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17/ENG02/063
COMPUTER ENGINEERING

Matrix Inverse method with MathCad

$$A := \begin{bmatrix} 2 & 2 & -4 & 2 & 6 & -2 \\ 4 & -2 & 2 & 4 & 2 & -6 \\ 2 & 6 & -6 & -2 & 4 & 2 \\ 10 & 4 & -2 & -2 & 4 & 2 \\ -6 & -2 & 4 & 6 & 2 & 6 \\ 8 & 6 & 2 & -12 & -6 & -4 \end{bmatrix} \qquad b := \begin{bmatrix} 12 \\ 60 \\ -45 \\ -9 \\ 48 \\ -81 \end{bmatrix}$$

$$A^{-1} \rightarrow \begin{bmatrix} \frac{-43}{284} & \frac{11}{142} & \frac{3}{71} & \frac{7}{71} & \frac{-15}{284} & \frac{-7}{142} \\ \frac{-39}{142} & \frac{58}{213} & \frac{173}{426} & \frac{-23}{213} & \frac{25}{213} & \frac{23}{426} \\ \frac{47}{284} & \frac{-4}{213} & \frac{-28}{213} & \frac{-1}{852} & \frac{35}{213} & \frac{107}{852} \\ \frac{-65}{142} & \frac{73}{213} & \frac{85}{213} & \frac{-35}{852} & \frac{1}{852} & \frac{-89}{852} \\ \frac{155}{284} & \frac{-19}{71} & \frac{-53}{142} & \frac{13}{284} & \frac{13}{142} & \frac{29}{284} \\ \frac{-11}{142} & \frac{-31}{426} & \frac{-2}{213} & \frac{19}{213} & \frac{5}{426} & \frac{-19}{426} \end{bmatrix}$$

$$T := A^{-1} \cdot b$$

$$T = \begin{bmatrix} 1.5 \\ -3 \\ 4.5 \\ 6 \\ 3 \\ -1.5 \end{bmatrix}$$

Gaussian elimination method with Mathcad

$$A := \begin{pmatrix} 2 & 2 & -4 & 2 & 6 & -2 \\ 4 & -2 & 2 & 4 & 2 & -6 \\ 2 & 6 & -6 & -2 & 4 & 2 \\ 10 & 4 & -2 & -2 & 4 & 2 \\ -6 & -2 & 4 & 6 & 2 & 6 \\ 8 & 6 & 2 & -12 & -6 & -4 \end{pmatrix}$$

$$b := \begin{pmatrix} 12 \\ 60 \\ -45 \\ -9 \\ 48 \\ -81 \end{pmatrix}$$

$n := \text{rows}(A)$

$n = 6$

$C := \text{augment}(A, b)$

Gaussian_elimination(step) :=
- $C \leftarrow C$
- for $k \in 1..n-1$
  - for $i \in (k+1)..n$
    - $\text{multiplier} \leftarrow \frac{C_{i,k}}{C_{k,k}}$
    - for $j \in k..n+1$
      - $C_{i,j} \leftarrow C_{i,j} - \text{multiplier} \cdot C_{k,j}$
    - $U_k \leftarrow C$
- Ustep

$step := 1..n-1$

submatrix(Gaussian_elimination(n-1),1,n,1,n)

bnew_value := submatrix(Gaussian_elimination(n-1),1,n,n+1,n+1)

$$bnew\_value = \begin{bmatrix} 1.5 \\ -3 \\ 4.5 \\ 6 \\ 3 \\ -6.5 \end{bmatrix}$$

Gaussian Elimination method with Excel

	A	B	C	D	E	F	G
1	2	2	-4	2	6	-2	12
2	4	-2	2	4	2	-6	60
3	2	6	-6	-2	4	2	-45
4	10	4	-2	-2	4	2	-9
5	-6	-2	4	6	2	6	48
6	8	6	2	-12	-6	-4	-81

C_{kj} Second

=A2-($A$2/$A$1)*A1

	J	K	L	M	N	O	P
1	2	2	-4	2	6	-2	12
2	0	-6	10	0	-10	-2	36
3	0	4	-8	-4	-2	4	-57
4	0	-6	18	-12	-26	12	-69
5	0	4	-8	12	20	0	84
6	0	-2	18	-20	-30	4	-129

Third

	A	B	C	D	E	F
12	0	4.67	-4	-8.67	2.67	-33
13	0	8	-12	-16	14	-105
14	0	-1.3	12	13.3	-1.3	108
15	0	14.67	-20	-26.67	4.67	-141

= P3 - (P3 / $K$2) * P2

Fourth

	J	K	L	M	N
12	0	-5.14286	-1.14286	9.428571	-48.4286
13	0	10.85714	10.85714	-0.57143	98.57143
14	0	-7.42857	0.571429	-3.71429	-37.2857

→ = F15 - ($B$15 / $B$12) * F12

Fifth

	B	C	D	E
18	0	8.444444	19.33333	-3.6667
19	0	2.222222	-17.3333	32.6667

→ = N14 - ($K$14 / $K$12) * N12

Sixth

K	L	M
0	-22.4211	33.63158

→ = E19 - ($C$19 / $C$18) * E18

Final Equation

2	2	4	2	6	-2	12
	-6	10	0	-10	-2	36
		4.66667	-4	-8.6667	2.666667	-33
			-5.14286	-1.14286	9.428571	-48.4286
				8.444444	19.33333	-3.6667
					-22.4211	33.63158

