

LAMPIRAN

Lampiran 1 Hasil Perhitungan *Response Surface Methodology* (RSM)

a. Buat bentuk matriks berdasarkan persamaan regresi multivarian

Rumus 1

$$x = \begin{pmatrix} 1 & 2 & 5 & 15 \\ 1 & 2 & 5 & 20 \\ 1 & 2 & 5 & 25 \\ 1 & 2 & 5 & 30 \\ 1 & 2,5 & 5 & 15 \\ 1 & 2,5 & 5 & 20 \\ 1 & 2,5 & 5 & 25 \\ 1 & 2,5 & 5 & 30 \\ 1 & 2 & 6 & 15 \\ 1 & 2 & 6 & 20 \\ 1 & 2 & 6 & 25 \\ 1 & 2 & 6 & 30 \\ 1 & 2,5 & 6 & 15 \\ 1 & 2,5 & 6 & 20 \\ 1 & 2,5 & 6 & 25 \\ 1 & 2,5 & 6 & 30 \end{pmatrix}$$

Rumus 2

$$x = \begin{pmatrix} 1 & 0,6931 & 1,6094 & 2,7081 \\ 1 & 0,6931 & 1,6094 & 2,9957 \\ 1 & 0,6931 & 1,6094 & 3,2189 \\ 1 & 0,6931 & 1,6094 & 3,4012 \\ 1 & 0,9163 & 1,6094 & 2,7081 \\ 1 & 0,9163 & 1,6094 & 2,9957 \\ 1 & 0,9163 & 1,6094 & 3,2189 \\ 1 & 0,9163 & 1,6094 & 3,4012 \\ 1 & 0,6931 & 1,7918 & 2,7081 \\ 1 & 0,6931 & 1,7918 & 2,9957 \\ 1 & 0,6931 & 1,7918 & 3,2189 \\ 1 & 0,6931 & 1,7918 & 3,4012 \\ 1 & 0,9163 & 1,7918 & 2,7081 \\ 1 & 0,9163 & 1,7918 & 2,9957 \\ 1 & 0,9163 & 1,7918 & 3,2189 \\ 1 & 0,9163 & 1,7918 & 3,4012 \end{pmatrix}$$

Rumus 3

$$x = \begin{pmatrix} 1,0000 & 10,0000 & 75,0000 & 30,0000 \\ 1,0000 & 10,0000 & 100,0000 & 40,0000 \\ 1,0000 & 10,0000 & 125,0000 & 50,0000 \\ 1,0000 & 10,0000 & 150,0000 & 60,0000 \\ 1,0000 & 12,5000 & 75,0000 & 37,5000 \\ 1,0000 & 12,5000 & 100,0000 & 50,0000 \\ 1,0000 & 12,5000 & 125,0000 & 63,5000 \\ 1,0000 & 12,5000 & 150,0000 & 75,0000 \\ 1,0000 & 12,0000 & 90,0000 & 30,0000 \\ 1,0000 & 12,0000 & 120,0000 & 40,0000 \\ 1,0000 & 12,0000 & 150,0000 & 50,0000 \\ 1,0000 & 12,0000 & 180,0000 & 60,0000 \\ 1,0000 & 15,0000 & 90,0000 & 37,5000 \\ 1,0000 & 15,0000 & 120,0000 & 50,0000 \\ 1,0000 & 15,0000 & 150,0000 & 62,5000 \\ 1,0000 & 15,0000 & 180,0000 & 75,0000 \end{pmatrix}$$

Rumus 4

$$x = \begin{pmatrix} 1,0000 & 50,0000 & 75,0000 & 120,0000 \\ 1,0000 & 50,0000 & 100,0000 & 160,0000 \\ 1,0000 & 50,0000 & 125,0000 & 200,0000 \\ 1,0000 & 50,0000 & 150,0000 & 240,0000 \\ 1,0000 & 62,5000 & 75,0000 & 234,3750 \\ 1,0000 & 62,5000 & 100,0000 & 312,5000 \\ 1,0000 & 62,5000 & 125,0000 & 390,6250 \\ 1,0000 & 62,5000 & 150,0000 & 468,7500 \\ 1,0000 & 72,0000 & 90,0000 & 120,0000 \\ 1,0000 & 72,0000 & 120,0000 & 160,0000 \\ 1,0000 & 72,0000 & 150,0000 & 200,0000 \\ 1,0000 & 72,0000 & 180,0000 & 240,0000 \\ 1,0000 & 90,0000 & 90,0000 & 234,3750 \\ 1,0000 & 90,0000 & 120,0000 & 312,5000 \\ 1,0000 & 90,0000 & 150,0000 & 390,6350 \\ 1,0000 & 90,0000 & 180,0000 & 468,7500 \end{pmatrix}$$

