6. MATRICES and A SET OF LINEAR EQUATIONS

This feature of the program allows the user to solve a set of linear equations with up to 70 unknown, to invert a square matrix and to multiply two matrices. Each matrix can be up to the size of 70x70.

NOTE:

To invert a matrix or to solve a set or linear equations, this program uses the Lotus INVERT command. Therefore any matrix that can't be inverted by LOTUS 1-2-3, can't be inverted by this program.

Integration Differentiation Curve_fit Root_find Matrices Help Integration of functions and data [ESC] - Previous menu Press <M> to get the next menu: Invert_square_matrix Multiply_matrices Linear_equations_solver

6.1 <I>nvert_square_matrix

Press <I> to get the next menu:

Retrieve Edit Clear Invert Data_save Help

6.1A <R>etrieve

Retrieve a spreadsheet matrix file (*.WK1), the matrix file includes the matrix as a square range starting at the A1 cell:

Press <R> to get the next prompt:

Input the file name - MATRIX

Type the file name and press ENTER to get the next screen:

Ret Ret	trieve trieve	Edit a spre A	Clear adsheet	Invert which : B	Data_ include	save a mat C	Help rix (se D	e help)	E	
1 = 2 3 =		Unit	S		Output	/Input			Memory	
	None						0.00			0.00
1 2 3 4 5		GA	1 2 3 4	GB	8 7 6 5	GC	9 10 3 4	GD	1 2 7 5	 GE

The program combines the matrix file and puts it at the upper corner at the cell GA1.

6.1B <E>dit

Press <E> to get into the EDIT mode.

The program is now in the Lotus EDIT mode. Type the numbers in the cells. Use the cursor keys to move through the cells, press the ENTER key only after you have finished inserting the numbers or if you don't want to change anything. The ENTER key is used ONLY to finish the EDIT mode and to get back to the menu.

**** WARNING ****

Since the program is now in the EDIT mode the Lotus keys are operative, however the user is strongly advised to use ONLY the UP, PGUP, DOWN and PGDN keys to scroll between the lines, the program doesn't allow scrolling to the sides by hiding all the columns except the current column. Trying to unhide the columns MAY destroy the program code. For example: if by mistake you have pressed the "/" key press ESC to get back to the READY mode and then press F2 to enter EDIT mode or just continue to type or press ENTER key to exit.

6.1C <I>nvert

Press <I> to get the next screen:

Ret:	rieve rieve	Edit Cl a spreads A	lear Invert sheet which in B	Data_save Hel clude a matrix C	p (see hel] D	p) E	
1 ==		Units	0	utput/Input	Memory		
3 =: 4 5 -:	None			0.	00		0.00
160 161 162	0.10 0.48 -0.29	GA)64814815 314814815)16666667	GB -0.2314814815 -0.4814814815 0.41666666667	GC -0.412037037 -0.037037037 0.0416666667	GD 0.648143 0.148143 -0.16666	81481 81481 66667	GE

163	-0.3333333333	0.33333333333	0.33333333333	-0.3333333333
164				
165				
166				
167				
168				
169				
170				
171				
171				
173				

The square matrix (4x4) is the inversion of the matrix at GA1. The program stores the inverted matrix starting in the cell GA160.

6.2 <M>ultiply_matrices

Press <M> to get the next menu:

Retrieve 1st_matrix_edit 2nd_matrix_edit Clear Multiply Data_save Help

6.2A <R>etrieve

Retrieve a spreadsheet matrix file (*.WK1), the matrix file includes the two matrices the first matrix starts at the A1 cell and the second matrix starts at the A80 cell.

Press <R> to get the next prompt:

Input the file name - MATRIX

Type the file name and press ENTER to get the next screen:

Ret Ret	rieve	ls a	st_matrix_ec spreadsheet A	lit 2nd which B	l_matrix includ	_edit C es the C	lear two m	Multiply atrices D	Data_sav (see help E	e Help)
1 = 2 2 -			Units		Outpu	======= t/Input			Memory	
5 = 4 5 -	None						0.00			0.00
1 2 3 4 5		GP	A 1 2 3 4	GB	8 7 6 5	GC	9 10 3 4	GD	1 2 7 5	 GE

7 8

9			
10			
11			
12			
13			
14			

The program combines the matrix file and puts it at the upper corner at the cell GA1 so that the second matrix is in the GA1 cell. To see or to edit the two matrices use the following options:

<1>st_matrix_edit

Press <1> to get the next screen and to enter the EDIT mode for the first matrix.

GA1: 1 EDI									EDIT
1 _		A	В		С		D	E	
1 = 2		Units		 0ເ	Output/Input			Memory	
5 = 4 5 -	None					0.00			0.00
1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 11 10 10 10 10 10 10 10 10 10 10 10		GA 1 2 3 4	GB	8 7 6 5	GC	9 10 3 4	GD	1 2 7 5	GE

The program is now in the Lotus EDIT mode. Type the numbers in the cells. Use the cursor keys to move through the cells, press the ENTER key only after you have finished inserting the numbers or if you don't want to change anything. The ENTER key is used ONLY to finish the EDIT mode and to get back to the menu.

