

16/ENG03/027

CIVIL ENGINEERING

ENG382

a) Gauss elimination method manually with the aid of a calculator

Finbarrs-Ezema Bernard
16/ENG03/027
Civil Engineering
ENG 382
Assignment 3

If the model of a system having thermocouples measuring $T(^\circ\text{C})$, at its different points is given by the set of expressions in Equation (1), estimate the values of the temperatures using:

$$\begin{cases} T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4 \\ 2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20 \\ T_1 + 3T_2 - 3T_3 - T_4 + 2T_5 + T_6 = -15 \\ *5T_1 + 2T_2 - T_3 - T_4 + 2T_5 + T_6 = -3 \\ -3T_1 - T_2 + 2T_3 + 3T_4 + T_5 + 3T_6 = 16 \\ 4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = -27 \end{cases}$$

a) Gauss elimination method manually (with aid of calculator)
b) Gauss elimination method with the aid of Microsoft Excel
c) Gauss elimination method with the aid of MATLAB
d) Matrix inverse method with the aid of Microsoft Excel
e) Matrix inverse method with the aid of MATLAB

Matrix

1	1	-2	1	3	-1	T_1	4
2	-1	1	2	1	-3	T_2	20
1	3	-3	-1	2	1	T_3	-15
5	2	-1	-1	2	1	T_4	-3
-3	-2	2	3	1	3	T_5	16
4	3	1	-6	-3	-2	T_6	-27

By Subtracting the product of the first pivot element of each column of row 1 and the pivot factor of each row from 2 - 6

1st Pivot element,

$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 & -1 & -2 & -1 & 2 \\ 0 & -3 & 9 & -6 & -13 & 6 \\ 0 & 2 & -4 & 6 & 10 & 0 \\ 0 & -1 & 9 & -10 & -15 & 2 \end{bmatrix}$	$\begin{bmatrix} T1 \\ T2 \\ T3 \\ T4 \\ T5 \\ T6 \end{bmatrix}$	$=$	$\begin{bmatrix} 4 \\ 12 \\ -19 \\ -23 \\ 28 \\ -43 \end{bmatrix}$	$\begin{bmatrix} f12 = (1/1) = 2 \\ f13 = (1/1) = 1 \\ f12 = (2/1) = 2 \\ f15 = (-3/1) = -3 \\ f16 = (4/1) = 4 \end{bmatrix}$
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2nd Pivot element,

By ~~Sub~~

$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 4 & -6 & -8 & 7 \\ 0 & 0 & -2/3 & 6 & 20/3 & -2/3 \\ 0 & 0 & 22/3 & -10 & -40/3 & 7/3 \end{bmatrix}$	$\begin{bmatrix} T1 \\ T2 \\ T3 \\ T4 \\ T5 \\ T6 \end{bmatrix}$	$=$	$\begin{bmatrix} 4 \\ 12 \\ -11 \\ -35 \\ 36 \\ -47 \end{bmatrix}$	$\begin{bmatrix} f23 = (2/3) = 2/3 \\ f23 = (-3/3) = 1 \\ f25 = (2/3) = 2/3 \\ f26 = (-1/3) = 1/3 \end{bmatrix}$
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3rd Pivot element,

$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 38/7 & 38/7 & -2/7 \\ 0 & 0 & 0 & -26/7 & 2/7 & -13/7 \end{bmatrix}$	$\begin{bmatrix} T1 \\ T2 \\ T3 \\ T4 \\ T5 \\ T6 \end{bmatrix}$	$=$	$\begin{bmatrix} 4 \\ 12 \\ -11 \\ -113/7 \\ 230/7 \\ -87/7 \end{bmatrix}$	$\begin{bmatrix} f34 = (4/7) = 4/7 \\ f35 = (-2/3) = -2/7 \\ f36 = (20/3) = 22/7 \end{bmatrix}$
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4th Pivot element,

$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 0 & 38/7 & 22/3 \\ 0 & 0 & 0 & 0 & 10/9 & -26/3 \end{bmatrix}$	$\begin{bmatrix} T1 \\ T2 \\ T3 \\ T4 \\ T5 \\ T6 \end{bmatrix}$	$=$	$\begin{bmatrix} 4 \\ 12 \\ -11 \\ -113/7 \\ -11/9 \\ 98/9 \end{bmatrix}$	$\begin{bmatrix} f45 = (38/7) = -19/9 \\ f46 = (-26/7) = 13/9 \\ f46 = (-18/7) = 13/9 \end{bmatrix}$
---	--	-----	---	--