Rumus 5

$$x = \begin{pmatrix} 1,0000 & 100,0000 & 75,0000 & 120,0000 \\ 1,0000 & 100,0000 & 100,0000 & 160,0000 \\ 1,0000 & 100,0000 & 125,0000 & 200,0000 \\ 1,0000 & 100,0000 & 150,0000 & 240,0000 \\ 1,0000 & 156,2500 & 75,0000 & 234,3750 \\ 1,0000 & 156,2500 & 100,0000 & 312,5000 \\ 1,0000 & 156,2500 & 125,0000 & 390,6250 \\ 1,0000 & 156,2500 & 150,0000 & 468,7500 \\ 1,0000 & 144,0000 & 90,0000 & 120,0000 \\ 1,0000 & 144,0000 & 120,0000 & 160,0000 \\ 1,0000 & 144,0000 & 150,0000 & 200,0000 \\ 1,0000 & 144,0000 & 180,0000 & 240,0000 \\ 1,0000 & 225,0000 & 90,0000 & 234,3750 \\ 1,0000 & 225,0000 & 120,0000 & 312,5000 \\ 1,0000 & 225,0000 & 150,0000 & 390,6350 \\ 1,0000 & 225,0000 & 180,0000 & 468,7500 \end{pmatrix}$$

Rumus 6

$$x = \begin{pmatrix} 1,0000 & 50,0000 & 75,0000 & 27000,0000 \\ 1,0000 & 50,0000 & 100,0000 & 64000,0000 \\ 1,0000 & 50,0000 & 125,0000 & 125000,000 \\ 1,0000 & 50,0000 & 150,0000 & 216000,000 \\ 1,0000 & 62,5000 & 75,0000 & 52734,3750 \\ 1,0000 & 62,5000 & 100,0000 & 125000,000 \\ 1,0000 & 62,5000 & 125,0000 & 244140,625 \\ 1,0000 & 62,5000 & 150,0000 & 421875,000 \\ 1,0000 & 72,0000 & 90,0000 & 27000,0000 \\ 1,0000 & 72,0000 & 120,0000 & 64000,0000 \\ 1,0000 & 72,0000 & 150,0000 & 125000,000 \\ 1,0000 & 72,0000 & 180,0000 & 216000,000 \\ 1,0000 & 90,0000 & 90,0000 & 52734,3750 \\ 1,0000 & 90,0000 & 120,0000 & 125000,000 \\ 1,0000 & 90,0000 & 150,0000 & 244140,625 \\ 1,0000 & 90,0000 & 180,0000 & 421875,000 \end{pmatrix}$$

Rumus 7

$$x = \begin{pmatrix} 1,0000 & 100,0000 & 375,0000 & 120,0000 \\ 1,0000 & 100,0000 & 500,0000 & 160,0000 \\ 1,0000 & 100,0000 & 625,0000 & 200,0000 \\ 1,0000 & 100,0000 & 750,0000 & 240,0000 \\ 1,0000 & 156,2500 & 375,0000 & 234,3750 \\ 1,0000 & 156,2500 & 500,0000 & 312,5000 \\ 1,0000 & 156,2500 & 625,0000 & 390,6250 \\ 1,0000 & 156,2500 & 750,0000 & 468,7500 \\ 1,0000 & 144,0000 & 540,0000 & 120,0000 \\ 1,0000 & 144,0000 & 720,0000 & 160,0000 \\ 1,0000 & 144,0000 & 900,0000 & 200,0000 \\ 1,0000 & 144,0000 & 1080,000 & 240,0000 \\ 1,0000 & 225,0000 & 540,0000 & 234,3750 \\ 1,0000 & 225,0000 & 720,0000 & 312,5000 \\ 1,0000 & 225,0000 & 900,0000 & 390,6250 \\ 1,0000 & 225,0000 & 1080,000 & 4468,750 \end{pmatrix}$$

