XXXX, depress = , depress STO YY, where YY is the respective register number. After initial entry, these values can be recorded on a magnetic card (bank 4) for subsequent loading with the program (banks 1 and 2).

Reference: Dodge, H.F. and H.G. Romig, Sampling Inspection Tables - Single and Double Sampling, John Wiley & Sons, Inc., Second Edition, 1959, New York, pg. 39. Copyright (1944) Bell Telephone Laboratories; y values reprinted by permission.

□ See Continuation Sheet

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User Instructions

Program Title AOQL Single Sampling Plans

Begin				

Partition (OP 17): 479.59
Parentheses Levels: 1
t Register: ☒
Angular Mode (if applicable):
SBR Levels: 1
Absolute Addresses: ☒
Library Module ID: 1
Disturbs Pending Operations: ☒

USER DEFINED KEYS

A	Begin new problem
B	
C	
D	
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS (INV Ost)

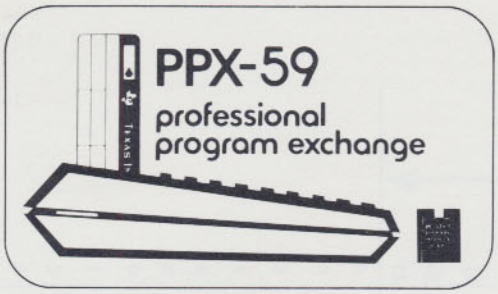
0	
1	n
2	AOQL
3	N or 0
4	
5	c
6	c/3
7	y
8	Indirect
9	
10	y's retrieved
11	y values
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	

FLAGS	0	1	2	3	4	5	6	7	8	9
	n for AOQL									

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
1	Load program and y values			
2	Choose design option:			
	.1 AOQL for given N, n, c Proceed to step 3 (Flag 1 off)			
	.2 n for given N, AOQL, c		2nd St flg	
		1		
	(Note: Flag 1 can be turned on or off between steps 3 and 4)			
3	Branch to program start	-	A	Space, program title prints, space, 0 displayed--awaiting entry or not of lot size, N
4	Choose to enter N or not			
	.1 Specify finite lot size, N	N	R/S	Prints with label and space
	.1.1 Flag 1 not set			Heading: ENTER SN prints, 3631 (SN Code) displayed--awaiting entry of n
	.1.2 Flag 1 set			Heading: ENTER AOQL prints, 13323427 displayed--awaiting entry of AOQL
	.2 Specify infinite lot size	-	R/S	
	.2.1 Flag 1 not set			Same as 4.1.1
	.2.2 Flag 1 set			Same as 4.1.2
5	Enter n or AOQL			
	.1 Flag 1 not set	n	R/S	Prints with label, space, 15 (C Code) displayed--awaiting entry of c
	.2 Flag 1 set	AOQL	R/S	Same as 5.1
6	Enter c	c	R/S	Prints with label, computation,

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☐ See Continuation Sheet



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Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: AOQL Single Sampling Plans	Rev.

Step	Procedure	Enter	Press	Output/Mode
6	.1 Flag 1 not set			AOQL value prints with label (displayed briefly), 15 displayed--awaiting entry of next c
	.2 Flag 1 set			n value prints with label (displayed briefly), 15 displayed--awaiting entry of next c
7	Step 6 may be repeated as often as desired for a series of c values or return to step 2 or 3 is allowed			

TEXAS INSTRUMENTS
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Sample Problem

Statement of Example

Several examples are presented for different values of the parameters of single sampling plans and for different options to illustrate the features of the program. The printed output is generally self-explanatory.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
Sample Problem 1 - Flag 1 not set - Finite lot size specified - Several c values			
-	A	ADQL SINGLE SAMPLING	0 displayed
500	R/S	500. LN	
		ENTER SN	3631 displayed
75	R/S	75. SN	
			15 displayed
0	R/S	0. C .0041695333 ADQL	
			15 displayed
1	R/S	1. C 0.00952 ADQL	
			15 displayed
2	R/S	2. C 0.015538 ADQL	
Sample Problem 2 - Flag 1 not set - Infinite lot size specified (No entry) - Several c values			
-	A	ADQL SINGLE SAMPLING	0 displayed
-	R/S		(No entry for N)
		ENTER SN	3631 displayed
50	R/S	50. SN	

☐ Over

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
			15 displayed
0	R/S	0. C 0.007358 AOQL	
			15 displayed
1	R/S	1. C 0.0168 AOQL	
			15 displayed
2	R/S	2. C 0.02742 AOQL	
Sample Problem 3 - Flag 1 set - Finite lot size - Several c values			
	2nd St flg		
1			
-	A	AOQL SINGLE SAMPLING	0 displayed
800	R/S	800. LN	
		ENTER AOQL	13323427 displayed
.025	R/S	0.025 AOQL	
			15 displayed
0	R/S	0. C 14. SN	
			15 displayed
1	R/S	1. C 32. SN	
			15 displayed
2	R/S	2. C 51. SN	
Sample Problem 4 - Flag 1 set (from above) - Infinite lot size (No entry) - Several c values			
-	A	AOQL SINGLE SAMPLING	0 displayed
-	R/S	ENTER AOQL	13323427 displayed
.05	R/S	0.05 AOQL	
			15 displayed
0	R/S	0. C 7. SN	
			(ditto)
(etc.)	(etc.)	1. C 17. SN	
		2. C 27. SN	

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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	11	A	
002	98	ADV	
003	98	ADV	
004	29	CP	
005	01	1	
006	03	3	
007	03	3	
008	02	2	
009	03	3	
010	04	4	
011	02	2	
012	07	7	
013	00	0	
014	00	0	
015	69	DP	
016	01	01	
017	03	3	
018	06	6	
019	02	2	
020	04	4	
021	03	3	
022	01	1	
023	02	2	
024	02	2	
025	02	2	
026	07	7	
027	69	DP	
028	02	02	
029	01	1	
030	07	7	
031	00	0	
032	00	0	
033	03	3	
034	06	6	
035	01	1	
036	03	3	
037	03	3	
038	00	0	
039	69	DP	
040	03	03	
041	03	3	
042	03	3	
043	02	2	
044	07	7	
045	02	2	
046	04	4	
047	03	3	
048	01	1	
049	02	2	
050	02	2	
051	69	DP	
052	04	04	
053	69	DP	
054	05	05	
055	98	ADV	
056	02	2	
057	07	7	
058	03	3	
059	01	1	
060	69	DP	
061	04	04	
062	25	CLR	
063	91	R/S	
064	42	STO	
065	03	03	
066	67	EQ	
067	98	ADV	
068	69	DP	
069	06	06	
070	76	LBL	
071	98	ADV	
072	87	IFF	
073	01	01	
074	48	EXC	
075	98	ADV	
076	69	DP	
077	00	00	
078	01	1	
079	07	7	
080	03	3	
081	01	1	
082	03	3	
083	07	7	
084	01	1	
085	07	7	
086	03	3	
087	05	5	
088	69	DP	
089	01	01	
090	03	3	
091	06	6	
092	03	3	
093	01	1	
094	69	DP	
095	02	02	
096	69	DP	
097	05	05	
098	91	R/S	
099	42	STO	
100	01	01	
101	71	SBR	
102	70	RAD	
103	61	GTO	
104	61	GTO	
105	76	LBL	
106	48	EXC	
107	98	ADV	
108	69	DP	
109	00	00	
110	01	1	
111	07	7	
112	03	3	
113	01	1	
114	03	3	
115	07	7	
116	01	1	
117	07	7	
118	03	3	
119	05	5	
120	69	DP	
121	01	01	
122	01	1	
123	03	3	
124	03	3	
125	02	2	
126	03	3	
127	04	4	
128	02	2	
129	07	7	
130	69	DP	
131	02	02	
132	69	DP	
133	05	05	
134	91	R/S	
135	42	STO	
136	02	02	
137	71	SBR	
138	80	GRD	
139	76	LBL	
140	61	GTO	
141	98	ADV	
142	01	1	
143	05	5	
144	69	DP	
145	04	04	
146	91	R/S	
147	42	STO	
148	05	05	
149	69	DP	
150	06	06	
151	67	EQ	
152	44	SUM	
153	75	-	
154	01	1	
155	95	=	
156	67	EQ	
157	42	STO	
158	75	-	
159	01	1	
160	95	=	

COMMENTS

MERGED CODES

62 Pgm Ind
63 Exc Ind
64 Prd Ind
72 STO Ind
73 RCL Ind
74 SUM Ind
83 GTO Ind
84 Op Ind
92 INV SBR

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LOC	CODE	KEY	COMMENTS
161	67	EQ	
162	24	CE	
163	43	RCL	
164	05	05	
165	55	÷	
166	03	3	
167	95	=	
168	42	STO	
169	06	06	
170	59	INT	
171	85	+	
172	01	1	
173	00	0	
174	95	=	
175	42	STO	
176	08	08	
177	73	RC*	
178	08	08	
179	42	STO	
180	10	10	
181	43	RCL	
182	06	06	
183	22	INV	
184	59	INT	
185	67	EQ	
186	38	SIN	
187	65	×	
188	01	1	
189	00	0	
190	55	÷	
191	03	3	
192	75	-	
193	01	1	
194	95	=	
195	59	INT	
196	67	EQ	
197	39	COS	
198	43	RCL	
199	10	10	
200	22	INV	
201	59	INT	
202	42	STO	
203	07	07	
204	61	GTO	
205	30	TAN	
206	76	LBL	
207	38	SIN	
208	43	RCL	
209	10	10	
210	65	×	
211	01	1	
212	52	EE	
213	04	4	
214	94	+/-	
215	95	=	

LOC	CODE	KEY	COMMENTS
216	59	INT	
217	65	×	
218	01	1	
219	52	EE	
220	04	4	
221	94	+/-	
222	95	=	
223	42	STO	
224	07	07	
225	61	GTO	
226	30	TAN	
227	76	LBL	
228	39	COS	
229	43	RCL	
230	10	10	
231	59	INT	
232	65	×	
233	01	1	
234	52	EE	
235	04	4	
236	94	+/-	
237	95	=	
238	22	INV	
239	59	INT	
240	42	STO	
241	07	07	
242	76	LBL	
243	30	TAN	
244	43	RCL	
245	05	05	
246	55	÷	
247	01	1	
248	05	5	
249	95	=	
250	59	INT	
251	67	EQ	
252	28	LOG	
253	01	1	
254	00	0	
255	00	0	
256	49	PRD	
257	07	07	
258	61	GTO	
259	53	(	
260	76	LBL	
261	28	LOG	
262	01	1	
263	00	0	
264	49	PRD	
265	07	07	
266	61	GTO	
267	53	(	
268	76	LBL	
269	44	SUM	
270	93	.	