8th Row element

$$\begin{array}{l} t \\ \text{for} \\ -2 \\ 1 \\ 5 \\ -3 \\ 4 \end{array} \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & T1 \\ 0 & -3 & 5 & 0 & -3 & -1 & T2 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & T3 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & T4 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 & T5 \\ 0 & 0 & 0 & 0 & 0 & -213/9 & T6 \end{array} \right] = \begin{array}{c} 4 \\ 12 \\ -11 \\ -113/7 \\ -11/9 \\ 213/9 \end{array}$$

$$T5 = \left(\frac{10/9}{38/9} \right) = 5/19$$

Hence, $\frac{-213}{19} T6 = \frac{213}{19}$

$$T6 = -1$$

$$\frac{-2/3}{-2} \left[\frac{38}{9} T5 + \frac{29}{3} T6 = \frac{-11}{9} \right]$$

$$T5 = \left(\frac{-11 - 29(-1)}{38} \right) / \left(\frac{38}{9} \right) = 2$$

$$\frac{-1/3}{-1/3} \left[-18/7 T4 - 4/7 T5 + 33/7 T6 = \frac{-113}{7} \right]$$

$$T4 = \left(\left(-\frac{113}{7} - \left(\frac{4}{7} (2) - \frac{33}{7} (-1) \right) \right) / \left(-\frac{18}{7} \right) \right) = 4$$

$$\frac{-12/7}{-12/7} \left[\left(\frac{7}{3} \right) T3 + (-2) T4 + \left(-\frac{13}{3} \right) T5 + \left(\frac{4}{3} \right) T6 = -11 \right]$$

$$\frac{-2/7}{-2/7} \left[T3 = 3 \right]$$

$$\frac{-22/7}{-22/7} \left[-3T2 + 5T3 + T4(2) - 5T5 - T6 = 12 \right]$$

$$T2 = \left((12 - 5(3) + 4(2) - 5(2) - 1) / 3 \right) = -2$$

$$\frac{1/9}{1/9} \left[T1 + T2 - 2T3 + T4 + 3T5 - T6 = 4 \right]$$

$$T1 = \left((4 - ((-2) - 2(3) + (4) + 3(2) - 1)) / 1 \right) = 1$$

Solution

$$\begin{bmatrix} T1 \\ T2 \\ T3 \\ T4 \\ T5 \\ T6 \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ 3 \\ 4 \\ 2 \\ -1 \end{bmatrix}$$

b) Gauss elimination with the aid of Microsoft excel

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A2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2																	
3			a						t	b							
4			1	1	-2	1	3	-1 T1		4							
5			2	-1	1	2	1	-3 T2		20							
6			1	3	-3	-1	2	1 T3		-15							
7			5	2	-1	-1	2	1 T4		-3							
8			-3	-1	2	3	1	3 T5		16							
9			4	3	1	-6	-3	-2 T6		-27							
10																	
11			a					t	b	factor							
12			1	1	-2	1	3	-1 T1		4							
13			0	-3	5	0	-5	-1 T2		12		2					
14			0	2	-1	-2	-1	2 T3		-19		1 1st					
15			0	-3	9	-6	-13	6 T4		-23		5					
16			0	2	-4	6	10	0 T5		28		-3					
17			0	-1	9	-10	-15	2 T6		-43		4					
18																	
19			a					t	b	factor							
20			1	1	-2	1	3	-1 T1		4							
21			0	-3	5	0	-5	-1 T2		12							
22			0	0	2.333333333	-2	-4.333333333	1.333333333 T3		-11		-0.666666667					
23			0	0	4	-6	-8	7 T4		-35		1 2nd					
24			0	0	-0.666666667	6	6.666666667	-0.666666667 T5		36		-0.666666667					
25			0	0	7.333333333	-10	-13.33333333	2.333333333 T6		-47		0.333333333					
26																	

Sheet1 Sheet2 Sheet3

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A2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
28			a						t	b	factor						
29			1	1	-2	1	3	-1 T1		4							
30			0	-3	5	0	-5	-1 T2		12							
31			0	0	2.333333333	-2	-4.333333333	1.333333333 T3		-11							
32			0	0	0	-2.571428571	-0.571428571	4.714285714 T4		-16.14285714		1.714285714 3rd					
33			0	0	0	5.428571429	5.428571429	-0.285714286 T5		32.85714286		-0.285714286					
34			0	0	0	-3.714285714	0.285714286	-1.857142857 T6		-12.42857143		3.142857143					
35																	
36			a						t	b	factor						
37			1	1	-2	1	3	-1 T1		4							
38			0	-3	5	0	-5	-1 T2		12							
39			0	0	2.333333333	-2	-4.333333333	1.333333333 T3		-11		4th					
40			0	0	0	-2.571428571	-0.571428571	4.714285714 T4		-16.14285714							
41			0	0	0	0	4.222222222	9.666666667 T5		-1.222222222		-2.111111111					
42			0	0	0	0	1.111111111	-8.666666667 T6		10.88888889		1.444444444					
43																	
44			a						t	b	factor	solution t					
45			1	1	-2	1	3	-1 T1		4		T1	1				
46			0	-3	5	0	-5	-1 T2		12		T2	-2				
47			0	0	2.333333333	-2	-4.333333333	1.333333333 T3		-11		T3	3				
48			0	0	0	-2.571428571	-0.571428571	4.714285714 T4		-16.14285714		T4	4				
49			0	0	0	0	4.222222222	9.666666667 T5		-1.222222222		T5	2				
50			0	0	0	0	0	-11.21052632 T6		11.21052632		0.263157895 T6	-1				