Rumus 8

$$x = \begin{pmatrix} 1,0000 & 2,0000 & 10,0000 & 30,0000 \\ 1,0000 & 2,0000 & 10,0000 & 40,0000 \\ 1,0000 & 2,0000 & 10,0000 & 50,0000 \\ 1,0000 & 2,0000 & 10,0000 & 60,0000 \\ 1,0000 & 2,5000 & 12,5000 & 37,5000 \\ 1,0000 & 2,5000 & 12,5000 & 50,0000 \\ 1,0000 & 2,5000 & 12,5000 & 62,5000 \\ 1,0000 & 2,5000 & 12,5000 & 75,0000 \\ 1,0000 & 2,0000 & 12,0000 & 30,0000 \\ 1,0000 & 2,0000 & 12,0000 & 40,0000 \\ 1,0000 & 2,0000 & 12,0000 & 50,0000 \\ 1,0000 & 2,0000 & 12,0000 & 60,0000 \\ 1,0000 & 2,5000 & 15,0000 & 37,5000 \\ 1,0000 & 2,5000 & 15,0000 & 50,0000 \\ 1,0000 & 2,5000 & 15,0000 & 62,5000 \\ 1,0000 & 2,5000 & 15,0000 & 75,0000 \end{pmatrix}$$

Rumus 9

$$x = \begin{pmatrix} 1,0000 & 5,0000 & 10,0000 & 75,0000 \\ 1,0000 & 5,0000 & 10,0000 & 100,0000 \\ 1,0000 & 5,0000 & 10,0000 & 125,0000 \\ 1,0000 & 5,0000 & 10,0000 & 150,0000 \\ 1,0000 & 5,0000 & 12,5000 & 75,0000 \\ 1,0000 & 5,0000 & 12,5000 & 100,0000 \\ 1,0000 & 5,0000 & 12,5000 & 125,0000 \\ 1,0000 & 5,0000 & 12,5000 & 150,0000 \\ 1,0000 & 6,0000 & 12,0000 & 90,0000 \\ 1,0000 & 6,0000 & 12,0000 & 120,0000 \\ 1,0000 & 6,0000 & 12,0000 & 150,0000 \\ 1,0000 & 6,0000 & 12,0000 & 180,0000 \\ 1,0000 & 6,0000 & 15,0000 & 90,0000 \\ 1,0000 & 6,0000 & 15,0000 & 120,0000 \\ 1,0000 & 6,0000 & 15,0000 & 150,0000 \\ 1,0000 & 6,0000 & 15,0000 & 180,0000 \end{pmatrix}$$

Rumus 10

$$x = \begin{pmatrix} 1,0000 & 15,0000 & 30,0000 & 75,0000 \\ 1,0000 & 20,0000 & 40,0000 & 100,0000 \\ 1,0000 & 25,0000 & 50,0000 & 125,0000 \\ 1,0000 & 30,0000 & 60,0000 & 150,0000 \\ 1,0000 & 15,0000 & 37,5000 & 75,0000 \\ 1,0000 & 20,0000 & 50,0000 & 100,0000 \\ 1,0000 & 25,0000 & 60,5000 & 125,0000 \\ 1,0000 & 30,0000 & 75,0000 & 150,0000 \\ 1,0000 & 15,0000 & 30,0000 & 90,0000 \\ 1,0000 & 20,0000 & 40,0000 & 120,0000 \\ 1,0000 & 25,0000 & 50,0000 & 150,0000 \\ 1,0000 & 30,0000 & 60,0000 & 180,0000 \\ 1,0000 & 15,0000 & 37,5000 & 90,0000 \\ 1,0000 & 20,0000 & 50,0000 & 120,0000 \\ 1,0000 & 25,0000 & 62,5000 & 150,0000 \\ 1,0000 & 30,0000 & 75,0000 & 180,0000 \end{pmatrix}$$