LOC	CODE	KEY	COMMENTS
271	03	3	
272	06	6	
273	07	7	
274	09	9	
275	42	STO	
276	07	07	
277	61	GTO	
278	53	(	
279	76	LBL	
280	42	STO	
281	93	.	
282	08	8	
283	04	4	
284	42	STO	
285	07	07	
286	61	GTO	
287	53	(	
288	76	LBL	
289	24	CE	
290	01	1	
291	93	.	
292	03	3	
293	07	7	
294	01	1	
295	42	STO	
296	07	07	
297	76	LBL	
298	53	(	
299	25	CLR	
300	87	IFF	
301	01	01	
302	54	)	
303	43	RCL	
304	07	07	
305	55	÷	
306	43	RCL	
307	01	01	
308	95	=	
309	42	STO	
310	02	02	
311	43	RCL	
312	03	03	
313	67	EQ	
314	55	÷	
315	55	÷	
316	43	RCL	
317	07	07	
318	95	=	
319	35	1/X	
320	22	INV	
321	44	SUM	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
322	02	02	
323	76	LBL	
324	55	÷	
325	71	SBR	
326	80	GRD	
327	66	PAU	
328	66	PAU	
329	61	GTO	
330	61	GTO	
331	76	LBL	
332	54	)	
333	43	RCL	
334	03	03	
335	67	EQ	
336	65	×	
337	55	÷	
338	43	RCL	
339	07	07	
340	95	=	
341	35	1/X	
342	85	+	
343	76	LBL	
344	65	×	
345	43	RCL	
346	02	02	
347	95	=	
348	55	÷	
349	43	RCL	
350	07	07	
351	95	=	
352	35	1/X	
353	85	+	
354	93	.	
355	05	5	
356	95	=	
357	59	INT	
358	42	STO	
359	01	01	
360	71	SBR	
361	70	RAD	
362	66	PAU	
363	66	PAU	
364	61	GTO	
365	61	GTO	
366	76	LBL	
367	70	RAD	
368	03	3	
369	06	6	
370	03	3	
371	01	1	
372	69	OP	
373	04	04	
374	43	RCL	
375	01	01	
376	69	OP	
377	06	06	
378	92	RTN	
379	76	LBL	
380	80	GRD	
381	01	1	
382	03	3	
383	03	3	
384	02	2	
385	03	3	
386	04	4	
387	02	2	
388	07	7	
389	69	OP	
390	04	04	
391	43	RCL	
392	02	02	
393	69	OP	
394	06	06	
395	92	RTN	

LOC	CODE	KEY	COMMENTS

LOC	CODE	KEY	COMMENTS

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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Submission Abstract

Program Title	Rev.
Unit Sequential Sampling Plans	

Abstract of Program

Computes the acceptance-rejection criteria (coefficients for the linear equations) as well as the operating characteristics (p vs. Pa) and average sample number (ASN) for attribute unit sequential sampling plans as designated by the user. Plans having operating characteristic (OC) curves passing through two designated points are derived. The user specifies the two points as (1) p_1, the fraction defective (nonconforming) usually associated with good (acceptable) quality and its corresponding probability of rejection, α, and (2) p_2, the fraction defective (nonconforming) usually associated with poor (unacceptable) quality and its corresponding probability of acceptance, β.

User Benefits:

Provides comprehensive analysis via the criteria and performance characteristics for attribute unit sequential sampling plans with user defined design parameters.

Category Number 27	Required Progs.	Prog. Steps 653	PC-100A Needed Opt. ☐ Library Module ID 1 ☐x

Submittal Agreement

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Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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Program Description

Program Title: Unit Sequential Sampling Plans

Rev.

Method, Equations, Sketches, Limitations, References, Error Recovery:

Upon input of the desired points (p_1,α) and (p_2,β), the program computes and prints the coefficients for the line of acceptance, $d=h_2+sn$ and the line of rejection, $d= -h_1+sn$. The values of h_1, h_2, and s are computed and printed (briefly displayed), where d represents the number of defective (nonconforming) units found in n units sampled and inspected.

$$h_1 = \log[(1-\alpha)/\beta]/\log[p_2(1-p_1)/p_1(1-p_2)]$$

$$h_2 = \log[(1-\beta)/\alpha]/\log[p_2(1-p_1)/p_1(1-p_2)]$$

$$s = \log[(1-p_1)/(1-p_2)]/\log[p_2(1-p_1)/p_1(1-p_2)]$$

The program then gives the user two options to compute values for the OC curve (p vs. Pa) and ASN curve or to return to develop the acceptance-rejection criteria for a new sequential sampling plan. The first option (B) develops the probability of acceptance, Pa, and average sample number, ASN, for a set of seven values of fraction defective, p, ranging from $p=p_1$ to $p=p_2$, with five intermediate values including p=s. The second option (C) develops Pa and ASN for a more detailed look at the OC and ASN curves (performance) over a set of seventeen values of fraction defective, including $p=p_1$, s, and p_2, but otherwise for fourteen different values of p than those of option 1. Therefore, for an even more detailed look at the performance characteristics, both options may be executed for a total of twenty one separate points. The first option represents series values for θ of 1.0, 0.5, 0.1, 0, -0.1,-0.5 and -1.0, while those of the second option are: 1.4, 1.2, 1.0, 0.8,0.6, 0.4, 0.2, 0.05, 0. -0.05, -0.2, -0.4, -0.6, -0.8, -1.0, -1.2, and -1.4, in the following formulas for p, Pa and ASN,

$$p=\left\{1-[(1-p_2)/(1-p_1)]^{\theta}\right\}/\left\{(p_2/p_1)^{\theta}-[(1-p_2)/(1-p_1)]^{\theta}\right\}$$

$$Pa=\left\{[(1-\beta)/\alpha]^{\theta}-1\right\}/\left\{[(1-\beta)/\alpha]^{\theta}-[\beta/(1-\alpha)]^{\theta}\right\}$$

$$ASN=\left\{Pa\cdot\log[\beta/(1-\alpha)]+(1-Pa)\log[(1-\beta)/\alpha]\right\}\div \left\{p\log(p_2/p_1)+(1-p)\log[(1-p_2)/(1-p_1)]\right\}$$

However, for θ=1.0, 0.0, and -1.0, the following formulas apply,

θ	1.0	0.0	-1.0
p	p_1	s	p_2
Pa	$1-\alpha$	$h_2/(h_1+h_2)$	β
ASN	$\dfrac{(1-\alpha)h_1-\alpha h_2}{s-p_1}$	$\dfrac{h_1h_2}{s(1-s)}$	$\dfrac{\beta h_1-(1-\beta)h_2}{s-p_2}$

☐ See Continuation Sheet

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User Instructions

Program Title Unit Sequential Sampling Plans

Entry	Opt.1	Opt. 2		

Partition (OP 17): 719 29
Parentheses Levels: 1
t Register: [X]
Angular Mode (if applicable):
SBR Levels: 1
Absolute Addresses: [ ]
Library Module ID: 1
Disturbs Pending Operations: [X]

USER DEFINED KEYS

A	Entry and criteria
B	Option 1 evauation
C	Option 2 evaluation
D	
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS (INV)

0	-
1	p_1
2	α
3	p_2
4	β
5	*
6	*
7	*
8	*
9	*
10	*
11	*
12	p
13	*
14	Pa
15	*
16	ASN
17	h_1
18	h_2
19	s
0	
1	
2	
3	
4	
5	*interim computations
6	
7	
8	
9	
0	
1	
2	
3	
4	

FLAGS	0	1	2	3	4	5	6	7	8	9

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
1	Branch to program start	-	A	Space,title prints,space,halts with 3302(P1 Code) displayed - awaiting input of p_1
2	Enter p_1	P1	R/S	Prints with label,halts with 13 (A Code) displayed - awaiting input of α
3	Enter α	α	R/S	Prints with label,space,halts with 3303(P2 Code) displayed - awaiting input of p_2
4	Enter p_2	p_2	R/S	Prints with label, halts with 14 (B Code) displayed - awaiting input of β
5	Enter β	β	R/S	Prints with label,space,computation, h_1 prints with label(briefly displayed), h_2 prints with label (briefly displayed), s prints with label (briefly displayed, space, halts with s displayed
6	Cont'd. on next page			

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☐ See Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: Unit Sequential Sampling Plans | Rev.

Step	Procedure	Ent	Prs	Output/Mode
6	At this point the user is offered the choice to return to step 1 to determine the acceptance-rejection criteria for a new problem, or to execute either or both of two options for evaluating the performance characteristics, p, Pa, and ASN for the sampling plan determined under (A). For the options, in any order,			
	(1) Brief evaluation. Upon completion, return to step 1 or execution of option (2) is allowed.	-	B	Computation, printing with labels, brief display, and space for five sets of p, Pa, and ASN values, beginning with $p=p_1$ and ending with $p=p_2$
	(2) Detailed evaluation. Upon completion, return to step 1 or execution of option (1) is allowed	-	C	Computation, printing with labels, brief display, and space for seventeen sets of p, Pa and ASN values.