Since the program is now in the EDIT mode the Lotus keys are operative, however the user is strongly advised to use ONLY the UP, PGUP, DOWN and PGDN keys to scroll between the lines, the program doesn't allow scrolling to the sides by hiding all the columns except the current column. Trying to unhide the columns MAY destroy the program code. For example: if by mistake you have pressed the "/" key press ESC to get back to the READY mode and then press F2 to enter EDIT mode or just continue to type or press ENTER key to exit.

<2>nd_matrix_edit

Press <2> to get the next screen and to enter the EDIT mode for the second matrix.



In this case the second matrix is a 4x2 matrix therefore the multiplication of a 4x4 matrix by 4x2 matrix is a 4x2 matrix. The program stores the second matrix at the GA80 cell.

<M>ultiply

Press <M> to get the resulted matrix and the next screen:

Ret:	rieve	a	spreadsheet A	which B	includes (s the C	two mat 	rices	(see help E)
2 3			Units		Output,	/Input			Memory	
4	None						0.00			0.00
240 241 242 243 244 245 246 247 248 249 250 251 252 253		GA	48 54 52 46	GB	81 85 57 61	GC		GD		GE

The program prints the result of the multiplication at the GA240 cell.

6.3 <L>inear_equations_solver

A set of linear equations can be written in matrix notation, for example let's look on a set of four linear equations with the 4 unknown W, X, Y and Z.

W+8X+ 9Y+ Z=47 2W+7X+10Y+2Z=57 3W+6X+ 3Y+7Z=43 4W+5X+ 4Y+5Z=44

can be rewritten in matrix language as:

1	8	9	Ζ	W		47
2	7	10	2	Х	=	57
3	6	3	7	Y		43
4	5	4	5	Z		44

The 4X4 matrix is called the 1st_matrix and the 4x1 matrix (vector) is called the 2nd_matrix.

Press <L> to get the next menu:

Retrieve 1st_matrix_edit 2nd_matrix_edit Clear Solve Data_save Help

6.3A <R>etrieve

Retrieve a spreadsheet matrix file (*.WK1), the matrix file includes the two matrices the first matrix starts at the A1 cell and the second matrix starts at the A80 cell.

Press <R> to get the next prompt:

Input the file name - LINEAR

Type the file name and press ENTER to get the next screen:

Ret Ret	rieve rieve	1st_r a spi A	natrix_e ceadshee	edit 2r et whic B	nd_matr: ch inclu	ix_edit udes the C	Clear S e two ma	olve Da trices D	ata_save (see he E	Help lp)
2		Un	its		Outr	put/Inpu	it		Memor	y
	None						0.00			0.00
1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 6 7 8 9 10 112 3 4 5 12 3 4 5 6 7 8 9 10 12 3 4 5 6 7 8 9 10 12 3 4 5 6 7 8 9 10 12 3 4 5 6 7 8 9 10 10 10 10 10 10 10 10 10 10 10 10 10		GA	1 2 3 4	GB	8 7 6 5	GC	9 10 3 4	GD	1 2 7 5	GE

The program combines the matrix file and puts it at the upper corner at the cell GA1 so that the second matrix is in the GA1 cell. To see or to edit the two matrices use the following options:

<1>st_matrix_edit

Press <1> to get the next screen and to enter the EDIT mode for the first matrix.



3 :			========	=======	======	======	=======	======	=======
4	None					0.00			0.00
5	GA		GB		GC		GD		GE
1		1		8		9		1	
2		2		7		10		2	
3		3		6		3		7	
4		4		5		4		5	
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

The program is now in the Lotus EDIT mode. Type the numbers in the cells. Use the cursor keys to move through the cells, press the ENTER key only after you have finished inserting the numbers or if you dont want to change anything. The ENTER key is used ONLY to finish the EDIT mode and to get back to the menu.

**** WARNING ****

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<2>nd_matrix_edit

Press <2> to get the next screen and to enter the EDIT mode for the second matrix.

GA 1	80: 1						EDIT
1		A	В	С	D	E	
1 = 2		Units		Output/Input		Memory	
3 4 5	None				0.00		0.00

	GA	GB	GC	GD	GE
80	47				
81	57				
82	43				
83	44				
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					

<S>olve

Press <s> to get the resulted matrix (solution) and the next screen:

Retrieve Retrieve		1st_matrix_ a spreadshe A	edit 2nd et which B	l_matrix_edit Clear includes the two C	r Solve Dat matrices (D	a_save Help see help) E
1 == 2 3 == 4	======	Units		Output/Input		 Memory
	None			0.0	00	0.00
240 241 242 243 244 245 246 247 248 249 250 251 252 253		GA 4 3 2 1	GB	GC	GD	GE

The program prints the result of the multiplication at the GA240 cell.