



50684 Program Description I

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NV-13A

Program Title LINEAR SYSTEMS k.k (k=1,2,...,7)

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Program Description, Equations, Variables

The matrix of the linear system has k rows and k+1 columns. It is reduced to a diagonal matrix, such as

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{matrix} r_1 \\ r_2 \\ r_3 \\ r_4 \\ r_5 \\ r_6 \end{matrix}$$

This takes some time, not only because of the necessary calculations, but, also owing to a shortage of storage places.

Operating Limits and Warnings

The system is supposed to have one solution. Certain precautions have to be taken, to avoid divisions by zero.

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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50684 Program Description II

Sketch(es)

2

1 LINEAR SYSTEMS $k.h$ ($k=1,2,\dots,7$)

[illegible]



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Program Listing I

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
0011	*LBL A		Enter k here	57	↑		factor f
2	STOO		k	58	x		$\Delta x = kf$
3	STOE		$K=k$	59	$\Rightarrow$		
4	STI		$i=k=K$	60	STI		
5	1			61	↓		
6	RS		a_1 first coefficient is entered	62	STO-i		$x_i \rightarrow x_i - \Delta x$
7	*LBL a			63	↓		
8	RS		a_i next coeff. is entered	64	LSTx		keep f in stack
9	STOi			65	$\Rightarrow$		
01010	↓			66	DSZ		
11	STO:i		$a_i := a_i / a_1$	67	GTO3		
12	DSZ			68	1		
13	GTOa			69	-		$p \rightarrow p-1$
14	RCLE		if $K=1$, solution has been found	70	=0		if $p=0$, end of left subtraction
15	1			71	GTOO		
16	=			72	RCLO		
17	GTOE			73	+		
18	*LBL O		Make room for next equation	74	STI		$i = p+k$
19	C			75	RCLO		
02020	RCLO			76	-		
21	x			77	RCLi		new factor f
22	STI		$i = k(K-k+1)$	78	RCLO		$i = k$
23	*LBL 1			79	STI		
24	RCLi			80	↓		
25	RCLE			81	$\Rightarrow$		
26	GSBc			82	GTO3		
27	STOi			83	*LBL O		division routine
28	LSTX			84	RCLO		
29	STI			85	STI		$i = k$
03030	DSZ			86	RCLi		$d = x_k$ (divisor)
31	GTO1			87	DSZ		
32	RCLE			88	*LBL 4		
33	STI			89	STO:i		$x_i \rightarrow x_i / d$
34	C			90	DSZ		
35	1			91	GTO4		
36	+			92	C		"right" subtraction
37	RS		see number of next equation enter a_1	93	ENT		
38	*LBL 2			94	*LBL 5		keep p in stack
39	RS		enter a_i	95	B		$i = K+p+k$
04040	STOi			96	RCLi		factor f = x_{K+p+k}
41	↓			97	STOD		
42	DSZ			98	RCLO		
43	GTO2			99	STI		$i = k-1$
44	RCLO		"left" subtraction	100	DSZ		
45	STI		$i = k$	101	↑		
46	↓			102	*LBL 6		
47	C		$p = K-k+1$ (number of equations before last equation)	103	RCLi		$x = x_i$
48	*LBL 3			104	RCLD		f
49	RCLO			105	x		$\Delta x = xf$
05050	$\Rightarrow$			106	$\Rightarrow$		
51	x			107	RCLO		
52	LSTx		keep p in stack	108	$\Rightarrow$		
53	$\Rightarrow$			109	x		
54	GSBb		$\Delta i = pk + K - k$	110	LSTX		keep f in stack
55	LSTx			111	$\Rightarrow$		
56	RCLi		$x = x_i$	112	GSBb		$\Delta i = pk + K - k$

all REGISTERS used

0	k	1		2		3		4		5		6		7		8		9	
S0		S1		S2		S3		S4		S5		S6		S7		S8		S9	
A		B		C		D		E		K		I		i					



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Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	$\Rightarrow$			169	LSTx		
114	STO-i		$x_i \rightarrow x_i - \Delta x$	170	STI		
115	$\Rightarrow$			171	RCLD		
116	LSTx			172	>		$g_0 > i?$
117	STI			173	GTO9		
118	$\downarrow$		p	174	1		
119	DSZ			175	STO-0		$k \rightarrow k-1$
120	GTO6			176	RCLO		
121	1			177	>		$k > 1?$
122	-		$p \rightarrow p-1$	178	GTOO		
123	ENT			179	*LBL E		✓ solution is ready
124	$\neq 0$			180	RCLE		
125	GTO5		if $p=0$, end of this part.	181	STI		$i=k$
126	C		fill gaps between rows of useful coefficients	182	*LBL e		
127	STOD		$p = k-k+1$	183	RCLi		
128	*LBL 7			184	-x-		see x_i
129	RCLD			185	DSZ		
130	1			186	GTOe		
131	-			187	RS		
132	STOD		$p \rightarrow p-1$	188	*LBL B		
133	=0			189	RCLO		
134	GTOO		if $p=0$ go to last gap	190	x		
135	B		$i = k_p + k$	191	RCLE		
136	*LBL 8			192	+		
137	ISZ			193	STI		
138	RCLi			194	RTN		
139	DSZ			195	*LBL C		
140	STOi			196	RCLE		
141	ISZ			197	RCLO		
142	RCI			198	-		
143	RCLD			199	1		
144	C			200	+		
145	1			201	RTN		
146	+			202	*LBL b		
147	RCLO			203	RCLE		
148	x			204	+		
149	+		$g_0 = k(k-k+2)$	205	RCLO		
150	>		$g_0 + p > i?$	206	-		
151	GTO8			207	*LBL c		
152	GTO7			208	RCI		
153	*LBL 0		fill last gap	209	+		
154	C			210	STI		
155	1			211	$\downarrow$		
156	+			212	RTN		
157	RCLO			213	*LBL D		✓ Proof
158	x			214	RCLE		
159	STOD			215	STI		
160	RCLE		g_0	216	0		
161	STI		$i=k$	217	*LBL d		
162	*LBL 9			218	RS		
163	ISZ			219	RCLi		enter a_i
164	RCLi			220	x		
165	C			221	+		
166	CHS		$\Delta i = -(k-k+1)$	222	DSZ		
167	GSBc			223	GTOd		
168	STOi			224	RS		find a_{k+1}

all LABELS used					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS		DISP
a	b	c	d	e	1	ON OFF		
0	1	2	3	4	2	0	☐ ☒	DEG ☒
5	6	7	8	9	3	1	☐ ☒	GRAD ☐
						2	☐ ☒	RAD ☐
						3	☐ ☒	FIX ☒
								SCI ☐
								ENG ☐
								n <u>9</u>