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Sample Problem

Statement of Example

The unit sequential sampling plan with parameters, p_1= .02, α= .05; p_2=.1, β=.10 is illustrated.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
-	A	UNIT SEQUENTIAL		
		SAMPLING PLAN		3302(P1 Code)displayed
.02	R/S	0.02	P1	13 (A Code) displayed
.05	R/S	0.05	A	3303 (P2 Code) displayed
.10	R/S	0.1	P2	14 (B Code) displayed
.10	R/S	0.1	B	
		1.328512619	H1	Displayed briefly
		1.705640893	H2	Displayed briefly
		.0502525808	S	Displayed
-	B	0.02	P	
		0.95	PA	Displayed briefly
		38.89932406	ASN	Displayed briefly
				Displayed briefly
		.0326237921	P	(Ditto)
		.8275847253	PA	
		45.68539697	ASN	

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
		.04631180003 P	(Ditto)
		.6244153126 PA	
		47.94253824 ASN	
		.0502525808 P	
		.5621471973 PA	
		47.47738506 ASN	
		.0543987179 P	
		.4985413487 PA	
		46.54691956 ASN	
		.0729490169 P	
		.2685039405 PA	
		39.25544588 ASN	
		0.1 P	
		0.1 PA	
		28.18690021 ASN	
-	C		
		.0130219877 P	
		.9832522078 PA	(As above)
		34.31847683 ASN	
		.0162016086 P	
		.9708648945 PA	
		36.41929019 ASN	
		0.02 P	
		0.95 PA	
		38.89932406 ASN	
		(etc.)	
		0.1 P	
		0.1 PA	
		28.18690021 ASN	
		.1117691999 P	
		.0651464075 PA	
		24.51332198 ASN	
		.1239467908 P	
		.0420583163 PA	
		21.41320878 ASN	

Modes: n* — Printed only (n) — Displayed Briefly (Pause)
(n)* — Printed and displayed

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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	11	A	
002	98	ADV	
003	98	ADV	
004	47	CMS	
005	69	□P	
006	00	00	
007	04	4	
008	01	1	
009	03	3	
010	01	1	
011	02	2	
012	04	4	
013	03	3	
014	07	7	
015	00	0	
016	00	0	
017	69	□P	
018	01	01	
019	03	3	
020	06	6	
021	01	1	
022	07	7	
023	03	3	
024	04	4	
025	04	4	
026	01	1	
027	01	1	
028	07	7	
029	69	□P	
030	02	02	
031	03	3	
032	01	1	
033	03	3	
034	07	7	
035	02	2	
036	04	4	
037	01	1	
038	03	3	
039	02	2	
040	07	7	
041	69	□P	
042	03	03	
043	69	□P	
044	05	05	
045	98	ADV	
046	03	3	
047	06	6	
048	01	1	
049	03	3	
050	03	3	
051	00	0	
052	03	3	
053	03	3	
054	69	□P	
055	01	01	
056	02	2	
057	07	7	
058	02	2	
059	04	4	
060	03	3	
061	01	1	
062	02	2	
063	02	2	
064	00	0	
065	00	0	
066	69	□P	
067	02	02	
068	03	3	
069	03	3	
070	02	2	
071	07	7	
072	01	1	
073	03	3	
074	03	3	
075	01	1	
076	00	0	
077	00	0	
078	69	□P	
079	03	03	
080	69	□P	
081	05	05	
082	98	ADV	
083	98	ADV	
084	03	3	
085	03	3	
086	00	0	
087	02	2	
088	69	□P	
089	04	04	
090	91	R/S	
091	69	□P	
092	06	06	
093	42	STO□	
094	01	01	
095	01	1	
096	03	3	
097	69	□P	
098	04	04	
099	91	R/S	
100	69	□P	
101	06	06	
102	42	STO□	
103	02	02	
104	98	ADV	
105	03	3	
106	03	3	
107	00	0	
108	03	3	
109	69	□P	
110	04	04	
111	91	R/S	
112	69	□P	
113	06	06	
114	42	STO□	
115	03	03	
116	01	1	
117	04	4	
118	69	□P	
119	04	04	
120	91	R/S	
121	69	□P	
122	06	06	
123	42	STO□	
124	04	04	
125	98	ADV	
126	98	ADV	
127	01	1	
128	75	-	
129	43	RCL	
130	02	02	
131	95	=	
132	55	÷	
133	43	RCL	
134	04	04	
135	95	=	
136	42	STO□	
137	05	05	
138	28	LOG□	
139	42	STO□	
140	06	06	
141	01	1	
142	75	-	
143	43	RCL	
144	04	04	
145	95	=	
146	55	÷	
147	43	RCL	
148	02	02	
149	95	=	
150	42	STO□	
151	07	07	
152	28	LOG□	
153	42	STO□	
154	08	08	
155	53	(	
156	01	1	
157	75	-	
158	43	RCL	
159	01	01	
160	54	)	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
161	55	÷	
162	53	(	
163	01	1	
164	75	-	
165	43	RCL	
166	03	03	
167	54	)	
168	95	=	
169	42	STO	
170	09	09	
171	65	×	
172	43	RCL	
173	03	03	
174	55	÷	
175	43	RCL	
176	01	01	
177	95	=	
178	28	LOG	
179	42	STO	
180	10	10	
181	02	2	
182	03	3	
183	00	0	
184	02	2	
185	69	OP	
186	04	04	
187	43	RCL	
188	06	06	
189	55	÷	
190	43	RCL	
191	10	10	
192	95	=	
193	42	STO	
194	17	17	
195	69	OP	
196	06	06	
197	66	PAU	
198	66	PAU	
199	02	2	
200	03	3	
201	00	0	
202	03	3	
203	69	OP	
204	04	04	
205	43	RCL	
206	08	08	
207	55	÷	
208	43	RCL	
209	10	10	
210	95	=	
211	42	STO	
212	18	18	
213	69	OP	
214	06	06	
215	66	PAU	

LOC	CODE	KEY	COMMENTS
216	66	PAU	
217	03	3	
218	06	6	
219	69	OP	
220	04	04	
221	43	RCL	
222	09	09	
223	28	LOG	
224	55	÷	
225	43	RCL	
226	10	10	
227	95	=	
228	42	STO	
229	19	19	
230	69	OP	
231	06	06	
232	66	PAU	
233	66	PAU	
234	98	ADV	
235	98	ADV	
236	91	R/S	
237	76	LBL	
238	12	B	
239	71	SBR	
240	38	SIN	
241	71	SBR	
242	99	PRT	
243	93	.	
244	05	5	
245	42	STO	
246	00	00	
247	71	SBR	
248	69	OP	
249	71	SBR	
250	99	PRT	
251	93	.	
252	01	1	
253	42	STO	
254	00	00	
255	71	SBR	
256	69	OP	
257	71	SBR	
258	99	PRT	
259	71	SBR	
260	39	COS	
261	71	SBR	
262	99	PRT	
263	93	.	
264	01	1	
265	94	+/-	
266	42	STO	
267	00	00	
268	71	SBR	
269	69	OP	
270	71	SBR	

LOC	CODE	KEY	COMMENTS
271	99	PRT	
272	93	.	
273	05	5	
274	94	+/-	
275	42	STO	
276	00	00	
277	71	SBR	
278	69	OP	
279	71	SBR	
280	99	PRT	
281	71	SBR	
282	30	TAN	
283	71	SBR	
284	99	PRT	
285	91	R/S	
286	76	LBL	
287	13	C	
288	29	CP	
289	01	1	
290	93	.	
291	06	6	
292	42	STO	
293	00	00	
294	76	LBL	
295	32	X↕T	
296	93	.	
297	02	2	
298	22	INV	
299	44	SUM	
300	00	00	
301	43	RCL	
302	00	00	
303	85	+	
304	01	1	
305	93	.	
306	06	6	
307	95	=	
308	67	EQ	
309	24	CE	
310	43	RCL	
311	00	00	
312	50	I×I	
313	75	-	
314	01	1	
315	95	=	
316	67	EQ	
317	42	STO	
318	43	RCL	
319	00	00	
320	67	EQ	
321	44	SUM	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

LOC	CODE	KEY	COMMENTS
322	71	SBR	
323	69	DP	
324	71	SBR	
325	99	PRT	
326	61	GTD	
327	32	X↕T	
328	76	LBL	
329	42	STD	
330	43	RCL	
331	00	00	
332	85	+	
333	01	1	
334	95	=	
335	67	EQ	
336	52	EE	
337	71	SBR	
338	38	SIN	
339	71	SBR	
340	99	PRT	
341	61	GTD	
342	32	X↕T	
343	76	LBL	
344	44	SUM	
345	93	.	
346	00	0	
347	05	5	
348	42	STD	
349	00	00	
350	71	SBR	
351	69	DP	
352	71	SBR	
353	99	PRT	
354	71	SBR	
355	39	COS	
356	71	SBR	
357	99	PRT	
358	93	.	
359	00	0	
360	05	5	
361	94	+/-	
362	42	STD	
363	00	00	
364	71	SBR	
365	69	DP	
366	71	SBR	
367	99	PRT	
368	00	0	
369	42	STD	
370	00	00	
371	61	GTD	
372	32	X↕T	
373	76	LBL	
374	52	EE	
375	71	SBR	
376	30	TAN	
377	71	SBR	
378	99	PRT	
379	61	GTD	
380	32	X↕T	
381	76	LBL	
382	24	CE	
383	91	R/S	
384	76	LBL	
385	38	SIN	
386	43	RCL	
387	01	01	
388	42	STD	
389	12	12	
390	01	1	
391	75	-	
392	43	RCL	
393	02	02	
394	95	=	
395	42	STD	
396	14	14	
397	65	×	
398	43	RCL	
399	17	17	
400	75	-	
401	53	(	
402	43	RCL	
403	02	02	
404	65	×	
405	43	RCL	
406	18	18	
407	54	)	
408	95	=	
409	55	÷	
410	53	(	
411	43	RCL	
412	19	19	
413	75	-	
414	43	RCL	
415	01	01	
416	54	)	
417	95	=	
418	42	STD	
419	16	16	
420	92	RTN	
421	76	LBL	
422	39	COS	
423	43	RCL	
424	19	19	
425	42	STD	
426	12	12	
427	43	RCL	
428	18	18	
429	55	÷	
430	53		
431	43	RCL	
432	17	17	
433	85	+	
434	43	RCL	
435	18	18	
436	54	)	
437	95	=	
438	42	STD	
439	14	14	
440	43	RCL	
441	17	17	
442	65	×	
443	43	RCL	
444	18	18	
445	55	÷	
446	43	RCL	
447	19	19	
448	55	÷	
449	53	(	
450	01	1	
451	75	-	
452	43	RCL	
453	19	19	
454	54	)	
455	95	=	
456	42	STD	
457	16	16	
458	92	RTN	
459	76	LBL	
460	30	TAN	
461	43	RCL	
462	03	03	
463	42	STD	
464	12	12	
465	43	RCL	
466	04	04	
467	42	STD	
468	14	14	
469	65	×	
470	43	RCL	
471	17	17	
472	75	-	
473	43	RCL	
474	18	18	
475	65	×	
476	53	(	
477	01	1	
478	75	-	
479	43	RCL	
480	04	04	
481	54	)	
482	95	=	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