Sheet1 Sheet2 Sheet3

Showing the formula used

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	B	C	D	E	F	G	H	I	J	K
2										
3		a						t	b	
4		1	1	-2	1	3	-1	T1	4	
5		2	-1	1	2	1	-3	T2	20	
6		1	3	-3	-1	2	1	T3	-15	
7		5	2	-1	-1	2	1	T4	-3	
8		-3	-1	2	3	1	3	T5	16	
9		4	3	1	-6	-3	-2	T6	-27	
10										
11		a						t	b	factor
12		=C4	=D4	=E4	=F4	=G4	=H4	T1	=J4	
13		=C5-\$K13*\$C\$4	=D5-\$K13*\$D\$4	=E5-\$K13*\$E\$4	=F5-\$K13*\$F\$4	=G5-\$K13*\$G\$4	=H5-\$K13*\$H\$4	T2	=J5-\$K13*\$J\$4	=C5/\$C\$4
14		=C6-\$K14*\$C\$4	=D6-\$K14*\$D\$4	=E6-\$K14*\$E\$4	=F6-\$K14*\$F\$4	=G6-\$K14*\$G\$4	=H6-\$K14*\$H\$4	T3	=J6-\$K14*\$J\$4	=C6/\$C\$4
15		=C7-\$K15*\$C\$4	=D7-\$K15*\$D\$4	=E7-\$K15*\$E\$4	=F7-\$K15*\$F\$4	=G7-\$K15*\$G\$4	=H7-\$K15*\$H\$4	T4	=J7-\$K15*\$J\$4	=C7/\$C\$4
16		=C8-\$K16*\$C\$4	=D8-\$K16*\$D\$4	=E8-\$K16*\$E\$4	=F8-\$K16*\$F\$4	=G8-\$K16*\$G\$4	=H8-\$K16*\$H\$4	T5	=J8-\$K16*\$J\$4	=C8/\$C\$4
17		=C9-\$K17*\$C\$4	=D9-\$K17*\$D\$4	=E9-\$K17*\$E\$4	=F9-\$K17*\$F\$4	=G9-\$K17*\$G\$4	=H9-\$K17*\$H\$4	T6	=J9-\$K17*\$J\$4	=C9/\$C\$4
18										
19		a						t	b	factor
20		=C12	=D12	=E12	=F12	=G12	=H12	T1	=J12	
21		=\$C5-\$K13*\$C\$4	=D5-\$K13*\$D\$4	=E5-\$K13*\$E\$4	=F5-\$K13*\$F\$4	=G5-\$K13*\$G\$4	=H5-\$K13*\$H\$4	T2	=J5-\$K13*\$J\$4	
22		=\$C6-\$K14*\$C\$4	=D6-\$K14*\$D\$4	=E6-\$K14*\$E\$4	=F6-\$K14*\$F\$4	=G6-\$K14*\$G\$4	=H6-\$K14*\$H\$4	T3	=J6-\$K14*\$J\$4	=\$D14/\$D\$13
23		=\$C7-\$K15*\$C\$4	=D7-\$K15*\$D\$4	=E7-\$K15*\$E\$4	=F7-\$K15*\$F\$4	=G7-\$K15*\$G\$4	=H7-\$K15*\$H\$4	T4	=J7-\$K15*\$J\$4	=\$D15/\$D\$13
24		=\$C8-\$K16*\$C\$4	=D8-\$K16*\$D\$4	=E8-\$K16*\$E\$4	=F8-\$K16*\$F\$4	=G8-\$K16*\$G\$4	=H8-\$K16*\$H\$4	T5	=J8-\$K16*\$J\$4	=\$D16/\$D\$13
25		=\$C9-\$K17*\$C\$4	=D9-\$K17*\$D\$4	=E9-\$K17*\$E\$4	=F9-\$K17*\$F\$4	=G9-\$K17*\$G\$4	=H9-\$K17*\$H\$4	T6	=J9-\$K17*\$J\$4	=\$D17/\$D\$13
26										