Temperature (KELVIN)

T(6)	T(5)	T(4)	T(3)	T(2)	T(1)
-1.5	3	6	4.5	-3	1.5

=K27/J27

=(K26-J26*C31)/I26

=(K25-I25*D31-J25*C31)/H25

=(K24-H24*E31-I24*D31-J24*C31)/G24

=(K23-G23*F31-H23*E31-I23*D31-J23*C31)/F23

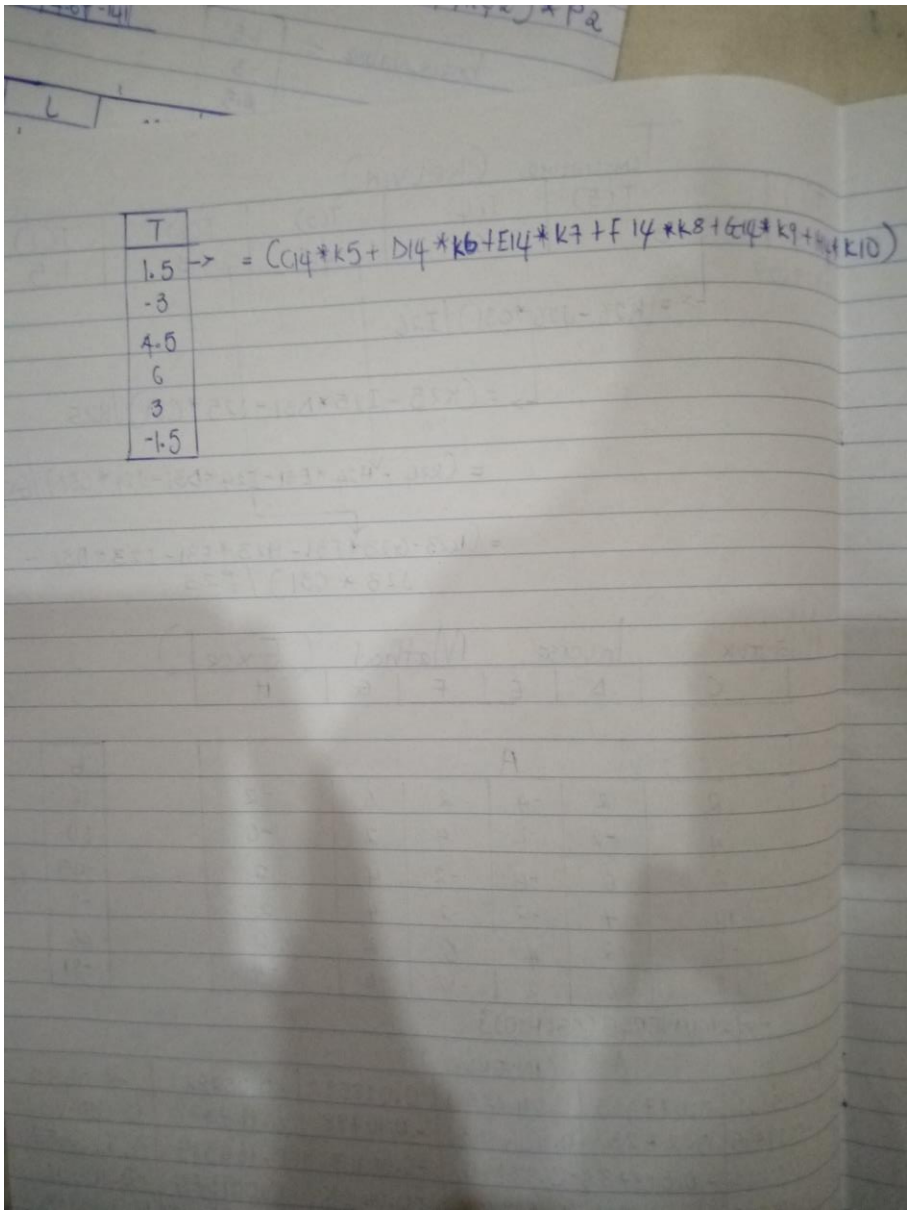
Matrix Inverse Method (Excel)

	C	D	E	F	G	H
	A					b
5	2	2	-4	2	6	-2	12
6	4	-2	2	4	2	-6	60
7	2	6	-6	-2	4	2	-45
8	10	4	-2	-2	4	2	-9
9	-6	-2	4	6	2	6	48
10	8	6	2	-12	-6	-4	-81

→{=MINVERSE(C5:H10)}

A (INVERSE)

14	-0.15141	0.077465	0.042254	0.098592	-0.05282	-0.0493
15	-0.27465	0.2723	0.406103	-0.10798	0.117371	0.053991
16	0.165493	-0.01878	-0.13146	-0.00117	0.164319	0.125587
17	-0.45775	0.342723	0.399061	-0.04108	0.001174	-0.10446
18	0.545775	-0.26761	-0.37324	0.045775	0.091549	0.102113
19	-0.07746	-0.07277	-0.00939	0.089202	0.011737	-0.0446


T
1.5
-3
4.5
6
3
-1.5
= C14*k5+ D14*k6+E14*k7+F14*k8+G14*k9+
k10)