

00741C PROGRAM DESCRIPTION I

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Program Title **MULTIPLE REGRESSION 1**
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Program Description, Equations, Variables

This program deals with interval estimations regarding the simplest case of multiple linear (or linearized) regression. The program fits basically the following form:

$$Y = a + bX_1 + cX_2 \quad \dots (1)$$

where X_1 and X_2 can be transformations of the same variable, or can be different variables. Each of Y , X_1 and X_2 can be a transformed (measured) variable.

The program has the following characteristics:

(1) Each of Y , X_1 , X_2 can be RE-NAMED by the user to fit his need. Default nomenclature is Y , X_1 , X_2 . If the user intends X_1 and X_2 to be "related" to the

Necessary Accessories **2 MEMORY MODULES.**

Operating Limits and Warnings **# of data > 3**

Reference(s) **Guttman, Wilkes and Hunter, "Introductory Engineering Statistics" page. 359, Second Edition, Wiley.**

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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same variable, by giving the same name, the program will be aware of that and data prompting will elegantly be adjusted to the fact that 2, and not 3, variables are to be input.

(2) To obtain high flexibility in transforming the data, the user informs the program the transformation of each variable using alphanumerics, as shown below:

<u>transform.</u>	<u>ALPHA INPUT</u>
$\ln()$	LN
none	none
$\sqrt{ () }$	SQRT
$1/()$	1/
$()^2$	SQR

Examples of some combinations are

Formula	Y	X_1	X_2
$y = a + bx + cx^2$	none	none	x^2
$\ln y = a + bx + \frac{c}{x}$	$\ln y$	none	$1/x$
$\ln y = a + b \ln x_1 + \ln x_2$	$\ln y$	$\ln x_1$	$\ln x_2$

(3) A subroutine in LBL04 can calculate the student t -statistic, saving the user the need to look it up from a table. During initialization, the program sets the proper registers to calculate t at 90% two-tailed confidence. Should the user want to change the % of confidence, the following table should help choosing the proper coefficients.

(CONTINUATION PAGE)

Contents of Reg.	CONSTANTS FOR t				
	1%	2%	5%	10%	20%
30	2.576	2.326	1.960	1.645	1.282
31	4.917	3.728	2.372	1.529	0.847
32	8.837	5.716	2.823	1.421	0.572
33	12.149	6.713	2.551	0.983	0.259
34	12.061	5.619	1.590	0.434	0.055

To calculate regression coeff. a , b and c in

$$Y = a + b X_1 + c X_2$$

we calculate

$$C_{11} = \sum X_1^2 - (\sum X_1)^2/n \quad (n = \# \text{ of data})$$

$$C_{22} = \sum X_2^2 - (\sum X_2)^2/n$$

$$C_{12} = \sum X_1 X_2 - (\sum X_1)(\sum X_2)/n$$

$$C_{1Y} = \sum X_1 Y - (\sum X_1)(\sum Y)/n$$

$$C_{2Y} = \sum X_2 Y - (\sum X_2)(\sum Y)/n$$

$$\Delta = C_{11}C_{22} - C_{12}^2$$

$$C'' = C_{22}/\Delta, \quad C'^2 = -C_{12}/\Delta, \quad C^{22} = C_{11}/\Delta$$

$$b = C''C_{1Y} + C'^2C_{2Y}$$

$$c = C'^2C_{1Y} + C^{22}C_{2Y}$$

$$a = [\sum Y - b \sum X_1 - c \sum X_2]/n$$

$$SSD = \sum Y^2 - a \sum Y - b \sum X_1 Y - c \sum X_2 Y$$

$$S_{eY}^2 = (SSD)/(n-3)$$

$$A' = \left(\frac{1}{n} + \sum_{i=1}^2 C^{ii} \bar{x}_i^2 + 2 C^{12} \bar{x}_1 \bar{x}_2 \right)$$

$$A = \left[\frac{1}{n} + \sum_{i=1}^2 C^{ii} (X_{i0} - \bar{x}_i)^2 + 2 C^{12} (X_{10} - \bar{x}_1)(X_{20} - \bar{x}_2) \right]$$

where X_{10}, X_{20} are X_1, X_2 values used to calculate $\bar{Y}$.