2 7 | 8 0 1 0

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LOC	CODE	KEY	COMMENTS
483	55	÷	
484	53	(	
485	43	RCL	
486	19	19	
487	75	-	
488	43	RCL	
489	03	03	
490	54	)	
491	95	=	
492	42	STO	
493	16	16	
494	92	RTN	
495	76	LBL	
496	69	OP	
497	43	RCL	
498	09	09	
499	35	1/X	
500	45	Y^x	
501	43	RCL	
502	00	00	
503	95	=	
504	42	STO	
505	11	11	
506	01	1	
507	75	-	
508	43	RCL	
509	11	11	
510	95	=	
511	42	STO	
512	12	12	
513	43	RCL	
514	03	03	
515	55	÷	
516	43	RCL	
517	01	01	
518	95	=	
519	45	Y^x	
520	43	RCL	
521	00	00	
522	95	=	
523	75	-	
524	43	RCL	
525	11	11	
526	95	=	
527	22	INV	
528	49	PRD	
529	12	12	
530	43	RCL	
531	07	07	
532	45	Y^x	
533	43	RCL	
534	00	00	
535	95	=	
536	42	STO	
537	13	13	
538	75	-	
539	01	1	
540	95	=	
541	42	STO	
542	14	14	
543	43	RCL	
544	05	05	
545	35	1/X	
546	45	Y^x	
547	43	RCL	
548	00	00	
549	95	=	
550	75	-	
551	43	RCL	
552	13	13	
553	95	=	
554	94	+/-	
555	22	INV	
556	49	PRD	
557	14	14	
558	43	RCL	
559	05	05	
560	35	1/X	
561	28	LOG	
562	65	×	
563	43	RCL	
564	14	14	
565	95	=	
566	42	STO	
567	16	16	
568	53	(	
569	01	1	
570	75	-	
571	43	RCL	
572	14	14	
573	54	)	
574	65	×	
575	43	RCL	
576	08	08	
577	95	=	
578	44	SUM	
579	16	16	
580	43	RCL	
581	03	03	
582	55	÷	
583	43	RCL	
584	01	01	
585	95	=	
586	28	LOG	
587	65	×	
588	43	RCL	
589	12	12	
590	95	=	
591	42	STO	
592	15	15	
593	43	RCL	
594	09	09	
595	35	1/X	
596	28	LOG	
597	65	×	
598	53	(	
599	01	1	
600	75	-	
601	43	RCL	
602	12	12	
603	54	)	
604	95	=	
605	85	+	
606	43	RCL	
607	15	15	
608	95	=	
609	22	INV	
610	49	PRD	
611	16	16	
612	92	RTN	
613	76	LBL	
614	99	PRT	
615	03	3	
616	03	3	
617	69	OP	
618	04	04	
619	43	RCL	
620	12	12	
621	69	OP	
622	06	06	
623	66	PAU	
624	66	PAU	
625	03	3	
626	03	3	
627	01	1	
628	03	3	
629	69	OP	
630	04	04	
631	43	RCL	
632	14	14	
633	69	OP	
634	06	06	
635	66	PAU	
636	66	PAU	
637	01	1	
638	03	3	
639	03	3	
640	06	6	
641	03	3	
642	01	1	
643	69	OP	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
644	04	04									
645	43	RCL									
646	16	16									
647	69	OP									
648	06	06									
649	66	PAU									
650	66	PAU									
651	98	ADV									
652	92	RTN									

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

2,7 8,0,1,1
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TEXAS INSTRUMENTS
Calculator Products Division

Submission Abstract

Program Title	Rev.
Variable Sampling Plan Design	

Abstract of Program

Facilitates the design of variable sampling plans, determination of the sample size, n, and the acceptance criterion, k, for two cases, (1) standard deviation not known (Flag 1 off or not set) and (2) standard deviation known (Flag 1 on or set). The plans are designed so that the operating characteristic (OC) curve satisfies two chosen points given by p_1, α;p_2,β. The normal distribution is assumed as is a single specification limit or double specification limits permitting joint application of each separately,(see Reference for more details). An option also permits the computation of points on the operating characteristic (OC) curve for the standard deviation known case. The program also permits the computation of the standard normal ordinate, f(z), (A'); the cumulative standard normal, $\Phi(z)$, (B'); its complement, $1-\Phi(z)$, (C'); the area under the standard normal curve, $\pm z$ units from the mean, $P(Z \leq |z|)$, (D'); and an approximation of z for $1-\Phi(z)$, (E').

User Benefits:

Provides for the design of variable sampling plans to meet user specified criteria on the operating characteristic (OC) curve. Provides for computation of the OC curve for known σ plans and permits computation of characteristics of the standard normal distribution.

Category Number	Required Progs.	Prog. Steps	PC-100A Needed Opt. ☒ Library Module ID
27		452	1 ☒

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Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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Program Description

Program Title: Variable Sampling Plan Design	Rev.

Method, Equations, Sketches, Limitations, References, Error Recovery:

For input of the parameters denoting two desired points on the operating characteristic (OC) curve of the derived variable sampling plan, the program computes the sample size, n, and the acceptance criterion, k. The chosen points on the OC curve are given by (p_1,α) and (p_2,β), where,

p_1 = process fraction defective, usually associated with good quality (AQL),

α = producer's risk, i.e., the probability of rejection of product with p_1 fraction defective,

p_2 = process fraction defective, usually associated with poor quality (LQL),

β = consumer's risk, i.e., the probability of acceptance of product with p_2 fraction defective.

Two cases are permitted. With Flag 1 off or not set, the following formulas are used to derive the parameters of the variable sampling plan for an unknown standard deviation of the measured quality characteristic, assuming the normal distribution,

$$n = (1 + k^2/2)\{(Z_\alpha + Z_\beta)/(Z_1 - Z_2)\}^2,$$

$k = (Z_\alpha Z_2 + Z_\beta Z_1)/(Z_\alpha + Z_\beta)$, where $Z_\alpha, Z_\beta, Z_1, Z_2$, are the standard normal deviates such that, $P(Z > Z_\alpha) = \alpha$ and $P(Z > Z_1) = p_1$, and similarly for β and p_2.

With Flag 1 on or set, the following formula is used to derive the sample size for the variable sampling plan for a known standard deviation of the measured quality characteristic, also assuming a normal distribution. The acceptance criterion, k, is the same for both cases.

$$n = \{(Z_\alpha + Z_\beta)/(Z_1 - Z_2)\}^2$$

A further option permits the evaluation of the operating characteristic (OC) curve for the variable sampling plan with known standard deviation. Any number of points can be computed. Each is determined for input of z, the multiple of standard deviations from either specification limit where the process mean is located. For each input, z, the fraction of the distribution of the measured quality characteristic lying outside the applicable specification limit, p, is computed (printed & displayed) followed by the probability of acceptance, Pa, as follows,

$$p = 1 - \Phi(z)$$

$Pa = \Phi\{(z - k)\sqrt{n}\}$, where, $\Phi(z) = P(Z \leq z)$, the cumulative probability for the standard normal deviate, Z.

A useful range of values for z is $Z_2 \leq z \leq Z_1$, but one or more values just outside this range may be desired. For $z = Z_1$, $p \simeq p_1$, $Pa \simeq 1 - \alpha$; and for $z = Z_2$, $p \simeq p_2$, $Pa \simeq \beta$, where Z_1 is stored in R_{01} and Z_2 in R_{03}.

☒ See Continuation Sheet

Continued From: ☒ Program Description ☐ User Instructions ☐ Stmt. of Example

Program Title: Variable Sampling Plan Design	Rev.

Since the normal distribution is used for the evaluation of the OC curve, the program permits the computation of certain characteristics of the standard normal, as follows, for input of z, (A' thru D') or $1 - \Phi(z)$, (E'),

A' , $f(z) = e^{-1/2\ z^2}/\sqrt{2\pi}$,

B' , $\Phi(z) = P(Z \leq z)$,

C' , $1 - \Phi(z) = P(Z > z)$,

D' , $P(Z \leq |z|)$,

E' , z for $1 - \Phi(z)$, primarily useful for $1 - \Phi(z) \leq .50$.

For additional details on variable sampling, including the use of this program for derivation of variable sampling plans with double specification limits, see the following reference,

Reference: Duncan, A.J., Quality Control and Industrial Statistics, 4th Edition, Richard D. Irwin, Inc., Homewood, Illinios, 1974, pp. 247-282.

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User Instructions

Program Title Variable Sampling Plan Design

f(z)	Φ(z)	1 − Φ(z)	P(Z≤|z|)	z, 1−Φ(z)
Begin	n,k Opt,	OC curve		

Partition (OP 17): 479.59
Parentheses Levels: 1
t Register ☒
Angular Mode (if applicable):
SBR Levels:
Absolute Addresses ☒
Library Module ID: 1
Disturbs Pending Operations ☒

USER DEFINED KEYS

A Begin new problem
B Optional branch for n,k
C OC curve
D
E
A' f(z)
B' Φ(z)
C' 1 − Φ(z)
D' P(Z ≤ |z|)
E' z for 1 − Φ(z)

DATA REGISTERS (INV) (LIST)

0
1 Z_1
2 Z_α
3 Z_2
4 Z_β
5 $Z_\alpha + Z_\beta$
6 k
7 n
8 z for p & Pa
9
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
5 Comp. of p & Pa
6 "
7 Z Comp. (E')
8 Comp. of Z (E')
9
0
1
2
3
4

FLAGS 0	σ known 1	2	3	4	5	6	7	8	9

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
1	Choose design option, .1 σ unknown, proceed to step 2 (Flag 1 off) .2 σ known, set Flag 1 (Note: Flag 1 can be turned on or off anytime before step 6 for new problem)	1	2nd St flg	
2	Branch to program start	−	A	Space, program title prints, space, 3302 (P1 Code) displayed--awaiting entry of p_1
3	Enter p_1	p_1	R/S	Prints with label, 13 (A Code) displayed--awaiting entry of α
4	Enter α	α	R/S	Prints with label, space, 3303 displayed--awaiting entry of p_2
5	Enter p_2	p_2	R/S	Prints with label, 14 (B Code) displayed--awaiting entry of β
6	Enter β	β	R/S	Prints with label, space, computation, n prints with label (displayed briefly), k prints with label and is displayed
7	At this point the initial variable sampling plan design problem is solved. The user is offered several options,(.1) return to step 1 for a new problem, including changing the flag setting,(.2) return to step 2 for a new problem with the same flag setting (same σ situation),(.3) a change of flag setting followed by branching to User Defined Key, B, for computation of n and k for the opposite σ situation (either direction, i.e., from known to unknown or vice versa), for the same input parameters entered in steps 3 thru 6. That is, this option simply saves re-entry of the design parameters, if it is desired to compute n and k for the opposite σ situation, for the same parameters--its use must be preceded by steps 2 thru 6. Go to step 8,			

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☒ See Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: Variable Sampling Plan Design	Rev.