Rumus 11

$$x = \begin{pmatrix} 1,0000 & 1500,0000 & 75,0000 & 120,0000 \\ 1,0000 & 2000,0000 & 100,0000 & 160,0000 \\ 1,0000 & 2500,0000 & 125,0000 & 200,0000 \\ 1,0000 & 3000,0000 & 150,0000 & 240,0000 \\ 1,0000 & 2343,7500 & 75,0000 & 234,3750 \\ 1,0000 & 3125,0000 & 100,0000 & 312,5000 \\ 1,0000 & 3906,2500 & 125,0000 & 390,6250 \\ 1,0000 & 4687,5000 & 150,0000 & 468,7500 \\ 1,0000 & 2160,0000 & 90,0000 & 120,0000 \\ 1,0000 & 2880,0000 & 120,0000 & 160,0000 \\ 1,0000 & 3600,0000 & 150,0000 & 200,0000 \\ 1,0000 & 4320,0000 & 180,0000 & 240,0000 \\ 1,0000 & 3375,0000 & 90,0000 & 234,3750 \\ 1,0000 & 4500,0000 & 120,0000 & 312,5000 \\ 1,0000 & 5625,0000 & 150,0000 & 390,6250 \\ 1,0000 & 6750,0000 & 180,0000 & 468,7500 \end{pmatrix}$$



b. Matriks pada langkah nomor 1 di transpose (x^T)

Rumus 1

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 2,0000 & 2,0000 & 2,0000 & 2,0000 & 2,5000 & 2,5000 & 2,5000 & 2,5000 & 2,0000 & 2,0000 & 2,0000 & 2,0000 & 2,5000 & 2,5000 & 2,5000 & 2,5000 \\ 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 \\ 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 \end{pmatrix}$$

Rumus 2

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 0,6931 & 0,6931 & 0,6931 & 0,6931 & 0,9163 & 0,9163 & 0,9163 & 0,9163 & 0,6931 & 0,6931 & 0,6931 & 0,6931 & 0,9163 & 0,9163 & 0,9163 & 0,9163 \\ 1,6094 & 1,6094 & 1,6094 & 1,6094 & 1,6094 & 1,6094 & 1,6094 & 1,6094 & 1,7918 & 1,7918 & 1,7918 & 1,7918 & 1,7918 & 1,7918 & 1,7918 & 1,7918 \\ 2,7081 & 2,9957 & 3,2189 & 3,4012 & 2,7081 & 2,9957 & 3,2189 & 3,4012 & 2,7081 & 2,9957 & 3,2189 & 3,4012 & 2,7081 & 2,9957 & 3,2189 & 3,4012 \end{pmatrix}$$

Rumus 3

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 10,000 & 10,000 & 10,000 & 10,000 & 12,500 & 12,500 & 12,500 & 12,500 & 12,000 & 12,000 & 12,000 & 12,000 & 15,000 & 15,000 & 15,000 & 15,000 \\ 75,000 & 100,00 & 125,00 & 150,00 & 75,000 & 100,00 & 125,00 & 150,00 & 90,000 & 120,00 & 150,00 & 180,00 & 90,000 & 120,00 & 150,00 & 180,00 \\ 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 & 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 \end{pmatrix}$$

4,375	312,500	390,625	468,750	120,000	160,000	200,000	240,000
1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
15,250	156,250	156,250	156,250	144,000	144,000	144,000	144,000
100,000	100,000	125,000	150,000	90,000	120,000	150,000	180,000
4,375	312,500	390,625	468,750	120,000	160,000	200,000	240,000
1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
62,500	62,500	62,500	62,500	72,000	72,000	72,000	72,000
75,000	100,000	125,000	150,000	90,000	120,000	150,000	180,000
734,375	125,000	244,140,625	421,875	27,000	64,000	125,000	210,000

