MATRIX INVERSION 2

LGP-30

Program D1-129.0

REVISION NOTICE

This publication replaces previous descriptions of "Matrix Inversion 2." Descriptions have been clarified and program references changed to current designations.

FUNCTION

The "Matrix Inversion 2" enables the user to replace the elements of a square matrix with the elements of its inverse. Matrices of any rank greater than 1 will be accommodated. Program D1-129.0 is entered and left in machine language, but it uses the Floating Point Interpretive System 1, program H1-24.0 for all calculations.

INPUT

The elements of a square matrix are stored in consecutive locations on the drum, beginning in M_O. The elements must be in floating point form.

OUTPUT

The elements of the inverse matrix are stored in consecutive locations, beginning in M_O, in floating point form.

CALLING SEQUENCE

Location	Order	Address
a - 1	E	0000
a	R	L_O + 0014
a + 1	U	L_O
a + 2	(n at 15)	M_O
a + 3	etc.	

CALLING SEQUENCE (Cont.)

The E0000 order in (a - 1) is required only if the previous instructions are interpreted by program H1-24.0. In (a + 2), n is the rank of the matrix.

TIME

Approximately 1.08 n^3 seconds are required for the inversion.

STORAGE

Two tracks are required for instructions and constants. No temporary storage is used except that required by program H1-24.0. Although only n^2 sectors are required for the matrix elements, the routine requires $n^2 + n$ sectors beginning in M_0.

NOTES

1. When reading in the "Matrix Inversion 1," it is necessary to supply, as the last word read in, the first location of program H1-24.0.

2. The floating point instructions used by this routine are the following: Bxxxx, Dxxxx, Mxxxx, Hxxxx, Cxxxx, Axxxx, Sxxxx, U0000, and E0000.

D1-29.0

ROYAL MCBEE CORPORATION
ELECTRONIC COMPUTER DEPARTMENT

FLOATING POINT MATRIX INVERSION
(Program 129.0)
Rice Institute

FUNCTION:

To replace the elements of a square matrix with the elements of its inverse. Matrices of any rank greater than one will be accomodated. The routine is entered and left in machine language, but it uses the floating point routine, program 24.0, for all calculations.

INPUT:

The elements of a square matrix in consecutive locations on the drum, beginning in M_o. The elements must be in floating point form.

OUTPUT:

The elements of the inverse matrix in consecutive locations, beginning in M_o, in floating point form.

CALLING SEQUENCE:

Location	Order	Address	
a - 1	E	0000	
a	R	L_o + 0014	
a + 1	U	L_o	
a + 2	(n at 15)	M_o	<— Code Word
a + 3	etc.		

The E0000 order in a - 1 is required only if the previous instructions are interpreted by program 24.0. In a + 2, n is the rank of the matrix.

TIME:

Approximately 1.08 n^3 seconds.

STORAGE:

Two tracks are required for instructions and constants. No temporary storage is used except that required by program 24.0. Although only n^2 sectors are required for the matrix elements, the routine requires $n^2 + n$ sectors beginning in M_o.

NOTES:

When reading in the matrix inversion routine, it is necessary to supply as the last word read in the first location of program 24.0. The floating point instructions used by this routine are the following: Bxxxx, Dxxxx, Mxxxx, Hxxxx, Cxxxx, Axxxx, Sxxxx, U0000, and E0000.

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Job No.______ Prog. No. 29.0 Prep. by E. C. HOLT Ck'd. by ______ Date 3-10-58

Problem MATRIX INVERSION ROUTINE Track ______

Program Input Codes	Stop	Location	Instruction Op.	Address	Stop	Contents of Address	Notes
	'						
	'	☒					
		00.00	B	0163	'	Lo FOR PROGRAM 24.0	
		01	Y	0061	'		
		02	Y	0062	'		
		03	Y	0032	'	☒	
		04	Y	0154	'		
		05	Y	0155	'		CONNECT TO
		06	Y	0033	'		PROGRAM 24.0
		07	Y	0122	'	☒	
		08	Y	0123	'		
		09	Y	0114	'		
		10	Y	0115	'		
		11	B	0014	'	☒	
		12	A	0108	'	1 @ 29	FIX EXIT
		13	Y	0058	'	EXIT	
		14	B	[0000]	'	CODE WORD	
		15	Y	0035	'	☒	
		16	M	0162	'	1 @ 14	
		17	H	0148	'	N	
		18	S	0108	'	1 @ 29	
		19	H	0149	'	☒ COUNTER	
		20	A	0134	'	2 @ 29	
		21	H	0161	'	N + 1	
		22	N	0149	'	N - 1	INITIALIZATION
		23	M	0150	'	☒ 1 @ 2	
		24	H	0107	'	$N^2 - 1$	
		25	A	0035	'	M_0	
		26	A	0108	'	1 @ 29	
		27	Y	0106	'	☒	
		28	Y	0135	'		
		29	A	0149	'	N - 1	
		30	Y	0036	'		
		31	Y	0124	'	☒	