Step	Procedure	Enter	Press	Output/Mode
	(.4) for σ known case (i.e. Flag 1 on or set), compute points, (p,Pa), on the OC curve for the sampling plan obtained in step 6. Go to step 9.			
8	Change Flag setting:			
	.1 With Flag 1 off previously	1	2nd Stflg	
	.2 With Flag 1 on previously	1	INV2nd Stflg	
	Branch to computation of n, k	-	B	n prints with label (displayed briefly), k prints with label and is displayed
	The same options of step 7 are available again			
9	Branch to compute OC curve pts.	-	C	Space, 46 (Z Code) displayed--awaiting entry of z value
10	Enter z (Note: Possible range of z values is $Z_2 \leq p \leq Z_1$; initial entry of Z_1 may be accomplished by the sequence: RCL 01, R/S; and when desired, $z = Z_2$ may be entered by the sequence: RCL 03, R/S)	z	R/S	z prints with label, computation, p value prints with label (displayed briefly), computation, Pa value prints with label (displayed briefly), space, 46 (Z Code) displayed--awaiting entry of next z value desired
11	Repeat step 10 for as many z values as desired			
	When completed, the same options of step 7 are available again			

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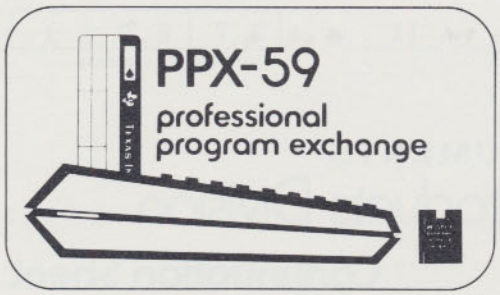

TEXAS INSTRUMENTS
Calculator Products Division

Sample Problem

Statement of Example

The variable sampling plans with parameters, p_1 = .005, α = .05; p_2 = .05, β = .10, are illustrated for σ unknown and σ known, including a series of points for the OC curve for the latter case.

Then with Flag 1 still set, the variable sampling plan with parameters, p_1 = .01, α = .075; p_2 = .05, β = .05, is developed (σ known), followed by that for unknown σ.

And since a further utilization of this program allows evaluation of a number of characteristics of the standard normal distribution, this is illustrated by a number of examples.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
-	A	VARIABLE SAMPLING		3302 displayed
.005	R/S	0.005	P1	13 displayed
.05	R/S	0.05	A	3303 displayed
.05	R/S	0.05	P2	14 displayed
.10	R/S	0.1	B	
		31.	N	Displayed briefly
		2.052909674	K	Displayed
1	2nd St flg			
				(No space here on print-out)
-	B	10.	N	Displayed briefly
		2.052909674	K	Displayed
-	C			46 displayed
-	RCL 01 R/S	2.577576069	Z	Z_1 from R_{01}
		.0049748287	P	Displayed briefly($\simeq p_1$)
		.9514563101	PA	Displayed briefly($\simeq 1-\alpha$)
2.5	R/S	2.5	Z	46 displayed
		.0062096799	P	(ditto)
		.9212931217	PA	

Modes

☒ Over

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Sample Problem (cont'd)

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ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
2.4	R/S	2.4	Z	
		.0081975289	P	(ditto)
		.8638094866	PA	
(etc.)	(etc.)	2.3	Z	
		.0107240811	P	"
		.7827070895	PA	
"	"	2.2		
		.0139033989	Z	"
		0.6790845	P	
		.4	PA	
"	"	1.7	Z	"
		.0445654317	P	
		.1322114592	PA	
-	RCL 03 R/S	1.644492343	Z	Z_2 from R_{03}
		.0500372568	P	Displayed briefly($\simeq p_2$)
		.0982602178	PA	Displayed briefly($\simeq \beta$)
				46 displayed
1.6	R/S	1.6	Z	
		.0547992894	P	
		.0760396009	PA	
With Flag 1	set:			
-	A	VARIABLE SAMPLING		(as above)
.01	R/S	0.01	P1	"
.075	R/S	0.075	A	"
.05	R/S	0.05	P2	"
.05	R/S	0.05	B	"
		20.	N	"
		2.008885572	K	"
				(No space here on print-out)
1	INV 2nd St flg			
-	B	61.	N	(as above)
		2.008885572	K	"

Modes: n* Printed only (n) Displayed Briefly (Pause)
(n)* Printed and displayed

PPX-59 Professional Program Exchange
Sample Problem (cont'd)

2 7 8 0 1 1
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ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
To illustrate computations for standard normal distribution:			
1	A'	.2419707245	f(1) displayed
1	B'	.8413447404	$\Phi(1)$ displayed
1	C'	.1586552596	$1-\Phi(1)$ displayed
-	E'	.9978041346	z for $1-\Phi(1)$, ($\simeq 1$)
1	D'	.6826894809	$P(Z \leq \lvert 1 \rvert)$
.05	E'	1.644492343	z for $1-\Phi(z) = .05$
-	C'	.0500372568	$1-\Phi(1.6444...) \simeq .05$
.025	E'	1.960448274	z for $1-\Phi(z) = .025$
-2	B'	0.022750062	$\Phi(-2)$
2	C'	0.022750062	$1-\Phi(2) = \Phi(-2)$
-1.5	C'	.9331927713	$1-\Phi(-1.5)$
0.5	D'	.3829249356	$P(Z \leq \lvert .5 \rvert)$

Modes: n' — Printed only (n) — Displayed Briefly (Pause)
(n)' — Printed and displayed

PPX-59 Professional Program Exchange

2 7 8 0 1 1
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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	16	A'	
002	53	(	
003	33	X²	
004	22	INV	
005	23	LNX	
006	65	×	
007	02	2	
008	65	×	
009	89	π	
010	54	)	
011	34	ΓX	
012	35	1/X	
013	92	RTN	
014	53	(	
015	50	I×I	
016	65	×	
017	93	.	
018	02	2	
019	03	3	
020	01	1	
021	06	6	
022	04	4	
023	01	1	
024	09	9	
025	85	+	
026	01	1	
027	54	)	
028	35	1/X	
029	53	(	
030	42	STO	
031	25	25	
032	49	PRD	
033	25	25	
034	42	STO	
035	26	26	
036	65	×	
037	93	.	
038	03	3	
039	01	1	
040	09	9	
041	03	3	
042	08	8	
043	01	1	
044	05	5	
045	03	3	
046	75	-	
047	93	.	
048	03	3	
049	05	5	
050	06	6	
051	05	5	
052	06	6	
053	03	3	
054	07	7	

LOC	CODE	KEY	COMMENTS
055	08	8	
056	02	2	
057	65	×	
058	43	RCL	
059	25	25	
060	49	PRD	
061	26	26	
062	85	+	
063	01	1	
064	93	.	
065	07	7	
066	08	8	
067	01	1	
068	04	4	
069	07	7	
070	07	7	
071	09	9	
072	03	3	
073	07	7	
074	65	×	
075	43	RCL	
076	26	26	
077	75	-	
078	01	1	
079	93	.	
080	08	8	
081	02	2	
082	01	1	
083	02	2	
084	05	5	
085	05	5	
086	09	9	
087	07	7	
088	08	8	
089	65	×	
090	43	RCL	
091	25	25	
092	49	PRD	
093	26	26	
094	33	X²	
095	85	+	
096	01	1	
097	93	.	
098	03	3	
099	03	3	
100	00	0	
101	02	2	
102	07	7	
103	04	4	
104	04	4	
105	02	2	
106	09	9	
107	65	×	
108	43	RCL	
109	26	26	

LOC	CODE	KEY	COMMENTS
110	54	)	
111	92	RTN	
112	76	LBL	
113	17	B'	
114	29	CP	
115	77	GE	
116	01	01	
117	37	37	
118	42	STO	
119	25	25	
120	16	A'	
121	53	(	
122	24	CE	
123	65	×	
124	43	RCL	
125	25	25	
126	71	SBR	
127	00	00	
128	14	14	
129	54	)	
130	92	RTN	
131	76	LBL	
132	18	C'	
133	29	CP	
134	77	GE	
135	01	01	
136	18	18	
137	71	SBR	
138	01	01	
139	18	18	
140	53	(	
141	94	+/-	
142	85	+	
143	01	1	
144	54	)	
145	92	RTN	
146	76	LBL	
147	19	D'	
148	71	SBR	
149	01	01	
150	18	18	
151	53	(	
152	94	+/-	
153	65	×	
154	02	2	
155	85	+	
156	01	1	
157	54	)	
158	92	RTN	
159	76	LBL	
160	10	E'	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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2	7	8	0	1	1

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LOC	CODE	KEY	COMMENTS
161	33	X²	
162	35	1/X	
163	23	LNX	
164	34	ΓX	
165	42	STO	
166	27	27	
167	65	×	
168	93	.	
169	02	2	
170	07	7	
171	00	0	
172	06	6	
173	01	1	
174	85	+	
175	02	2	
176	93	.	
177	03	3	
178	00	0	
179	07	7	
180	05	5	
181	03	3	
182	95	=	
183	42	STO	
184	28	28	
185	53	(	
186	43	RCL	
187	27	27	
188	33	X²	
189	65	×	
190	93	.	
191	00	0	
192	04	4	
193	04	4	
194	08	8	
195	01	1	
196	85	+	
197	43	RCL	
198	27	27	
199	65	×	
200	93	.	
201	09	9	
202	09	9	
203	02	2	
204	02	2	
205	09	9	
206	85	+	
207	01	1	
208	54	)	
209	22	INV	
210	49	PRD	
211	28	28	
212	43	RCL	
213	28	28	
214	22	INV	
215	44	SUM	