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	C	D	E	F	G	H	I	J	K	L	M
28		a						t	b	factor	
29		=C12	=D12	=E12	=F12	=G12	=H12	T1	=J12		
30		=\$C5-\$K13*\$C\$4	=D5-\$K13*\$D\$4	=E5-\$K13*\$E\$4	=F5-\$K13*\$F\$4	=G5-\$K13*\$G\$4	=H5-\$K13*\$H\$4	T2	=J5-\$K13*\$J\$4		
31		=\$C6-\$K14*\$C\$4	=D6-\$K14*\$D\$4	=E6-\$K14*\$E\$4	=F6-\$K14*\$F\$4	=G6-\$K14*\$G\$4	=H6-\$K14*\$H\$4	T3	=J6-\$K14*\$J\$4		
32		=\$C7-\$K15*\$C\$4	=D7-\$K15*\$D\$4	=E7-\$K15*\$E\$4	=F7-\$K15*\$F\$4	=G7-\$K15*\$G\$4	=H7-\$K15*\$H\$4	T4	=J7-\$K15*\$J\$4	=E23/\$E\$22	3rd
33		=\$C8-\$K16*\$C\$4	=D8-\$K16*\$D\$4	=E8-\$K16*\$E\$4	=F8-\$K16*\$F\$4	=G8-\$K16*\$G\$4	=H8-\$K16*\$H\$4	T5	=J8-\$K16*\$J\$4	=E24/\$E\$22	
34		=\$C9-\$K17*\$C\$4	=D9-\$K17*\$D\$4	=E9-\$K17*\$E\$4	=F9-\$K17*\$F\$4	=G9-\$K17*\$G\$4	=H9-\$K17*\$H\$4	T6	=J9-\$K17*\$J\$4	=E25/\$E\$22	
35											
36		a						t	b	factor	
37		=C29	=D29	=E29	=F29	=G29	=H29	T1	=J29		
38		=\$C5-\$K13*\$C\$4	=D5-\$K13*\$D\$4	=E5-\$K13*\$E\$4	=F5-\$K13*\$F\$4	=G5-\$K13*\$G\$4	=H5-\$K13*\$H\$4	T2	=J5-\$K13*\$J\$4		
39		=\$C6-\$K14*\$C\$4	=D6-\$K14*\$D\$4	=E6-\$K14*\$E\$4	=F6-\$K14*\$F\$4	=G6-\$K14*\$G\$4	=H6-\$K14*\$H\$4	T3	=J6-\$K14*\$J\$4		4th
40		=\$C7-\$K15*\$C\$4	=D7-\$K15*\$D\$4	=E7-\$K15*\$E\$4	=F7-\$K15*\$F\$4	=G7-\$K15*\$G\$4	=H7-\$K15*\$H\$4	T4	=J7-\$K15*\$J\$4		
41		=\$C8-\$K16*\$C\$4	=D8-\$K16*\$D\$4	=E8-\$K16*\$E\$4	=F8-\$K16*\$F\$4	=G8-\$K16*\$G\$4	=H8-\$K16*\$H\$4	T5	=J8-\$K16*\$J\$4	=F33/F32	
42		=\$C9-\$K17*\$C\$4	=D9-\$K17*\$D\$4	=E9-\$K17*\$E\$4	=F9-\$K17*\$F\$4	=G9-\$K17*\$G\$4	=H9-\$K17*\$H\$4	T6	=J9-\$K17*\$J\$4	=F34/F32	
43											
44		a						t	b	factor	soluti
45		=C37	=D37	=E37	=F37	=G37	=H37	T1	=J37		
46		=\$C5-\$K13*\$C\$4	=D5-\$K13*\$D\$4	=E5-\$K13*\$E\$4	=F5-\$K13*\$F\$4	=G5-\$K13*\$G\$4	=H5-\$K13*\$H\$4	T2	=J5-\$K13*\$J\$4	=(J45-(D45*M46+E45*M47+F45*M48+G45*M49+H45*M50))/C45	
47		=\$C6-\$K14*\$C\$4	=D6-\$K14*\$D\$4	=E6-\$K14*\$E\$4	=F6-\$K14*\$F\$4	=G6-\$K14*\$G\$4	=H6-\$K14*\$H\$4	T3	=J6-\$K14*\$J\$4	=(J46-(E46*M47+F46*M48+G46*M49+H46*M50))/D46	
48		=\$C7-\$K15*\$C\$4	=D7-\$K15*\$D\$4	=E7-\$K15*\$E\$4	=F7-\$K15*\$F\$4	=G7-\$K15*\$G\$4	=H7-\$K15*\$H\$4	T4	=J7-\$K15*\$J\$4	=(J47-(F47*M48+G47*M49+H47*M50))/E47	
49		=\$C8-\$K16*\$C\$4	=D8-\$K16*\$D\$4	=E8-\$K16*\$E\$4	=F8-\$K16*\$F\$4	=G8-\$K16*\$G\$4	=H8-\$K16*\$H\$4	T5	=J8-\$K16*\$J\$4	=(J48-(G48*M49+H48*M50))/F48	
50		=\$C9-\$K17*\$C\$4	=D9-\$K17*\$D\$4	=E9-\$K17*\$E\$4	=F9-\$K17*\$F\$4	=G9-\$K17*\$G\$4	=H9-\$K17*\$H\$4	T6	=J9-\$K17*\$J\$4	=(J49-H49*M50)/G49	