Rumus 5

Rumus 6

Rumus 7

110

Rumus 8

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 2,0000 & 2,0000 & 2,0000 & 2,0000 & 2,5000 & 2,5000 & 2,5000 & 2,5000 & 2,0000 & 2,0000 & 2,0000 & 2,0000 & 2,5000 & 2,5000 & 2,5000 & 2,5000 \\ 10,000 & 10,000 & 10,000 & 10,000 & 12,500 & 12,500 & 12,500 & 12,500 & 12,000 & 12,000 & 12,000 & 12,000 & 15,000 & 15,000 & 15,000 & 15,000 \\ 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 & 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 \end{pmatrix}$$

Rumus 9

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 5,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 & 6,0000 \\ 10,000 & 10,000 & 10,000 & 10,000 & 12,500 & 12,500 & 12,500 & 12,500 & 12,000 & 12,000 & 12,000 & 12,000 & 15,000 & 15,000 & 15,000 & 15,000 \\ 75,000 & 100,00 & 125,00 & 150,00 & 75,000 & 100,00 & 125,00 & 150,00 & 90,000 & 120,00 & 150,00 & 180,00 & 90,000 & 120,00 & 150,00 & 180,00 \end{pmatrix}$$

Rumus 10

$$x^T = \begin{pmatrix} 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 & 1,0000 \\ 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 & 15,000 & 20,000 & 25,000 & 30,000 \\ 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 & 30,000 & 40,000 & 50,000 & 60,000 & 37,500 & 50,000 & 62,500 & 75,000 \\ 75,000 & 100,00 & 125,00 & 150,00 & 75,000 & 100,00 & 125,00 & 150,00 & 90,000 & 120,00 & 150,00 & 180,00 & 90,000 & 120,00 & 150,00 & 180,00 \end{pmatrix}$$

Rumus 11

$$x^T = \begin{pmatrix} 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 & 1,00000 \\ 1500,00 & 2000,00 & 2500,00 & 3000,00 & 2343,75 & 3125,00 & 3906,25 & 4687,50 & 2160,00 & 2880,00 & 3600,00 & 4320,00 & 3375,00 & 4500,00 & 5625,00 & 6750,00 \\ 75,0000 & 100,000 & 125,000 & 150,000 & 75,0000 & 100,000 & 125,000 & 150,000 & 90,0000 & 120,000 & 150,000 & 180,000 & 90,0000 & 120,000 & 150,000 & 180,000 \\ 120,000 & 160,000 & 250,000 & 240,000 & 234,375 & 312,500 & 390,625 & 468,750 & 120,000 & 160,000 & 200,000 & 240,000 & 234,375 & 312,500 & 390,625 & 468,750 \end{pmatrix}$$

- c. Kalikan nilai transpose matriks dengan nilai “x”, dimana nilai tersebut dimisalkan menjadi c

Rumus 1

$$c = x^T x = \begin{bmatrix} 16,00 & 36,00 & 88,00 & 360,0 \\ 36,00 & 82,00 & 198,0 & 810,0 \\ 88,00 & 198,0 & 488,0 & 1980 \\ 360,0 & 810,0 & 1980 & 8600 \end{bmatrix}$$

Rumus 2

$$c = x^T x = \begin{bmatrix} 16,0000 & 12,8752 & 27,2096 & 49,2956 \\ 12,8752 & 10,5599 & 21,8956 & 39,6682 \\ 27,2096 & 21,8956 & 46,4057 & 83,8321 \\ 49,2956 & 39,6682 & 83,8321 & 152,950 \end{bmatrix}$$

Rumus 3

1,0e+05*

$$c = x^T x = \begin{bmatrix} 0,0002 & 0,0020 & 0,0198 & 0,0081 \\ 0,0020 & 0,0250 & 0,2470 & 0,1015 \\ 0,0198 & 0,2470 & 2,6230 & 1,0642 \\ 0,0081 & 0,1015 & 1,0642 & 0,4497 \end{bmatrix}$$

Rumus 4

1,0e+06*

$$c = x^T x = \begin{bmatrix} 0,0000 & 0,0011 & 0,0020 & 0,0043 \\ 0,0011 & 0,0788 & 0,1381 & 0,3023 \\ 0,0020 & 0,1381 & 0,2623 & 0,5587 \\ 0,0043 & 0,3023 & 0,5587 & 1,3250 \end{bmatrix}$$