LOC	CODE	KEY	COMMENTS
216	27	27	
217	43	RCL	
218	27	27	
219	92	RTN	
220	76	LBL	
221	11	A	
222	98	ADV	
223	98	ADV	
224	47	CMS	
225	29	CP	
226	04	4	
227	02	2	
228	01	1	
229	03	3	
230	69	OP	
231	01	01	
232	03	3	
233	05	5	
234	02	2	
235	04	4	
236	01	1	
237	03	3	
238	01	1	
239	04	4	
240	02	2	
241	07	7	
242	69	OP	
243	02	02	
244	01	1	
245	07	7	
246	00	0	
247	00	0	
248	03	3	
249	06	6	
250	01	1	
251	03	3	
252	03	3	
253	00	0	
254	69	OP	
255	03	03	
256	03	3	
257	03	3	
258	02	2	
259	07	7	
260	02	2	
261	04	4	
262	03	3	
263	01	1	
264	02	2	
265	02	2	
266	69	OP	
267	04	04	
268	69	OP	
269	05	05	
270	98	ADV	

LOC	CODE	KEY	COMMENTS
271	03	3	
272	03	3	
273	00	0	
274	02	2	
275	69	OP	
276	04	04	
277	91	R/S	
278	69	OP	
279	06	06	
280	71	SBR	
281	10	E'	
282	42	STO	
283	01	01	
284	01	1	
285	03	3	
286	69	OP	
287	04	04	
288	91	R/S	
289	69	OP	
290	06	06	
291	71	SBR	
292	10	E'	
293	42	STO	
294	02	02	
295	98	ADV	
296	03	3	
297	03	3	
298	00	0	
299	03	3	
300	69	OP	
301	04	04	
302	91	R/S	
303	69	OP	
304	06	06	
305	71	SBR	
306	10	E'	
307	42	STO	
308	03	03	
309	01	1	
310	04	4	
311	69	OP	
312	04	04	
313	91	R/S	
314	69	OP	
315	06	06	
316	71	SBR	
317	10	E'	
318	42	STO	
319	04	04	
320	98	ADV	
321	85	+	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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2	7	8	0	1	1

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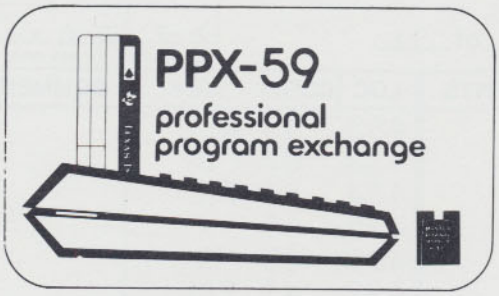
LOC	CODE	KEY	COMMENTS
322	43	RCL	
323	02	02	
324	95	=	
325	42	STO	
326	05	05	
327	43	RCL	
328	02	02	
329	65	×	
330	43	RCL	
331	03	03	
332	95	=	
333	42	STO	
334	06	06	
335	43	RCL	
336	01	01	
337	65	×	
338	43	RCL	
339	04	04	
340	95	=	
341	44	SUM	
342	06	06	
343	43	RCL	
344	05	05	
345	22	INV	
346	49	PRD	
347	06	06	
348	76	LBL	
349	12	B	
350	03	3	
351	01	1	
352	69	OP	
353	04	04	
354	43	RCL	
355	01	01	
356	75	-	
357	43	RCL	
358	03	03	
359	95	=	
360	55	÷	
361	43	RCL	
362	05	05	
363	95	=	
364	35	1/X	
365	33	X^2	
366	87	IFF	
367	01	01	
368	61	GTO	
369	65	×	
370	53	(	
371	01	1	
372	85	+	
373	43	RCL	
374	06	06	
375	33	X^2	
376	55	÷	
377	02	2	
378	54	)	
379	95	=	
380	76	LBL	
381	61	GTO	
382	85	+	
383	93	.	
384	05	5	
385	95	=	
386	59	INT	
387	42	STO	
388	07	07	
389	69	OP	
390	06	06	
391	66	PAU	
392	66	PAU	
393	02	2	
394	06	6	
395	69	OP	
396	04	04	
397	43	RCL	
398	06	06	
399	69	OP	
400	06	06	
401	91	R/S	
402	76	LBL	
403	13	C	
404	98	ADV	
405	04	4	
406	06	6	
407	69	OP	
408	04	04	
409	91	R/S	
410	69	OP	
411	06	06	
412	42	STO	
413	08	08	
414	03	3	
415	03	3	
416	69	OP	
417	04	04	
418	43	RCL	
419	08	08	
420	71	SBR	
421	18	C'	
422	69	OP	
423	06	06	
424	66	PAU	
425	66	PAU	
426	03	3	
427	03	3	
428	01	1	
429	03	3	
430	69	OP	
431	04	04	
432	43	RCL	
433	07	07	
434	34	FX	
435	65	×	
436	53	(	
437	43	RCL	
438	08	08	
439	75	-	
440	43	RCL	
441	06	06	
442	54	)	
443	95	=	
444	71	SBR	
445	17	B'	
446	69	OP	
447	06	06	
448	66	PAU	
449	66	PAU	
450	61	GTO	
451	13	C	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR



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Calculator Products Division

Submission Abstract

Program Title	Rev.
Operating Characteristics for Continuous Sampling Plans	

Abstract of Program

Computes measures of the operating (performance) characteristics for Continuous Sampling Plans, CSP-1 and CSP-2, and allows for the design of CSP-1 and 2 plans to meet consumer-type protection criteria. For input of the parameters, f and i, for CSP-1; and f, i, and k (k often equal to i), and Flag 1 set or on, for CSP-2, together with a series of any number of fraction defective (non-conforming), p, values, common measures of performance are computed. Further measures of the AOQL and LQL may be computed for CSP-1. A further option allows for the determination of the parameter, i, for inputs of f and LQL for either or both CSP-1 and CSP-2, so as to design a plan having a limiting value (the LQL) on the quality of units that will have an overall probability of acceptance of 0.10.

User Benefits:

Provides comprehensive evaluation of CSP-1 and CSP-2 sampling plans via common performance measures and design of certain CSP-1 and CSP-2 plans.

Category Number 27	Required Progs.	Prog. Steps 547	PC-100A Needed Opt. Library Module ID 1 ☐

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Submission Checklist

- ☐ Recorded Magnetic Cards
- ☐ Submission Abstract
- ☐ Program Description
- ☐ User Instructions
- ☐ Sample Problem
- ☐ Listing
- ☐ _____
- ☐ _____

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Program Description

Program Title: OC for CSP-1 and CSP-2	Rev.

Method, Equations, Sketches, Limitations, References, Error Recovery:

Continuous sampling plans, CSP-1, are specified by two parameters, namely, (1) f, the fraction of units to be inspected during sampling, and (2) i, the clearing interval or number of consecutive nondefective units which must be found during 100% inspection before sampling may be instituted. An additional parameter, k, is used in CSP-2, i.e. in addition to f and i, where k is a further clearing interval during sampling. It is the number of consecutive non-defective units which must be found during sampling,following the occurrence of a defective, in order to remain on sampling. Many applications use k=i, but this is primarily for administrative convenience. The program allows for the general case.

Under a Flag 1 option, either the performance characteristics for CSP-1 (Flag 1 off, or not set) or CSP-2 (Flag 1 on, or set) can be developed in the main portion of the program (A). Upon input of f and i for CSP-1, or f, i, and k for CSP-2, and one or more in a series of fraction defective (nonconforming) values, p, the program computes, prints and briefly displays the following common measures for evaluating the operating characteristics of continuous sampling plans.

1. The average number of units inspected in a 100 per cent screening sequence following the finding of a defective unit. This is given by the following for both CSP-1 and CSP-2,

   $u = (1-q^i)/(pq^i)$, where $q=1-p$

2. The average number of units passed under the sampling procedure before a defective unit is found. This is given for CSP-1 and CSP-2 by the following,

   $v=1/(fp)$ for CSP-1, and $v=(2-q^k)/[fp(1-q^k)]$ for CSP-2

3. The average fraction of total produced units inspected in the long run. This is given by the following for both CSP-1 and CSP-2, using the appropriate v from 2,

   $AFI=(u+fv)/(u+v)$

4. The average outgoing quality (AOQ) as given by the following for both CSP-1 and CSP-2, using AFI from 3,

   $AOQ=p(1-AFI)$

5. The average fraction of produced units passed under the sampling procedure. This is given by the following for both CSP-1 and CSP-2, again using the appropriate v from 2,

☐ See Continuation Sheet

Program Title: OC for CSP-1 and CSP-2	Rev.

$$Pa=v/(u+v)$$

The symbol, Pa, is used for this measure due to its similarity to the probability of acceptance associated with ordinary sampling plans, though they are not the same. The program has been written to facilitate the evaluation of CSP-1 and CSP-2 plans for different values of p, in that it returns to allow new entries of p for the same parameters, f, i and k.

Additional performance measures for CSP-1 may be obtained, as desired, by branching to User-defined key,C. This portion of the program develops the AOQL and LQL for CSP-1 plans for the input parameters of f and i. Or, to avoid duplicate input for the same parameters used in the main portion of the program (User-defined key,A),branching can be to the User-defined key, D. AOQL is the average outgoing quality limit for the given plan, i.e. the limit of the AOQ over p. It is obtained by iterative solution of the following equation, with p_A=AOQL. The computation can take up to several minutes for some values of the parameters (especially for plans with AOQL > .05).

$$p_A = [i(1-p_A)/(i+1)]^{(i+1)} \cdot [(1-f)/(if)]$$

LQL is the limiting quality level for the given plan, i.e. the level of quality,p, for which the overall Pa (from 5 above) equals 0.10. It is obtained by solution of the following equation, with p_L=LQL.

$$p_L = 1 - [f/(9+f)]^{(1/i)}$$

A further option in the program allows for the design of CSP-1 and/or CSP-2 plans with given f and LQL,by computing the corresponding parameter, i, for those inputs. This is accomplished by branching to User-defined key, B. Computation of i is by solution of the following equations for CSP-1 and CSP-2, with p_L= LQL,

$$i=[\ln f - \ln(9+f)]/\ln(1-p_L) \text{ for CSP-1,}$$

$$i=\ln[1-3/\sqrt{9+f}]/\ln(1-p_L) \quad \text{for CSP-2.}$$

Storage Register Map

Knowledge of the stored values and their locations may enable the user to perform some operations of special interest to him or her.