c) Gauss elimination with the aid of matlab

```

commandwindow
clear
clc
close all
format short g
A = [1 1 -2 1 3 -1
2 -1 1 2 1 -3
1 3 -3 -1 2 1
5 2 -1 -1 2 1
-3 -1 2 3 1 3
4 3 1 -6 -3 -2];
A = [A(1,1), A(1,2), A(1,3), A(1,4), A(1,5) A(1,6)
A(2,1), A(2,2), A(2,3), A(2,4), A(2,5) A(2,6)
A(3,1), A(3,2), A(3,3) A(3,4), A(3,5) A(3,6)
A(4,1), A(4,2), A(4,3) A(4,4), A(4,5) A(4,6)
A(5,1), A(5,2), A(5,3) A(5,4), A(5,5) A(5,6)
A(6,1), A(6,2), A(6,3) A(6,4), A(6,5) A(6,6)]
B = [4
20
-15
-3
16
-27];

```

```

B = [B(1,1)
B(2,1)
B(3,1)
B(4,1)
B(5,1)
B(6,1)]

f12 = A(2,1)/A(1,1)
f13 = A(3,1)/A(1,1)
f14 = A(4,1)/A(1,1)
f15 = A(5,1)/A(1,1)
f16 = A(6,1)/A(1,1)

C = [A(1,1), A(1,2), A(1,3), A(1,4), A(1,5) A(1,6)
A(2,1)-f12*A(1,1), A(2,2)-f12*A(1,2), A(2,3)-f12*A(1,3), A(2,4)-f12*A(1,4), A(2,5)-f12*A(1,5), A(2,6)-f12*A(1,6)
A(3,1)-f13*A(1,1), A(3,2)-f13*A(1,2), A(3,3)-f13*A(1,3), A(3,4)-f13*A(1,4), A(3,5)-f13*A(1,5), A(3,6)-f13*A(1,6)
A(4,1)-f14*A(1,1), A(4,2)-f14*A(1,2), A(4,3)-f14*A(1,3), A(4,4)-f14*A(1,4), A(4,5)-f14*A(1,5), A(4,6)-f14*A(1,6)
A(5,1)-f15*A(1,1), A(5,2)-f15*A(1,2), A(5,3)-f15*A(1,3), A(5,4)-f15*A(1,4), A(5,5)-f15*A(1,5), A(5,6)-f15*A(1,6)
A(6,1)-f16*A(1,1), A(6,2)-f16*A(1,2), A(6,3)-f16*A(1,3), A(6,4)-f16*A(1,4), A(6,5)-f16*A(1,5), A(6,6)-f16*A(1,6)
]

```

```

D = [B(1,1)
     B(2,1)-f12*B(1,1)
     B(3,1)-f13*B(1,1)
     B(4,1)-f14*B(1,1)
     B(5,1)-f15*B(1,1)
     B(6,1)-f16*B(1,1)]

f23 = C(3,2)/C(2,2)
f24 = C(4,2)/C(2,2)
f25 = C(5,2)/C(2,2)
f26 = C(6,2)/C(2,2)

E = [C(1,1), C(1,2), C(1,3), C(1,4), C(1,5) C(1,6)
     C(2,1), C(2,2), C(2,3), C(2,4), C(2,5) C(2,6)
     C(3,1), C(3,2)-f23*C(2,2), C(3,3)-f23*C(2,3), C(3,4)-f23*C(2,4), C(3,5)-f23*C(2,5), C(3,6)-f23*C(2,6)
     C(4,1), C(4,2)-f24*C(2,2), C(4,3)-f24*C(2,3), C(4,4)-f24*C(2,4), C(4,5)-f24*C(2,5), C(4,6)-f24*C(2,6)
     C(5,1), C(5,2)-f25*C(2,2), C(5,3)-f25*C(2,3), C(5,4)-f25*C(2,4), C(5,5)-f25*C(2,5), C(5,6)-f25*C(2,6)
     C(6,1), C(6,2)-f26*C(2,2), C(6,3)-f26*C(2,3), C(6,4)-f26*C(2,4), C(6,5)-f26*C(2,5), C(6,6)-f26*C(2,6)
     ]

F = [D(1,1)
     D(2,1)
     D(3,1)-f23*D(2,1)
     D(4,1)-f24*D(2,1)
     D(5,1)-f25*D(2,1)
     D(6,1)-f26*D(2,1)]

