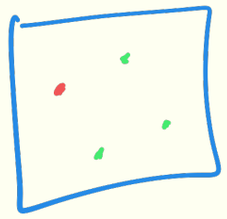
$$\to \begin{pmatrix} 4 & 1 \\ 1 & 4 \end{pmatrix} \qquad N = 4$$



$$f_{1i} = \frac{4(i-1)+4-i}{3} = \frac{4i-4+4-i}{3} = i$$

$$f_{2i} = \frac{i + 4(3-i)}{3} = \frac{12-3i}{3} = 4-i$$

$$\gamma_i = \frac{f_{2i}}{f_{1i}} = \frac{4-i}{i} = \boxed{\frac{4}{i} - 1}$$

$$x_1 = \frac{1 + \sum_{j=1}^{3} \prod_{k=1}^{j} \gamma_k}{1 + \sum_{i=1}^{3} \prod_{k=1}^{i} \gamma_k}$$

$$= \frac{1}{1 + \gamma_1 + \gamma_1\gamma_2 + \gamma_1\gamma_2\gamma_3}$$

$$= \frac{1}{1 + 3 + 3\times 1 + 3\times 1\times\frac{1}{3}} = \frac{1}{8}$$