The values of t , in the t -test, to test the hypothesis $a = A, b = B, c = C$ are obtained

(CONTINUATION PAGE)

using :

$$t = (a - A) / \sqrt{A' S_{ey}^2}$$

$$t = (b - B) / \sqrt{C'' S_{ey}^2}$$

$$t = (c - C) / \sqrt{C^{22} S_{ey}^2}$$

The interval estimators at $(1-\alpha)100\%$ confidence are

$$a \pm t_{n-3;\alpha} \sqrt{A' S_{ey}^2}$$

$$b \pm t_{n-3;\alpha} \sqrt{C'' S_{ey}^2}$$

$$c \pm t_{n-3;\alpha} \sqrt{C^{22} S_{ey}^2}$$

$$\hat{y} \pm t_{n-3;\alpha} \sqrt{A S_{ey}^2}$$

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Sample Problem (Sketch if Desired)

Using the table, fit $y = a + bx + cx^2$

- (1) Calculate a, b, c, r^2 and SSD.
- (2) test at 90% that $a = A (=0)$
- (2) test at 90% that $b = B (=0)$
- (3) test at 90% that $c = C (=1)$
- (4) Calculate the confidence intervals for a, b and c .
- (5) Calculate $\hat{y}$ & its interval for $x = 7.0$
- (6) Calculate $\hat{y}$ for $x = 8.0$.

y	x
9	2.9
64	8.1
36	5.89
4	2
1	1
25	5.1

SOLUTION:

Input	Function	Display	Comments
	XEQ "NLR"		XEQ B
NM Y?		$Y = a + bX + cX^2$	XEQ H
	RUN	$R^2 = 0.99879$	T = 1.92764
NM X1?		$a = -0.68301$	Z = 2.55338
X	RUN	$b = 0.62574$	Y = 0.62574
NM X2?		$c = 0.91225$	X = -1.30190
X	RUN	SSD = 3.51231	
Y			XEQ I
	RUN	READY	
X			XEQ c
	RUN	A?	T = 0.20945
X		0.00000	Z = 1.12169
SQR	RUN	T = 0.44652	Y = 0.91225
	XEQ A	ACCEPT HYPOTHESIS	X = 0.70280
Y↑X?			X?
	9.00000 ENTER↑	B?	7.00000 RUN
	2.90000 RUN	0.00000	
Y↑X?		T = 0.76371	T = 1.59517
	64.00000 ENTER↑	ACCEPT HYPOTHESIS	Z = 49.99236
	8.10000 RUN		Y = 48.39719
Y↑X?		C?	X = 46.80202
	36.00000 ENTER↑	1.00000	XEQ b
	5.89000 RUN	T = 0.98572	X?
Y↑X?		ACCEPT HYPOTHESIS	8.00000 RUN
	4.00000 ENTER↑		Y HAT = 62.70661
	2.00000 RUN	XEQ G	
Y↑X?		T = 3.59069	
	1.00000 ENTER↑	Z = 2.91567	
	RUN	Y = -0.68301	
Y↑X?		X = -4.28170	
	25.00000 ENTER↑		
	5.10000 RUN		
Y↑X?			

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Sample Problem (Sketch if Desired)

- Using the table, fit
 $\text{Conc.} = a + b \text{ Temp} + c \text{ Press}$
- (1) Calculate a, b, c, r^2, SSD
 - (2) Find (at 90% confidence) the intervals estimated for a, b and c .
 - (3) For $\text{TEMP} = 350$, $\text{PRESS.} = 3$. calculate $\hat{\text{CONC}}$ and the corresponding interval.
 - (4) Calculate $\hat{\text{CONC}}$ only, for $\text{TEMP} = 350$
 $\text{PRESS} = 3$.

Conc.	Temp.	Press
1	290	1.5
1.2	300	2.0
1.3	310	2.45
1.5	320	3.0
1.75	350	3.5
2.00	400	3.7

SOLUTION:

Input	Function	Display	Comments
		1.75000 ENTER↑	
		350.00000 ENTER↑	
		3.50000 RUN	XEQ I
NM Y?			
CONC	RUN	CONC↑TEMP↑PRESS?	T= 0.05918
NM X1?		2.00000 ENTER↑	Z= 0.30324
TEMP	RUN	400.00000 ENTER↑	Y= 0.24406
NM X2?		3.70000 RUN	X= 0.18488
PRESS	RUN	CONC↑TEMP↑PRESS?	XEQ F
CONC			TEMP↑PRESS?
	RUN	CONC=a+b TEMP+c PRESS	350.00000 ENTER↑
TEMP		R2=0.99791	3.00000 RUN
	RUN	a=-0.55764	
PRESS		b=0.00414	T= 0.02496
	RUN	c=0.24406	Z= 1.64822
	XEQ A	SSD=0.00142	Y= 1.62327
CONC↑TEMP↑PRESS?			X= 1.59831
1.00000 ENTER↑			
290.00000 ENTER↑		READY	XEQ b
1.50000 RUN			TEMP↑PRESS?
CONC↑TEMP↑PRESS?			360.00000 ENTER↑
1.20000 ENTER↑		T= 0.27964	3.00000 RUN
300.00000 ENTER↑		Z= -0.27799	CONC HAT=1.66466
2.00000 RUN		Y= -0.55764	
CONC↑TEMP↑PRESS?		X= -0.83728	
1.30000 ENTER↑			
310.00000 ENTER↑			
2.45000 RUN			
CONC↑TEMP↑PRESS?			
1.50000 ENTER↑			
320.00000 ENTER↑			
3.00000 RUN			
CONC↑TEMP↑PRESS?			

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USER INSTRUCTIONS

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SIZE: 040
(HP-41C)

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program (8 tracks)			
2	Initialize		XEQ 'NLR	NM Y?
3	Input optional name for Y	(Y NAME)*	R/S	NM X1?
4	Input optional name for X ₁	(X ₁ NAME)*	R/S	NM X2?
5	" " " " X ₂	(X ₂ NAME)*	R/S	Y**
6	Input optional transformation for Y (see alpha table)	(TRAN. Y)*	R/S	X1**
7	Input optional transf. for X ₁	(TRAN. X ₁)*	R/S	X2**
8	" " " " X ₂	(TRAN. X ₂)*	R/S	
	* optional input.			
	** may appear different if variable is renamed.			
9	Input data		XEQ A	Y↑X ₁ (↑X ₂)?***
	Input y, X ₁ (and X ₂ if X ₁ ≠ X ₂)	Y	ENTER↑	
		X ₁	ENTER↑†	
	*** won't appear if X ₁ ≡ X ₂	X ₂ †	R/S	Y↑X ₁ (↑X ₂)?***
	+ Omit if X ₁ ≡ X ₂			
	Repeat 9, inputting variables until all data is entered.			
10	To delete data		XEQ a	Y↑X ₁ (↑X ₂)?***
		Y _k	ENTER↑	
		X _{1,k}	ENTER↑†	
		X _{2,k} †	R/S	Y↑X ₁ (↑X ₂)?*** (prompt for adding data.)

				SIZE: (HP-41C)
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
11	To calculate regression coeff. †† Omit if printer is connected and ON.		XEQ B R/S†† R/S†† R/S†† R/S†† R/S††	(Model Type) R2 = (r²) a = (a) b = (b) c = (c) SSD = (SSD)
12	To prepare for interval calculations.		XEQ C	READY
13	(Optional) To test the hypothesis a = A	A	XEQ C R/S R/S††	A? T = (t) (comment)
14	(Optional) To test b = B	B	XEQ d R/S R/S††	B? T = (t) (comment)
15	(Optional) To test c = C	C	XEQ e R/S R/S††	C? T = (t) (comment)
16	(Optional) To calculate ŷ only.	X₁ X₂†	XEQ b ENTER†† R/S	X₁ (†X₂)? ** Y HAT = (ŷ)
17	(Optional) The confidence intervals for a, b, c & ŷ will be calculated and accumulated in stack as follows:			
	T Δψ X ψ - Δψ			
	Z ψ + Δψ ψ is a or b or			
	Y ψ c or ŷ			

SIZE:
(HP-41C)

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	If printer is ON, PRSTK will be executed, otherwise manual R↓'s should be used.			
	for a		XEQ G	$a - \Delta a$
			R↓	a
			R↓	$a + \Delta a$
			R↓	Δa
	for b		XEQ H	$b - \Delta b$
			R↓	b
			R↓	$b + \Delta b$
			R↓	Δb
	for c		XEQ I	$c - \Delta c$
			R↓	c
			R↓	$c + \Delta c$
			R↓	Δc
	for $\hat{y}$		XEQ F	$X_1 (\hat{X}_2)?$
		X_1	ENTER↑↑	
		X_2^+	R/S	$\hat{y} - \Delta \hat{y}$
			R↓	$\hat{y}$
			R↓	$\hat{y} + \Delta \hat{y}$
			R↓	$\Delta \hat{y}$
18	To select t at $\alpha \neq 10\%$ store proper numbers (see table) in registers 30-34	R_{30}	STO 30	
		R_{31}	STO 31	
		R_{32}	STO 32	
		R_{33}	STO 33	
		R_{34}	STO 34	