' Conditional Stop Code ☒ Carriage Return

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Job No. ______ Prog. No. 29.0 Prep. by E.C HOLT Ck'd. by ______ Page 2 of 4 Date 3-10-58

Problem MATRIX INVERSION Track ______

Program Input Codes	Stop	Location	Instruction Op. Address	Stop	Contents of Address	Notes
	'					
	'	☒				
		0032	R(0000)	'	}	
		33	U(0000)	'	}→ PROG. 24.0	
		34	B0151	'	ONE	
		35	D(0000)	'	☒ A_{11}	
		36	H(0000)	'	$A_{N+1,N}$	
		37	XU0000	'		
		38	XE0000	'		
		39	B0035	'	☒ M_0	
		40	A0108	'	1 @29	
		41	Y0156	'		
		42	A0107	'	N^2-1	
		43	Y0157	'	☒	
		44	S0124	'	$M(M_0+N^2+N-1)$	
		45	T0154	'	→ NEXT TERM, FIRST ROW	
		46	B0156	'	M_0+N	
		47	Y0063	'	☒	
		48	S0106	'	$S(M_0+N^2)$	
		49	T0061	'	→ NEXT ROW	
		50	B0135	'	$B(M_0+N^2)$	
		51	Y0109	'	☒	
		52	S0148	'	N	
		53	Y0110	'		
		54	S0135	'	$B(M_0+N^2)$	
		55	T0109	'	☒→ NEXT TERM, LAST ROW	
		56	B0149	'	COUNTER	
		57	S0108	'	1 @ 29	
		58	T(0000)	'	→ EXIT	
		59	C0149	'	☒ COUNTER	
		60	U0032	'	→ REPEAT	
		61	R(0000)	'	}	
		62	U(0000)	'	} → 24.0	
		63	S(0000)	'	☒ A_{11}	

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Job No. ______ Prog. No. 24.0 Prep. by C. C. HOLT Ck'd. by ______ Date 3-10-58

Problem MATRIX INVERSION Track ______

Program Input Codes	Stop	Location	Instruction Op. Address	Stop	Contents of Address	Notes
	'					
	'	☒				
		0100	XU0000	'		
		01	XE0000	'		
		02	B0106	'	$M_o + N^2$	
		03	Y0116	'	☒	
		04	B0063	'		
		05	U0143	'	DELAY	
		06	S(0000)	'		$S(M_o + N^2)$
		07	( )	'	☒	$N^2 - 1$
		08	XZ0001	'		1 @ 29
		09	B(0000)	'	$A_{N+1,j}$	
		10	C(0000)	'	$A_{N,j}$	
		11	B0109	'	☒	
		12	A0108	'	1@29	
		13	U0051	'	→ DO ANOTHER	
		14	R(0000)	'	}	
		15	U(0000)	'	☒ } → 24.0	
		16	M(0000)	'	$A_{N+1,j-1}$	
		17	A(0000)	'	A_{ij}	
		18	H(0000)	'	$A_{i-1,j-1}$	
		19	XE0000	'	☒	
		20	U0130	'	DELAY	
		21	Y0125	'		
		22	R(0000)	'		
		23	U(0000)	'	☒ → 24.0	
		24	M(0000)	'	$A_{N+1,N}$	
		25	C(0000)	'	$A_{i-1,N}$	
		26	XE0000			
		27	B0063	'	☒	
		28	A0148	'	N	
		29	U0047	'	→ DO ANOTHER	
		30	B0116	'		
		31	U0136	'	☒ DELAY	

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Job No. ________ Prog. No. 29.0 Prep. by E.C. HOLT Ck'd. by ________ Date 3-10-58

Problem MATRIX INVERSION Track ________

Program Input Codes	Stop	Location	Instruction Op. Address	Stop	Contents of Address	Notes
	'					
	'	☒				
		0132	Y0118	'		
		33	U0114	'	DELAY	
		34	XZ0002	'		2@29
		35	B(0000)	☒		$B(M_o + N^2)$
		36	A0108	'	1@29	
		37	Y0116	'		
		38	S0124	'	$M(M_o + N^2 + N - 1)$	
		39	T0152	☒	→ NEXT TERM	
		40	B0063	'		
		41	S0108	'	1@29	
		42	U0121	'	DELAY	
		43	A0108	☒	1@29	
		44	U0145	'	DELAY	
		45	Y0117	'		
		46	S0161	'	N+1	
		47	U0132	☒	DELAY	
,0000 0004'		48	( )	'		N
		49	( )	'		COUNTER
		50	20000000	'		1@2
		51	40000002	☒		ONE
		52	B0117	'		
		53	U0143	'	→ DO ANOTHER	
		54	R(0000)	'	}	
		55	U(0000)	☒	} → 24.0	
		56	M(0000)	'	A_{ij}	
		57	C(0000)	'	$A_{n+1, j-1}$	
		58	XE0000	'		
		59	B0156	☒		
		60	U0040	'	→ DO ANOTHER	
		61	( )	'		N+1
		62	XY0000	'		1@14
Lo FOR 24.0 =	'	63	00XZ0000	☒		Lo FOR 24.0

' Conditional Stop Code ☒ Carriage Return

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