Rumus 5

1,0e+06*

$$c = x^T x = \begin{bmatrix} 0,0000 & 0,0025 & 0,0020 & 0,0043 \\ 0,0025 & 0,4231 & 0,3146 & 0,7118 \\ 0,0020 & 0,3146 & 0,2623 & 0,5587 \\ 0,0043 & 0,7118 & 0,5587 & 1,3250 \end{bmatrix}$$

Rumus 6

1,0e+11*

$$c = x^T x = \begin{bmatrix} 0,0000 & 0,0000 & 0,0000 & 0,0000 \\ 0,0000 & 0,0000 & 0,0000 & 0,0018 \\ 0,0000 & 0,0000 & 0,0000 & 0,0037 \\ 0,0000 & 0,0018 & 0,0037 & 6,4619 \end{bmatrix}$$

Rumus 7

1,0e+06*

$$c = x^T x = \begin{bmatrix} 0,0000 & 0,0025 & 0,0110 & 0,0043 \\ 0,0025 & 0,4231 & 1,7721 & 0,7118 \\ 0,0110 & 1,7721 & 8,2603 & 3,0984 \\ 0,0043 & 0,7118 & 3,0984 & 1,3250 \end{bmatrix}$$

Rumus 8

1,0e+04*

$$c = x^T x = \begin{bmatrix} 0,0016 & 0,0036 & 0,0198 & 0,0810 \\ 0,0036 & 0,0082 & 0,0451 & 0,1845 \\ 0,0198 & 0,0451 & 0,2501 & 1,0148 \\ 0,0810 & 0,1845 & 1,0148 & 4,4075 \end{bmatrix}$$

Rumus 9

$$c = x^T x = \begin{bmatrix} 16,0000 & 88,0000 & 198,000 & 1980,00 \\ 88,0000 & 488,000 & 1098,00 & 10980,0 \\ 198,000 & 1098,00 & 2501,00 & 24705,0 \\ 1980,00 & 10980,0 & 24705,0 & 262300 \end{bmatrix}$$

Rumus 10

$$c = x^T x = \begin{bmatrix} 16,0000 & 360,000 & 810,000 & 1980,00 \\ 360,000 & 8600,00 & 19350,0 & 47300,0 \\ 810,000 & 19350,0 & 44075,0 & 106425 \\ 1980,00 & 47300,0 & 106425 & 262300 \end{bmatrix}$$

Rumus 11

1,0e+08*

$$c = x^T x = \begin{pmatrix} 0,0000 & 0,0006 & 0,0000 & 0,0000 \\ 0,0006 & 2,2742 & 0,0751 & 0,1700 \\ 0,0000 & 0,0751 & 0,0026 & 0,0056 \\ 0,0000 & 0,1700 & 0,0056 & 0,0133 \end{pmatrix}$$

d. Cari nilai invers $c = (x^T x)$ menggunakan rumus $\text{Invc} = (x^T x)^{-1}$

Rumus 1

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 16,00 & 36,00 & 88,00 & 360,0 \\ 36,00 & 82,00 & 198,0 & 810,0 \\ 88,00 & 198,0 & 488,0 & 1980 \\ 360,0 & 810,0 & 1980 & 8600 \end{pmatrix}^{-1} = \begin{pmatrix} 13,7000 & -2,2500 & -1,3750 & -0,0450 \\ -2,2500 & 1,0000 & -0,0000 & -0,0000 \\ -1,3750 & -0,0000 & 0,2500 & -0,0000 \\ -0,0450 & -0,0000 & -0,0000 & 0,0020 \end{pmatrix}$$

Rumus 2

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 16,0000 & 12,8752 & 27,2096 & 49,2956 \\ 12,8752 & 10,5599 & 21,8956 & 39,6682 \\ 27,2096 & 21,8956 & 46,4057 & 83,8321 \\ 49,2956 & 39,6682 & 83,8321 & 152,950 \end{pmatrix}^{-1} = \begin{pmatrix} 33,90280 & -4,0382 & -12,7789 & -2,8754 \\ -4,03820 & 5,01820 & -0,00000 & -0,0000 \\ -12,7789 & -0,0000 & 7,514300 & 0,00000 \\ -2,87540 & -0,0000 & 0,000000 & 0,93330 \end{pmatrix}$$