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
01	LBL	NLR		48	" "		TRANSF. FOR
02	CLRG		CLEAR	49	ASTO 17		"X ₂ "
03	1.645		REGS.	50	CLA		
04	STO 30			51	FS? 00		
05	1.524		STORE CONST.	52	" "		
06	STO 31		FOR $t_{d.f.}; 10\%$	53	ARCL 15		
07	1.421			54	PROMPT		
08	STO 32			55	FC?C 23		
09	.983			56	" "		
10	STO 33			57	ASTO 18		
11	.434			58	AOFF		
12	STO 34			59	BEEP		
13	CF 00			60	CLX		
14	SF 27			61	RTN		Σ- ROUTINE
15	SF 21			62	LBL a		
16	BEEP			63	SF 01		Σ+ ROUTINE
17	CF 23			64	LBL A		
18	"NM Y?"		INPUT NAME	65	CLA		TEST FLG 0
19	AON		FOR "Y"	66	ARCL 13		TO DECIDE
20	PROMPT			67	"H↑"		PROMPTED
21	FC?C 23			68	ARCL 14		MESSAGE
22	"Y"			69	FS? 00		
23	ASTO 13			70	GTO 01		
24	"NM X1?"		INPUT NAME	71	"H↑"		
25	PROMPT		FOR "X ₁ "	72	ARCL 15		
26	FC?C 23			73	LBL 01		
27	"X1"			74	"H?"		
28	ASTO 14		INPUT NAME	75	TOE 9		
29	"NM X2?"		FOR "X ₂ "	76	PROMPT		
30	PROMPT			77	FS? 00		
31	FC?C 23			78	ENTER↑		TRANSF.
32	"X2"			79	XEQ IND		VARIABLES
33	ASTO 15		CHECK IF	18			
34	RCL 15		$X_2 \equiv X_2$ (SAME	80	STO 39		
35	RCL 14		VARIABLE)	81	RDN		
36	X=Y?			82	XEQ IND		
37	SF 00			17			
38	CLA			83	STO 38		
39	ARCL 13		TRANSFORMATION	84	RDN		
40	PROMPT		FOR "Y"	85	XEQ IND		
41	FC?C 23			16			
42	" "			86	STO 37		START ACCUM-
43	ASTO 16			87	ΣREG 00		ULATION IN
44	CLA			88	RCL 37		STAT REG'S.
45	ARCL 14		TRANSF. FOR	89	RCL 38		
46	PROMPT		"X ₁ "	90	FC? 01		
47	FC?C 23			91	Σ+		
				92	FS? 01		
				93	Σ-		

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
94	ΣREG 06			141	FC? 02		
95	RCL 37			142	X↑2		
96	RCL 39			143	FS?C 02		
97	FC? 01			144	SQRT		
98	Σ+		USING FL61	145	RTN		
99	FS? 01		Σ+ OR Σ-	146	LBL B		
100	Σ-		DEPENDING ON	147	20.1		
101	RCL 38		STATUS	148	STO 35		
102	RCL 39			149	RCL 01		
103	*			150	RCL 00		
104	FC? 01			151	RCL 00		
105	ST+ 12			152	RCL 05		
106	FS?C 01			153	XEQ 00		
107	ST- 12			154	RCL 07		
108	TONE 8			155	RCL 06		
109	" I="			156	RCL 06		
110	FIX 0			157	RCL 05		
111	CF 29			158	XEQ 00		
112	ARCL 05			159	RCL 12		
113	FIX 5			160	RCL 06		
114	SF 29			161	RCL 00		
115	CF 21			162	RCL 05		
116	AVIEW			163	XEQ 00		
117	SF 21			164	RCL 04		
118	PSE		PAUSE TO SHOW	165	RCL 00		
119	GTO A		# DATA	166	RCL 02		
120	RTN		TRANSF. ROUTINE	167	RCL 05		
121	LBL " "			168	XEQ 00		
122	CF 02		NONE	169	RCL 10		
123	RTN			170	RCL 06		
124	LBL "1/"			171	RCL 02		
125	1/X		1/X	172	RCL 05		
126	CF 02			173	XEQ 00		
127	RTN			174	GTO 02		
128	LBL "LN"			175	LBL 00		
129	FC? 02		LN X	176	/		
130	LN			177	*		
131	FS?C 02			178	-		
132	E↑X			179	STO IND		
133	RTN			35			
134	LBL "SQR			180	ISG 35		
135	FC? 02		√x	181	RTN		
136	SQRT			182	LBL 02		
137	FS?C 02			183	RCL 20		
138	X↑2			184	RCL 21		
139	RTN			185	*		
140	LBL "SQR		x ²	186	RCL 22		
"				187	X↑2		