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Continuation Sheet

Continued From: ☐ Program Description ☐ User Instructions ☐ Stmt. of Example

Program Title: OC for CSP-1 and CSP-2	Rev.

Register	Input and Main Computations(A)	Computation of i for f and LQL(B)	Computation of AOQL and LQL (C and D)
00	-	LQL(p_L)	p_L
01	f	f	f
02	i	ln(1-p_L)	i
03	k	9+f	(1-f)/if
04	p	i	i+1
05	q		ε=.00001
06	q^i		right side
07	$(1-q^i)$ and u		
08	v		
09	q^k		
10	$(2-q^k)/(1-q^k)$		δ
11	(u+fv)and AFI		
12	(u+v)		

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User Instructions

Program Title OC for CSP-1 and CSP-2

Main	i	AOQL-LQL	AOQL-LQL	

Partition (OP 17): 559.49
Parentheses Levels: 1
t Register: ☒
Angular Mode (if applicable):
SBR Levels: 1
Absolute Addresses: ☐
Library Module ID: 1
Disturbs Pending Operations: ☒

USER DEFINED KEYS

A	Main Entry & OC
B	i for f & LQL
C	AOQL & LQL W Input
D	AOQL & LQL W/O Input
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS (INV) (LIST)

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4

See Program Description

FLAGS 0	1	2	3	4	5	6	7	8	9
	CSP-2	Internal							

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
	Branching to A,B, or C is allowed in any order to execute those portions of the program at the respective User-defined keys. The following is presented in alphabetic order for convenience, and since A is the main portion of the program.			
1	Choose between evaluation of CSP-1 or CSP-2 by setting Flag 1 for the latter. It is important that Flag 2 is not set from previous programs or work. .1 CSP-1 desired, go to step 2, step 8 or step 12 as desired. .2 CSP-2 desired, set Flag 1, continue with step 2 (Note; Entry follows operation) or step 8 as desired.	1	2nd St flg	
2	Branch to program start	-	A	Space,Heading:CSP-1 or CSP-2 (as chosen in step 1) prints, space, halts with 21(F Code) displayed -- awaiting entry of f
3	Enter f	f	R/S	f value prints with label, halts with 24 (I Code) displayed -- awaiting entry of i

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

☐ See Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: OC for CSP-1 and CSP-2	Rev.

Step	Procedure	Enter	Press	Output/Mode
4	Enter i .1 CSP-1 chosen in step 1, continue with step 6 .2 CSP-2 chosen in step 1, continue with step 5	i	R/S	i value prints with label, space, 33 (P Code) displayed--awaiting entry of p i value prints with label, 26 (K Code) displayed--awaiting entry of k
5	Enter k	k	R/S	k value prints with label, space, 33 (P Code) displayed--awaiting entry of p
6	Enter p	p	R/S	p value prints with label, computation of u,v,AFI,AOQ, and Pa, each printed with labels and displayed briefly, space, 33 (P Code) displayed--awaiting entry of next p value
7	At this point the user is offered the option to repeat step 6 as many times as desired for a series of p values or return to step 1 to evaluate another CSP-1 or CSP-2 plan, or branch to B (step 8) to design a CSP-1 or CSP-2 plan for given f and LQL, or branch to C (step 12) to input new parameters for a CSP-1 plan with computation of AOQL and LQL, or branch to D (step 16) to compute AOQL and LQL for the same CSP-1 entered in steps 3 and 4, i.e., with no further entries required			
8	Branch to design CSP-1 or CSP-2 plan for given f and LQL. Step 1 should be executed to choose CSP-1 or CSP-2	-	B	Space, Heading: CSP-1 or CSP-2 (as chosen in step 1) prints, space, 21 (F Code) displayed--awaiting entry of f
9	Enter f	f	R/S	f value prints with label, 2734 27 (LQL Code) displayed--awaiting entry of LQL value desired
10	Enter LQL	LQL	R/S	LQL value prints with label, space, computation of i, i value prints with label and is displayed
11	Problem solved. Return to any of the valid options is possible, step 1, step 2 directly if Flag 1 is as desired, step 8 or step 12			
12	Branch to compute AOQL and LQL for desired CSP-1 plan	-	C	Space, Heading: CSP-1 prints, space, 21 (F Code) displayed--awaiting entry of f
13	Repeat steps 3 and 4 to enter f and i for the desired CSP-1 plan	(f) (i)	(R/S) (R/S)	Upon entry of i, computation of AOQL begins immediately (may take several minutes), AOQL value prints and is displayed
14	Compute LQL	-	R/S	Computation of LQL, LQL value prints with label and is displayed

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Continuation Sheet

Continued From: ☐ Program Description ☒ User Instructions ☐ Stmt. of Example

Program Title: OC for CSP-1 and CSP-2	Rev.

Step	Procedure	Enter	Press	Output/Mode
15	Problem solved. Return to any of the valid options is possible, step 1, step 2 directly (if CSP-1 evaluation is desired), step 8, or step 12			
16	Branch to compute AOQL and LQL for CSP-1 plan previously entered in steps 2 thru 4	-	D	Computation of AOQL (may be long), AOQL prints with label and is displayed
17	Compute LQL	-	R/S	Computation of LQL, LQL prints with label and is displayed
18	Problem solved. Return to any of the valid options is possible, step 1, step 2 directly (if CSP-1 evaluation is desired), step 8 or step 12			

2,7 8,0,1,2
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Sample Problem

Statement of Example

1. Performance measures for CSP-1 with f=.05, i=150 for several values of p, also with AOQL and LQL computations.
2. Performance measures for CSP-2 with f=.10, i=50, k=25, and p=.015
3. Design (computation of i) for CSP-1 and CSP-2 with f=.10, LQL=.05
4. AOQL and LQL computations for CSP-1 with f=.05, i=20

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
Sample Problem 1				
-	A	CSP-1		21 displayed
.05	R/S	0.05	F	24 displayed
150	R/S	150.	I	33 displayed
.01	R/S	0.01	P	
		351.5655586	U	Briefly displayed
		2000.	V	Briefly displayed
		0.192027629	AFI	Briefly displayed
		.0080797237	ADQ	Briefly displayed
		.8504972327	PA	Briefly displayed
				33 displayed
.02	R/S	0.02	P	
		985.2819696	U	
		1000.	V	
		.5214785534	AFI	(ditto)
		.0095704289	ADQ	
		.5037067859	PA	
.03	R/S	0.03	P	
		3181.204972	U	
		666.6666667	V	(ditto)
		.8354068449	AFI	
		.0049377947	ADQ	
		.1732559527	PA	

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Sample Problem (cont'd)

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ENTER	PRESS	OUTPUT/MODE (see legend below)		COMMENT
-	D	.0100714121	ADQL	Just under 2 min-
-	R/S	.0340629832	LQL	utes required. Each
Sample Problem 2				displayed.
	2nd St flg			
1				
-	A	CSP-2		21 displayed
.1	R/S	0.1	F	24 displayed
50	R/S	50.	I	26 displayed
25	R/S	25.	K	33 displayed
.015	R/S	0.015	P	
		75.27085441	U	briefly displayed
		2785.352245	V	Briefly displayed
		.1236814731	AFI	Briefly displayed
		.0131447779	ADQ	Briefly displayed
		.9736872521	PA	Briefly displayed
				33 displayed
Sample Problem 3				
	INV 2nd St flg			
1				
-	B	CSP-1		21 displayed
.1	R/S	0.1	F	273427 displayed
.05	R/S	0.05	LQL	
		87.94247982	I	i displayed
	2nd St flg			
1				
-	B	CSP-2		21 displayed
.1	R/S	0.1	F	273427 displayed
.05	R/S	0.05	LQL	
		101.4021054	I	i displayed
Sample Problem 4				
	INV 2nd St flg			
1				
-	C	CSP-1		21 displayed
.05	R/S	0.05	F	24 displayed
20	R/S	20.	I	
-	R/S	.0716207291	ADQL	over 2 1/2 minu-
		.2288904687	LQL	tes required. Each displayed.