Rumus 3

1,0e+05*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0002 & 0,0020 & 0,0198 & 0,0081 \\ 0,0020 & 0,0250 & 0,2470 & 0,1015 \\ 0,0198 & 0,2470 & 2,6230 & 1,0642 \\ 0,0081 & 0,1015 & 1,0642 & 0,4497 \end{pmatrix}^{-1} = \begin{pmatrix} 3,45070 & -0,2328 & -0,0068 & 0,00660 \\ -0,2328 & 0,02210 & 0,00020 & -0,0013 \\ -0,0068 & 0,00020 & 0,00020 & -0,0004 \\ 0,00660 & -0,0013 & -0,0004 & 0,00130 \end{pmatrix}$$

Rumus 4

1,0e+06*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0000 & 0,0011 & 0,0020 & 0,0043 \\ 0,0011 & 0,0788 & 0,1381 & 0,3023 \\ 0,0020 & 0,1381 & 0,2623 & 0,5587 \\ 0,0043 & 0,3023 & 0,5587 & 1,3250 \end{pmatrix}^{-1} = \begin{pmatrix} 1,88080 & -0,0181 & -0,0060 & 0,00060 \\ -0,0181 & 0,00040 & -0,0000 & -0,0000 \\ -0,0060 & -0,0000 & 0,00010 & -0,0000 \\ 0,00060 & -0,0000 & -0,0000 & 0,00000 \end{pmatrix}$$

Rumus 5

1,0e+06*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0000 & 0,0025 & 0,0020 & 0,0043 \\ 0,0025 & 0,4231 & 0,3146 & 0,7118 \\ 0,0020 & 0,3146 & 0,2623 & 0,5587 \\ 0,0043 & 0,7118 & 0,5587 & 1,3250 \end{pmatrix}^{-1} = \begin{pmatrix} 1,56590 & -0,0055 & -0,0080 & 0,00130 \\ -0,0055 & 0,00000 & 0,00000 & -0,0000 \\ -0,0080 & 0,00000 & 0,00010 & -0,0000 \\ 0,00130 & -0,0000 & -0,0000 & 0,00000 \end{pmatrix}$$

Rumus 6

1,0e+11*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0000 & 0,0000 & 0,0000 & 0,0000 \\ 0,0000 & 0,0000 & 0,0000 & 0,0018 \\ 0,0000 & 0,0000 & 0,0000 & 0,0037 \\ 0,0000 & 0,0018 & 0,0037 & 6,4619 \end{pmatrix}^{-1} = \begin{pmatrix} 2,29190 & -0,0166 & -0,0117 & 0,00000 \\ -0,0166 & 0,00030 & -0,0000 & 0,00000 \\ -0,0117 & -0,0000 & 0,00020 & -0,0000 \\ 0,00000 & 0,00000 & -0,0000 & 0,00000 \end{pmatrix}$$

Rumus 7

1,0e+06*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0000 & 0,0025 & 0,0110 & 0,0043 \\ 0,0025 & 0,4231 & 1,7721 & 0,7118 \\ 0,0110 & 1,7721 & 8,2603 & 3,0984 \\ 0,0043 & 0,7118 & 3,0984 & 1,3250 \end{pmatrix}^{-1} = \begin{pmatrix} 1,10340 & -0,0040 & -0,0007 & 0,00030 \\ -0,0040 & 0,00000 & -0,0000 & -0,0000 \\ -0,0007 & -0,0000 & 0,00000 & -0,0000 \\ 0,00030 & -0,0000 & -0,0000 & 0,00000 \end{pmatrix}$$

Rumus 8

1,0e+04*

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0016 & 0,0036 & 0,0198 & 0,0810 \\ 0,0036 & 0,0082 & 0,0451 & 0,1845 \\ 0,0198 & 0,0451 & 0,2501 & 1,0148 \\ 0,0810 & 0,1845 & 1,0148 & 4,4075 \end{pmatrix}^{-1} = \begin{pmatrix} 5,12500 & -2,2500 & 0,00000 & 0,00000 \\ -2,2500 & 2,67320 & -0,2683 & -0,0088 \\ 0,00000 & -0,2683 & 0,04880 & -0,0000 \\ 0,00000 & -0,0088 & -0,0000 & 0,00040 \end{pmatrix}$$