calculate
C₁₁, C₁₂, C₂₂,
C_{1Y}, C_{2Y}

calculate Δ

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
188	-			236	*		
189	ST/ 21		<i>calculate</i>	237	+		
190	ST/ 20		<i>c'', c'', c''</i>	238	RCL 27		<i>CALC. Y²</i>
191	CHS			239	RCL 10		
192	ST/ 22			240	*		
193	RCL 21			241	+		
194	RCL 23			242	RCL 02		
195	*			243	X↑2		
196	RCL 22			244	RCL 05		
197	RCL 24			245	/		
198	*		<i>calculate</i>	246	-		
199	+		<i>a, b & c</i>	247	LASTX		
200	STO 26			248	CHS		
201	RCL 22			249	RCL 03		
202	RCL 23			250	+		
203	*			251	/		
204	RCL 20			252	"R2="		<i>DISPLAY</i>
205	RCL 24			253	ARCL X		<i>RESULTS</i>
206	*			254	AVIEW		
207	+			255	"a="		
208	STO 27			256	ARCL 25		
209	RCL 06			257	AVIEW		
210	*			258	"b="		
211	RCL 26			259	ARCL 26		
212	RCL 00			260	AVIEW		
213	*			261	"c="		
214	+			262	ARCL 27		
215	RCL 02			263	AVIEW		<i>CALC. SSD</i>
216	-			264	RCL 03		
217	CHS			265	RCL 02		
218	RCL 05			266	RCL 25		
219	/			267	*		
220	STO 25			268	-		
221	CLA			269	RCL 26		
222	ARCL 16		<i>ACCUMULATE</i>	270	RCL 04		
223	ARCL 13		<i>FORMULA TYPE</i>	271	*		
224	"t=a+b"		<i>IN ALPHAREG</i>	272	-		
225	ARCL 17			273	RCL 27		
226	ARCL 14			274	RCL 10		
227	"t+c"			275	*		
228	ARCL 18			276	-		
229	ARCL 15			277	"SSD="		
230	AVIEW			278	ARCL X		
231	RCL 02			279	RCL 05		
232	RCL 25			280	3		
233	*			281	-		
234	RCL 26			282	/		
235	RCL 04			283	STO 19		

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
284	BEEP			332	LBL e		
285	AVIEW			333	"C?"		<i>c = C ? test</i>
286	RTN			334	PROMPT		
287	LBL C		PREPARE	335	RCL 27		
288	RCL 06		FOR INTERVAL	336	-		
289	RCL 00		ESTIMATORS	337	RCL 20		
290	*			338	LBL 03		
291	RCL 05			339	RCL 19		
292	X↑2			340	*		
293	/			341	SQRT		
294	RCL 22			342	/		<i>calc. t</i>
295	*			343	ABS		
296	ST+ X			344	"T="		
297	RCL 21			345	ARCL X		
298	RCL 00			346	STO 36		
299	X↑2			347	AVIEW		<i>calc. $t_{n-3}; \alpha$</i>
300	*			348	XEQ 04		
301	RCL 20			349	RCL 36		
302	RCL 06			350	"REJECT"		
303	X↑2			351	X<=Y?		FORM COMMENT
304	*			352	"ACCEPT"		ACCORDING TO
305	+			353	"HYPOT		RESULTS.
306	RCL 05				HESIS"		
307	X↑2			354	AVIEW		
308	/			355	RTN		
309	+			356	LBL 04		<i>ROUTINE TO</i>
310	RCL 05			357	RCL 05		<i>CALC. $t_{n-3}; \alpha$</i>
311	1/X			358	3		
312	+			359	-		
313	STO 29			360	1/X		
314	"READY"			361	ENTER↑		
315	BEEP			362	ENTER↑		
316	AVIEW			363	ENTER↑		
317	RTN			364	RCL 34		
318	LBL c		<i>a = A ? test</i>	365	*		
319	"A?"			366	RCL 33		
320	PROMPT			367	+		
321	RCL 25			368	*		
322	-			369	RCL 32		
323	RCL 29			370	+		
324	GTO 03			371	*		
325	LBL d		<i>b = B ? test</i>	372	RCL 31		
326	"B?"			373	+		
327	PROMPT			374	*		
328	RCL 26			375	RCL 30		
329	-			376	+		
330	RCL 21			377	RTN		
331	GTO 03			378	LBL b		<i>γ (ONLY) ROUTINE</i>