```

```

f34 = E(4,3)/E(3,3)
f35 = E(5,3)/E(3,3)
f36 = E(6,3)/E(3,3)

G = [E(1,1), E(1,2), E(1,3), E(1,4), E(1,5) E(1,6)
     E(2,1), E(2,2), E(2,3), E(2,4), E(2,5) E(2,6)
     E(3,1), E(3,2), E(3,3), E(3,4), E(3,5), E(3,6)
     E(4,1), E(4,2), E(4,3)-f34*E(3,3), E(4,4)-f34*E(3,4), E(4,5)-f34*E(3,5), E(4,6)-f34*E(3,6)
     E(5,1), E(5,2), E(5,3)-f35*E(3,3), E(5,4)-f35*E(3,4), E(5,5)-f35*E(3,5), E(5,6)-f35*E(3,6)
     E(6,1), E(6,2), E(6,3)-f36*E(3,3), E(6,4)-f36*E(3,4), E(6,5)-f36*E(3,5), E(6,6)-f36*E(3,6)
     ]

H = [F(1,1)
     F(2,1)
     F(3,1)
     F(4,1)-f34*F(3,1)
     F(5,1)-f35*F(3,1)
     F(6,1)-f36*F(3,1)]

f45 = G(5,4)/G(4,4)
f46 = G(6,4)/G(4,4)

```

```

I = [G(1,1), G(1,2), G(1,3), G(1,4), G(1,5) G(1,6)
     G(2,1), G(2,2), G(2,3), G(2,4), G(2,5) G(2,6)
     G(3,1), G(3,2), G(3,3), G(3,4), G(3,5), G(3,6)
     G(4,1), G(4,2), G(4,3), G(4,4), G(4,5), G(4,6)
     G(5,1), G(5,2), G(5,3), G(5,4)-f45*G(4,4), G(5,5)-f45*G(4,5), G(5,6)-f45*G(4,6)
     G(6,1), G(6,2), G(6,3), G(6,4)-f46*G(4,4), G(6,5)-f46*G(4,5), G(6,6)-f46*G(4,6)
     ]

J = [H(1,1)
     H(2,1)
     H(3,1)
     H(4,1)
     H(5,1)-f45*H(4,1)
     H(6,1)-f46*H(4,1)]

f56 = I(6,5)/I(5,5)

K = [I(1,1), I(1,2), I(1,3), I(1,4), I(1,5) I(1,6)
     I(2,1), I(2,2), I(2,3), I(2,4), I(2,5) I(2,6)
     I(3,1), I(3,2), I(3,3), I(3,4), I(3,5), I(3,6)
     I(4,1), I(4,2), I(4,3), I(4,4), I(4,5), I(4,6)
     I(5,1), I(5,2), I(5,3), I(5,4), I(5,5), I(5,6)
     I(6,1), I(6,2), I(6,3), I(6,4), I(6,5)-f56*I(5,5), I(6,6)-f56*I(5,6)
     ]

```

```

L = [J(1,1)
     J(2,1)
     J(3,1)
     J(4,1)
     J(5,1)
     J(6,1)-f56*J(5,1)]

T6 = L(6,1)/K(6,6)
T5 = (L(5,1)-(K(5,6)*T6))/K(5,5)
T4 = (L(4,1)-(K(4,5)*T5+K(4,6)*T6))/K(4,4)
T3 = (L(3,1)-(K(3,4)*T4+K(3,5)*T5+K(3,6)*T6))/K(3,3)
T2 = (L(2,1)-(K(2,3)*T3+K(2,4)*T4+K(2,5)*T5+K(2,6)*T6))/K(2,2)
T1 = (L(1,1)-(K(1,2)*T2+K(1,3)*T3+K(1,4)*T4+K(1,5)*T5+K(1,6)*T6))/K(1,1)

T = [ T1; T2; T3; T4; T5; T6 ]

```

K =

1	1	-2	1	3	
0	-3	5	0	-5	
0	0	2.3333	-2	-4.3333	1.33
0	0	0	-2.5714	-0.57143	4.71
0	0	0	0	4.2222	9.66
0	0	0	0	0	-11.2