Rumus 9

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 16,0000 & 88,0000 & 198,000 & 1980,00 \\ 88,0000 & 488,000 & 1098,00 & 10980,0 \\ 198,000 & 1098,00 & 2501,00 & 24705,0 \\ 1980,00 & 10980,0 & 24705,0 & 262300 \end{pmatrix}^{-1} = \begin{pmatrix} 7,62500 & -1,3750 & -0,0000 & -0,0000 \\ -1,3750 & 0,44920 & -0,0738 & -0,0015 \\ -0,0000 & -0,0738 & 0,03280 & 0,00000 \\ -0,0000 & -0,0015 & 0,00000 & 0,00010 \end{pmatrix}$$

Rumus 10

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 16,0000 & 360,000 & 810,000 & 1980,00 \\ 360,000 & 8600,00 & 19350,0 & 47300,0 \\ 810,000 & 19350,0 & 44075,0 & 106425 \\ 1980,00 & 47300,0 & 106425 & 262300 \end{pmatrix}^{-1} = \begin{pmatrix} 1,0750 & -0,0450 & -0,0000 & 0,00000 \\ -0,0450 & 0,02550 & -0,0042 & -0,0026 \\ -0,0000 & -0,2683 & 0,00190 & 0,00000 \\ 0,00000 & -0,0088 & 0,00000 & 0,00050 \end{pmatrix}$$

Rumus 11

$$\text{Invc} = (x^T x)^{-1} = (c)^{-1} = \begin{pmatrix} 0,0000 & 0,0006 & 0,0000 & 0,0000 \\ 0,0006 & 2,2742 & 0,0751 & 0,1700 \\ 0,0000 & 0,0751 & 0,0026 & 0,0056 \\ 0,0000 & 0,1700 & 0,0056 & 0,0133 \end{pmatrix}^{-1} = \begin{pmatrix} 1,06590 & 0,00020 & -0,0095 & -0,0015 \\ 0,00020 & 0,00000 & -0,0000 & -0,0000 \\ -0,0095 & -0,0000 & 0,00020 & 0,00000 \\ -0,0015 & -0,0000 & 0,00000 & 0,00000 \end{pmatrix}$$

e. Mencari nilai a_0 , a_1 , a_2 , a_3

Rumus 1

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{pmatrix} 15,900 \\ -25,8750 \\ 23,1875 \\ 1,5725 \end{pmatrix}$$

Rumus 2

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 24,904 \\ -0,5074 \\ 10,604 \\ 0,2894 \end{matrix}$$

Rumus 3

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 65,7472 \\ 1,5981 \\ 0,8939 \\ -1,4924 \end{matrix}$$

Rumus 4

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 52,1209 \\ 0,4844 \\ 0,5335 \\ -0,1159 \end{matrix}$$

Rumus 5

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 55,9625 \\ 0,1890 \\ 0,5976 \\ -0,1462 \end{matrix}$$

Rumus 6

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 37,2649 \\ 0,2406 \\ 0,6894 \\ -0,0001 \end{matrix}$$

Rumus 7

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 77,8102 \\ 0,0586 \\ 0,0854 \\ -0,0939 \end{matrix}$$

Rumus 8

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 178,8125 \\ -100,0335 \\ 10,7195 \\ 0,6756 \end{matrix}$$

Rumus 9

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} -6,9375 \\ 26,3117 \\ -4,3033 \\ 0,2915 \end{matrix}$$

Rumus 10

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 85,2125 \\ -1,4792 \\ -1,1535 \\ 1,0267 \end{matrix}$$

Rumus 11

$$a = (x^T x)^{-1} x^T y_{\text{diameter serat nano PVA-Averrhoa Bilimbi}} = \begin{matrix} 86,2539 \\ 0,0138 \\ 0,3101 \\ -0,1973 \end{matrix}$$