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
379	SF 03			424	+		
380	LBL F			425	RCL 00		
381	CLA			426	RCL 05		
382	ARCL 14		<i>g</i> INTERVAL	427	/		
383	"F↑"		ROUTINE	428	RCL 38		
384	FS? 00			429	-		
385	CLA			430	X↑2		
386	ARCL 15			431	RCL 21		
387	"F?"			432	*		
388	PROMPT			433	+		
389	FS? 00			434	RCL 06		
390	ENTER↑			435	RCL 05		
391	XEQ IND			436	/		
18				437	RCL 39		
392	STO 39			438	-		
393	RCL 27			439	X↑2		
394	*		<i>calculate</i>	440	RCL 20		
395	X<>Y		<i>g</i>	441	*		
396	XEQ IND			442	+		
17				443	STO 28		
397	STO 38			444	XEQ 04		
398	RCL 26			445	RCL 28		
399	*			446	XEQ 05		
400	+			447	RCL 37		
401	RCL 25			448	GTO 06		
402	+			449	LBL 07		
403	SF 02			450	CLA		
404	XEQ IND			451	ARCL 13		
16				452	"F HAT="		
405	STO 37			453	ARCL 37		
406	FS?C 03			454	PROMPT		
407	GTO 07			455	RTN		
408	RCL 00		<i>calculate</i>	456	LBL G		INTERVAL FOR
409	RCL 05		<i>Δg</i>	457	XEQ 04		a
410	/			458	RCL 29		
411	RCL 38			459	XEQ 05		
412	-			460	RCL 25		
413	RCL 06			461	GTO 06		
414	RCL 05			462	LBL H		INTERVAL FOR
415	/			463	XEQ 04		b
416	RCL 39			464	RCL 21		
417	-			465	XEQ 05		
418	*			466	RCL 26		
419	RCL 22			467	GTO 06		
420	*			468	LBL I		INTERVAL FOR
421	ST+ X			469	XEQ 04		c
422	RCL 05			470	RCL 20		
423	1/X			471	XEQ 05		

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PROGRAM LISTING

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☐ 67 ☐ 97 ☒ 41C

[illegible]