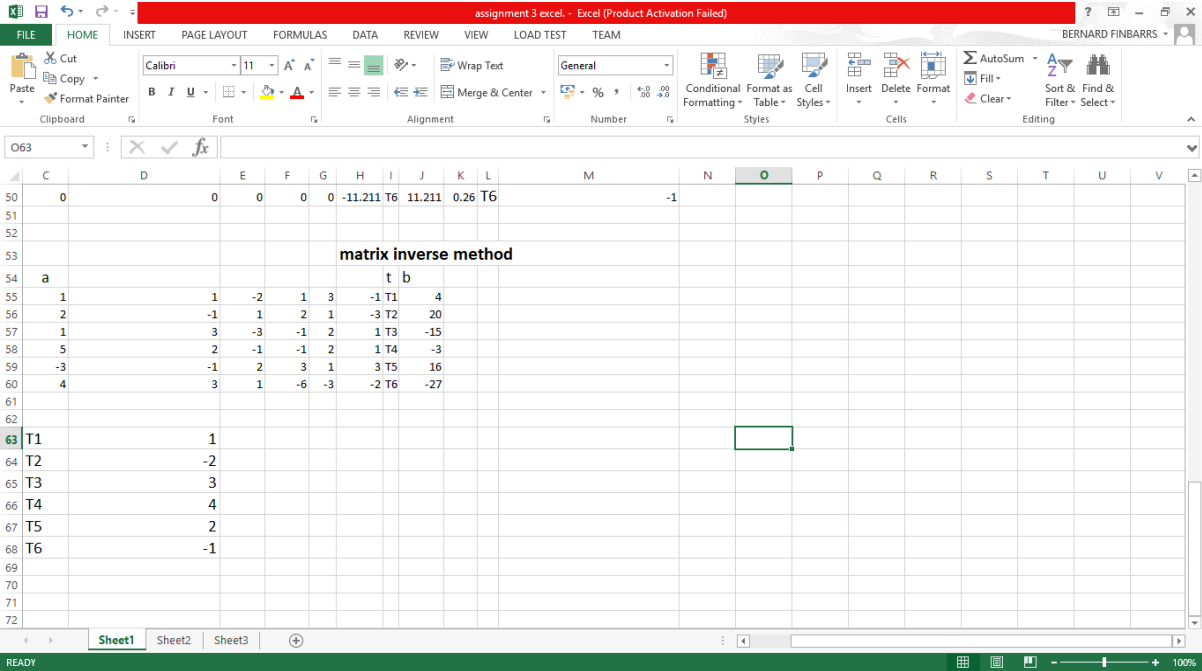
$$T6 = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$$

$$T3 = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$$

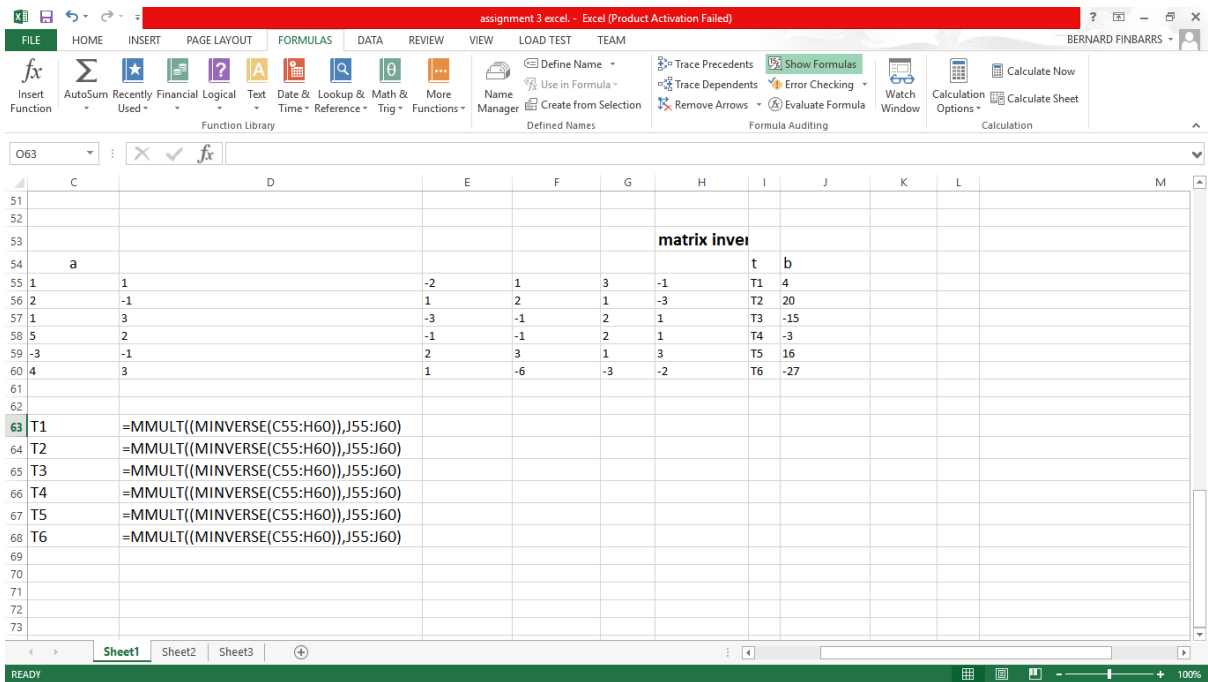
$$T2 = \begin{pmatrix} 1 \\ 3 \\ 2 \\ -1 \end{pmatrix}$$

