1. x_1, x_2, x_3 的数学模型

$$F(x) = x_1 x3 t_1 - y(1 + x_1 t_1 + x_2 t_2)$$

$$F = [F_1(x), F_2(x), F_3(x), F_4(x), F_5(x)] \begin{cases} 0.13 = \frac{x_1 x_3}{1+x_1+x_2} \\ 0.22 = \frac{2 \cdot x_1 x_3}{1+2x_1+x_2} \\ 0.08 = \frac{x_1 x_3}{1+x_1+2x_2} \\ 0.13 = \frac{2x_1 x_3}{1+2x_1+2x_2} \\ 0.19 = \frac{0.1 \cdot x_1 x_3}{1+0.1 \cdot x_1} \end{cases}$$

$$\begin{cases} F_1(x) = x_1 x_3 - 0.13(1 + x_1 + x_2) \\ F_2(x) = 2 \cdot x_1 x_3 - 0.22(1 + 2x_1 + x_2) \\ F_3(x) = x_1 x_3 - 0.08(1 + x_1 + 2x_2) \\ F_4(x) = 2x_1 x_3 - 0.13(1 + 2x_1 + 2x_2) \\ F_5(x) = x_1 x_3 - 0.19(10 + x_1) \end{cases}$$

最小二乘法模型: $\min f(x) = \frac{1}{2}||F(x)||^2 = \frac{1}{2}\sum_{i=1}^{5} F_i^2(x)$

2.

$$\bigtriangledown F_1(x) = [x3 - 0.13, -0.13, x_1]$$
$$\bigtriangledown F_2(x) = [2x_3, -0.22, 2x_1]$$
$$\bigtriangledown F_3(x) = [x_3, -0.16, x_1]$$
$$\bigtriangledown F_4(x) = [2x_3, -0.26, 2x_1]$$
$$\bigtriangledown F_5(x) = [x_3, 0, x_1]$$

$$x_{k+1} = x_k - (J_F^T J_F)^{-1} J_F F$$