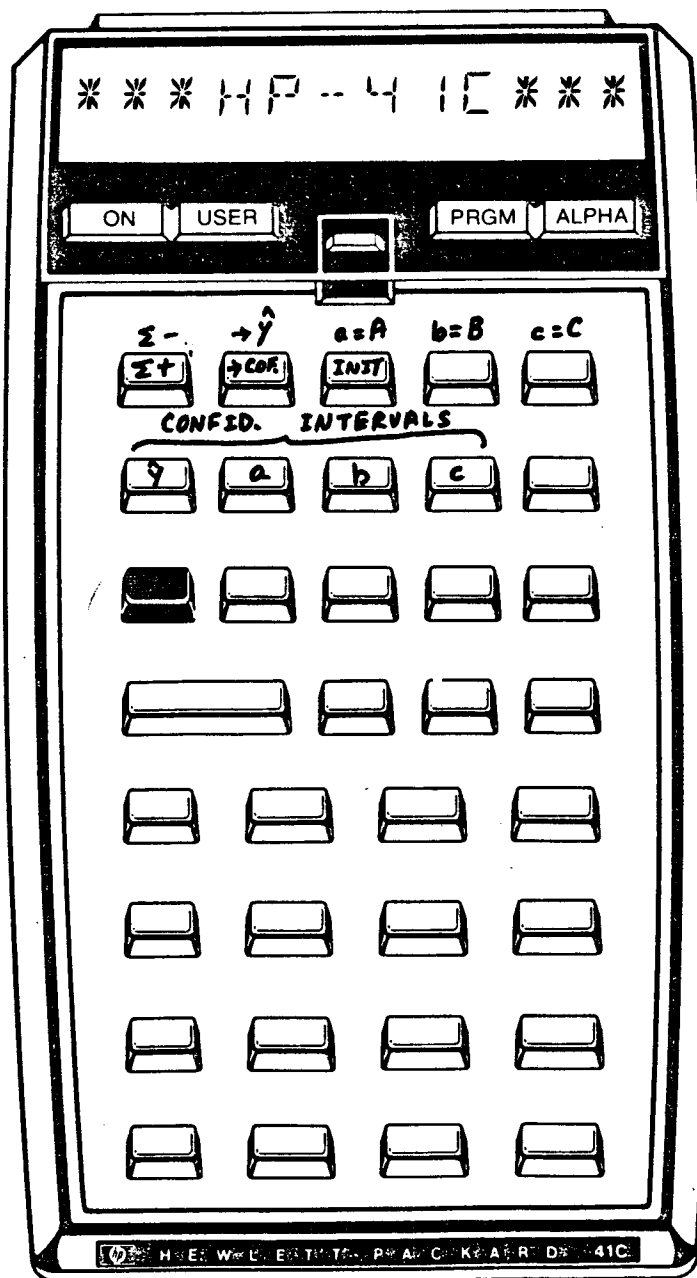
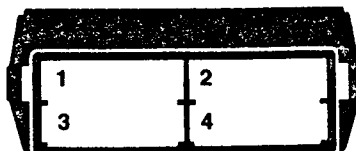
Note: Refer to "HP-41C OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for specific information on keystrokes. The Function Index is found at the very back of the Handbook. Refer to Appendix E in 67 or 97 OWNER'S HANDBOOK AND PROGRAMMING GUIDE for exact keystrokes.

REGISTERS, STATUS, FLAGS, ASSIGNMENTS

[illegible]

KEYBOARD CARD LABELING

KEYBOARD

SYSTEM
CONFIGURATION

CARD



PROGRAM REGISTERS NEEDED: 125

ROW 1 (1 : 3)



ROW 2 (4 : 7)



ROW 3 (7 : 11)



ROW 4 (12 : 18)



ROW 5 (18 : 24)



ROW 6 (24 : 28)



ROW 7 (28 : 32)



ROW 8 (32 : 41)



ROW 9 (41 : 48)



ROW 10 (49 : 55)



ROW 11 (56 : 64)



ROW 12 (64 : 70)



ROW 13 (71 : 77)



ROW 14 (77 : 85)



ROW 15 (85 : 92)



ROW 16 (92 : 99)



ROW 17 (100 : 107)



ROW 18 (107 : 111)



ROW 19 (112 : 119)



ROW 20 (119 : 124)



ROW 21 (124 : 128)



ROW 22 (128 : 134)



ROW 23 (134 : 140)



ROW 24 (140 : 146)



ROW 25 (147 : 153)



ROW 26 (154 : 163)



ROW 27 (163 : 173)



ROW 28 (173 : 181)



ROW 29 (182 : 190)



ROW 30 (190 : 197)



ROW 31 (198 : 205)



ROW 32 (206 : 216)



ROW 33 (217 : 224)



ROW 34 (224 : 228)



ROW 35 (229 : 238)



ROW 36 (238 : 250)



ROW 37 (251 : 256)



ROW 38 (257 : 263)



ROW 39 (264 : 273)



ROW 40 (274 : 281)



ROW 41 (282 : 292)



ROW 42 (293 : 301)



ROW 43 (302 : 313)



ROW 44 (314 : 319)



ROW 45 (319 : 326)



ROW 46 (326 : 333)



ROW 47 (333 : 341)



ROW 48 (342 : 348)



ROW 49 (349 : 352)



ROW 50 (352 : 353)



ROW 51 (353 : 362)



ROW 52 (363 : 372)



ROW 53 (372 : 380)



ROW 54 (381 : 387)



ROW 55 (387 : 395)



ROW 56 (396 : 403)



ROW 57 (404 : 411)



ROW 58 (412 : 421)



ROW 59 (422 : 432)



ROW 60 (433 : 443)



ROW 61 (443 : 448)



ROW 62 (449 : 453)



ROW 63 (454 : 460)



ROW 64 (460 : 465)



ROW 65 (466 : 471)



ROW 66 (471 : 480)



ROW 67 (481 : 489)



ROW 68 (490 : 491)