$$T1 = \begin{pmatrix} 1 \\ -2 \\ 3 \\ 4 \\ 2 \\ -1 \end{pmatrix}$$

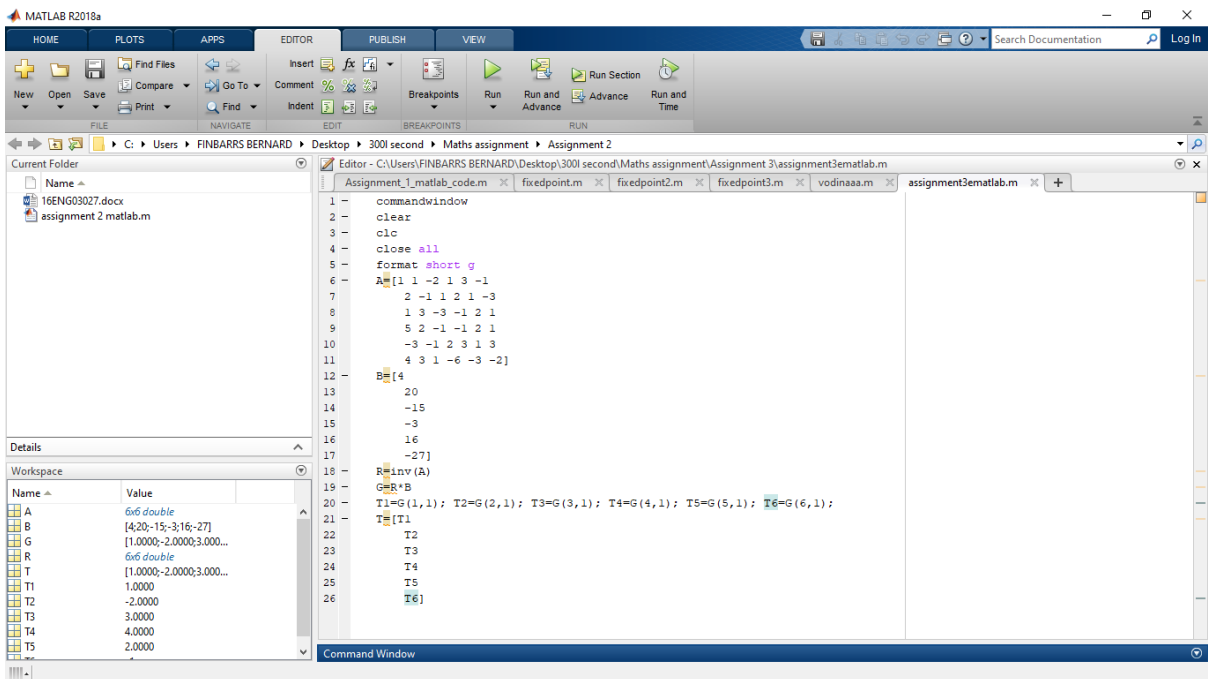
d) Matrix inverse method with the aid of Microsoft excel



Showing formulas



e) Matrix inverse method with the aid of matlab



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```

A =
     1     1    -2     1     3    -1
     2    -1     1     2     1    -3
     1     3    -3    -1     2     1
     5     2    -1    -1     2     1
    -3    -1     2     3     1     3
     4     3     1    -6    -3    -2

B =
     4
    20
   -15
    -3
     16
   -27

R =
   -0.30282    0.15493    0.084507    0.19718   -0.10563   -0.098592
   -0.5493     0.5446     0.81221   -0.21596    0.23474    0.10798
    0.33099   -0.037559   -0.26291   -0.0023474    0.32864    0.25117
   -0.91549    0.68545    0.79812   -0.08216    0.0023474   -0.20892
    1.0915   -0.53521   -0.74648    0.091549    0.1831    0.20423
   -0.18493   -0.14554   -0.018779    0.1784    0.023474   -0.089202

```

Workspace

Name	Value
A	6x6 double
B	[4;20;-15;-3;16;-27]
G	[1.0000;-2.0000;3.0000...
R	6x6 double
T	[1.0000;-2.0000;3.0000...
T1	1.0000
T2	-2.0000
T3	3.0000
T4	4.0000
T5	2.0000

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```

-0.30282    0.15493    0.084507    0.19718   -0.10563   -0.098592
-0.5493     0.5446     0.81221   -0.21596    0.23474    0.10798
 0.33099   -0.037559   -0.26291   -0.0023474    0.32864    0.25117
-0.91549    0.68545    0.79812   -0.08216    0.0023474   -0.20892
 1.0915   -0.53521   -0.74648    0.091549    0.1831    0.20423
-0.18493   -0.14554   -0.018779    0.1784    0.023474   -0.089202

G =
     1
    -2
     3
     4
     2
    -1

T =
     1
    -2
     3
     4
    -1

```

Workspace

Name	Value
A	6x6 double
B	[4;20;-15;-3;16;-27]
G	[1.0000;-2.0000;3.0000...
R	6x6 double
T	[1.0000;-2.0000;3.0000...
T1	1.0000
T2	-2.0000
T3	3.0000
T4	4.0000
T5	2.0000