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LOC	CODE	KEY	COMMENTS
000	76	LBL	
001	11	A	
002	98	ADV	
003	98	ADV	
004	47	CMS	
005	69	□P	
006	00	00	
007	71	SBR	
008	89	π	
009	02	2	
010	01	1	
011	69	□P	
012	04	04	
013	91	R/S	
014	42	STO□	
015	01	01	
016	69	□P	
017	06	06	
018	02	2	
019	04	4	
020	69	□P	
021	04	04	
022	91	R/S	
023	42	STO□	
024	02	02	
025	69	□P	
026	06	06	
027	87	IFF	
028	02	02	
029	14	D	
030	22	INV	
031	87	IFF	
032	01	01	
033	61	GTO□	
034	02	2	
035	06	6	
036	69	□P	
037	04	04	
038	91	R/S	
039	42	STO□	
040	03	03	
041	69	□P	
042	06	06	
043	76	LBL	
044	61	GTO□	
045	98	ADV	
046	03	3	
047	03	3	
048	69	□P	
049	04	04	
050	91	R/S	
051	42	STO□	
052	04	04	
053	69	□P	
054	06	06	
055	75	-	
056	01	1	
057	95	=	
058	94	+/-	
059	42	STO□	
060	05	05	
061	45	Y^x	
062	43	RCL	
063	02	02	
064	95	=	
065	42	STO□	
066	06	06	
067	75	-	
068	01	1	
069	95	=	
070	94	+/-	
071	42	STO□	
072	07	07	
073	04	4	
074	01	1	
075	69	□P	
076	04	04	
077	43	RCL	
078	04	04	
079	65	×	
080	43	RCL	
081	06	06	
082	95	=	
083	22	INV	
084	49	PRD	
085	07	07	
086	43	RCL	
087	07	07	
088	69	□P	
089	06	06	
090	66	PAU	
091	66	PAU	
092	04	4	
093	02	2	
094	69	□P	
095	04	04	
096	43	RCL	
097	01	01	
098	65	×	
099	43	RCL	
100	04	04	
101	95	=	
102	35	1/X	
103	42	STO□	
104	08	08	
105	22	INV	
106	87	IFF	
107	01	01	
108	99	PRT	
109	43	RCL	
110	05	05	
111	45	Y^x	
112	43	RCL	
113	03	03	
114	95	=	
115	42	STO□	
116	09	09	
117	75	-	
118	02	2	
119	95	=	
120	94	+/-	
121	42	STO□	
122	10	10	
123	01	1	
124	75	-	
125	43	RCL	
126	09	09	
127	95	=	
128	22	INV	
129	49	PRD	
130	10	10	
131	43	RCL	
132	10	10	
133	49	PRD	
134	08	08	
135	43	RCL	
136	08	08	
137	76	LBL	
138	99	PRT	
139	69	□P	
140	06	06	
141	66	PAU	
142	66	PAU	
143	01	1	
144	03	3	
145	02	2	
146	01	1	
147	02	2	
148	04	4	
149	69	□P	
150	04	04	
151	43	RCL	
152	01	01	
153	65	×	
154	43	RCL	
155	08	08	
156	85	+	
157	43	RCL	
158	07	07	
159	95	=	
160	42	STO□	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
161	11	11	
162	43	RCL	
163	07	07	
164	85	+	
165	43	RCL	
166	08	08	
167	95	=	
168	42	STO	
169	12	12	
170	22	INV	
171	49	PRD	
172	11	11	
173	43	RCL	
174	11	11	
175	69	OP	
176	06	06	
177	66	PAU	
178	66	PAU	
179	01	1	
180	03	3	
181	03	3	
182	02	2	
183	03	3	
184	04	4	
185	69	OP	
186	04	04	
187	01	1	
188	75	-	
189	43	RCL	
190	11	11	
191	95	=	
192	65	×	
193	43	RCL	
194	04	04	
195	95	=	
196	69	OP	
197	06	06	
198	66	PAU	
199	66	PAU	
200	03	3	
201	03	3	
202	01	1	
203	03	3	
204	69	OP	
205	04	04	
206	43	RCL	
207	08	08	
208	55	÷	
209	43	RCL	
210	12	12	
211	95	=	
212	69	OP	
213	06	06	
214	66	PAU	
215	66	PAU	
216	61	GTO	
217	61	GTO	
218	76	LBL	
219	12	B	
220	98	ADV	
221	98	ADV	
222	69	OP	
223	00	00	
224	71	SBR	
225	89	π	
226	02	2	
227	01	1	
228	69	OP	
229	04	04	
230	91	R/S	
231	42	STO	
232	01	01	
233	69	OP	
234	06	06	
235	02	2	
236	07	7	
237	03	3	
238	04	4	
239	02	2	
240	07	7	
241	69	OP	
242	04	04	
243	91	R/S	
244	42	STO	
245	00	00	
246	69	OP	
247	06	06	
248	01	1	
249	75	-	
250	43	RCL	
251	00	00	
252	95	=	
253	23	LNX	
254	42	STO	
255	02	02	
256	09	9	
257	85	+	
258	43	RCL	
259	01	01	
260	95	=	
261	42	STO	
262	03	03	
263	87	IFF	
264	01	01	
265	42	STO	
266	43	RCL	
267	01	01	
268	23	LNX	
269	42	STO	
270	04	04	
271	43	RCL	
272	03	03	
273	23	LNX	
274	22	INV	
275	44	SUM	
276	04	04	
277	43	RCL	
278	02	02	
279	22	INV	
280	49	PRD	
281	04	04	
282	61	GTO	
283	48	EXC	
284	76	LBL	
285	42	STO	
286	03	3	
287	55	÷	
288	43	RCL	
289	03	03	
290	34	ΓX	
291	75	-	
292	01	1	
293	95	=	
294	94	+/-	
295	23	LNX	
296	55	÷	
297	43	RCL	
298	02	02	
299	95	=	
300	42	STO	
301	04	04	
302	76	LBL	
303	48	EXC	
304	98	ADV	
305	02	2	
306	04	4	
307	69	OP	
308	04	04	
309	43	RCL	
310	04	04	
311	69	OP	
312	06	06	
313	91	R/S	
314	76	LBL	
315	13	C	
316	22	INV	
317	86	STF	
318	01	01	
319	86	STF	
320	02	02	
321	61	GTO	

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

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LOC	CODE	KEY	COMMENTS
322	11	A	
323	76	LBL	
324	14	D	
325	01	1	
326	52	EE	
327	05	5	
328	94	+/-	
329	42	STO	
330	05	05	
331	65	×	
332	05	5	
333	00	0	
334	00	0	
335	95	=	
336	42	STO	
337	10	10	
338	43	RCL	
339	02	02	
340	65	×	
341	04	4	
342	95	=	
343	35	1/X	
344	42	STO	
345	00	00	
346	01	1	
347	75	-	
348	43	RCL	
349	01	01	
350	95	=	
351	55	÷	
352	43	RCL	
353	01	01	
354	55	÷	
355	43	RCL	
356	02	02	
357	95	=	
358	42	STO	
359	03	03	
360	43	RCL	
361	02	02	
362	85	+	
363	01	1	
364	95	=	
365	42	STO	
366	04	04	
367	76	LBL	
368	59	INT	
369	01	1	
370	75	-	
371	43	RCL	
372	00	00	
373	95	=	
374	55	÷	
375	43	RCL	
376	04	04	
377	65	×	
378	43	RCL	
379	02	02	
380	95	=	
381	45	Y^x	
382	43	RCL	
383	04	04	
384	95	=	
385	65	×	
386	43	RCL	
387	03	03	
388	95	=	
389	42	STO	
390	06	06	
391	75	-	
392	43	RCL	
393	00	00	
394	95	=	
395	50	I×I	
396	75	-	
397	43	RCL	
398	05	05	
399	95	=	
400	67	EQ	
401	33	X²	
402	77	GE	
403	34	√X	
404	76	LBL	
405	33	X²	
406	25	CLR	
407	98	ADV	
408	01	1	
409	03	3	
410	03	3	
411	02	2	
412	03	3	
413	04	4	
414	02	2	
415	07	7	
416	69	OP	
417	04	04	
418	43	RCL	
419	06	06	
420	69	OP	
421	06	06	
422	91	R/S	
423	61	GTO	
424	52	EE	
425	76	LBL	
426	34	√X	
427	43	RCL	
428	06	06	
429	75	-	
430	43	RCL	
431	00	00	
432	95	=	
433	77	GE	
434	35	1/X	
435	43	RCL	
436	00	00	
437	75	-	
438	43	RCL	
439	10	10	
440	95	=	
441	42	STO	
442	00	00	
443	43	RCL	
444	10	10	
445	55	÷	
446	01	1	
447	00	0	
448	95	=	
449	42	STO	
450	10	10	
451	85	+	
452	43	RCL	
453	00	00	
454	95	=	
455	42	STO	
456	00	00	
457	61	GTO	
458	59	INT	
459	76	LBL	
460	35	1/X	
461	43	RCL	
462	00	00	
463	85	+	
464	43	RCL	
465	10	10	
466	95	=	
467	42	STO	
468	00	00	
469	61	GTO	
470	59	INT	
471	76	LBL	
472	52	EE	
473	02	2	
474	07	7	
475	03	3	
476	04	4	
477	02	2	
478	07	7	
479	69	OP	
480	04	04	
481	09	9	
482	85	+	

MERGED CODES

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LOC	CODE	KEY	COMMENTS
483	43	RCL	
484	01	01	
485	95	=	
486	55	÷	
487	43	RCL	
488	01	01	
489	95	=	
490	35	1/X	
491	45	Y^x	
492	53	(	
493	43	RCL	
494	02	02	
495	35	1/X	
496	54	)	
497	95	=	
498	75	-	
499	01	1	
500	95	=	
501	94	+/-	
502	69	OP	
503	06	06	
504	22	INV	
505	86	STF	
506	02	02	
507	91	R/S	
508	76	LBL	
509	89	π	
510	87	IFF	
511	01	01	
512	24	CE	
513	01	1	
514	05	5	
515	03	3	
516	06	6	
517	03	3	
518	03	3	
519	02	2	
520	00	0	
521	00	0	
522	02	2	
523	69	OP	
524	01	01	
525	69	OP	
526	05	05	
527	98	ADV	
528	92	RTN	
529	76	LBL	
530	24	CE	
531	01	1	
532	05	5	
533	03	3	
534	06	6	
535	03	3	
536	03	3	
537	02	2	
538	00	0	
539	00	0	
540	03	3	
541	69	OP	
542	01	01	
543	69	OP	
544	05	05	
545	98	ADV	
546	92	RTN	

LOC	CODE	KEY	COMMENTS

LOC	CODE	KEY	COMMENTS

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
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QA1 - SAMPLING PLAN

- **OPERATING CHARACTERISTICS FOR SINGLE SAMPLING PLANS**
  Provides comprehensive evaluation of single sampling plans via common performance measure with choice of probability functions (hypergeometric, binomial, and poisson). Inputs include the sample size, the acceptance number, and optionally, the lot size.

- **SINGLE SAMPLING PLAN DESIGN**
  Provide for the design of single sampling plans to meet user specified criteria on the operating characteristic curve.

- **AOQL SINGLE SAMPLING PLANS**
  Designs single sampling plans of the Average Outgoing Quality Limit (AOQL) type.

- **UNIT SEQUENTIAL SAMPLING PLANS**
  Provides comprehensive analysis via the criteria and performance characteristics for attribute unit sequential sampling plans with user defined design parameters.

- **VARIABLE SAMPLING PLAN DESIGN**
  Provides for the design of variable sampling plans to meet user specified criteria on the operating characteristic curve.

- **OPERATING CHARACTERISTICS FOR CONTINUOUS SAMPLING PLANS**
  Provides comprehensive evaluation of Continuous Sampling Plan - 1 (CSP-1) and CSP-2 sampling plans via common performance measures and design of certain CSP-1 and CSP-2 plans. Inputs are: fraction of units to be inspected, clearing interval, and any number of fraction defective values. For CSP-2, further clearing interval is also input.

PREPROGRAMMED MAGNETIC CARDS ARE NOT INCLUDED.
(The program Code Lists must be keyed into blank magnetic cards.)

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