7 Coordinates-to-index & Index-to-coordinates

7.1 2-dimension

a) For a 2-dimensional grid with sizes *(L_1, L_2)*, the equations between coordinates *(x_1, x_2)* and index *I* are as following.

$$I = L_1 x_2 + x_1$$

$$\begin{cases} x_1 = I \bmod L_1 \\ x_2 = [I / L_1] \end{cases}$$

7.2 d-dimension

a) For a d-dimension grid with sizes *(L_1, L_2, L_3, …, L_d)*, the equations between coordinates *(x_1, x_2, x_3, …, x_d)* and index *I* are as following.

$$I = x_1 + L_1 x_2 + L_1 L_2 x_3 + \cdots + L_1 L_2 \dots L_{d-1} x_d = x_1 + \sum_{i=2}^{d} (\prod_{k=1}^{i-1} L_k) x_i$$

$$\begin{cases} x_1 = \left[I \bmod \prod_{k=1}^{d-1} L_k \bmod \prod_{k=1}^{d-2} L_k \bmod \dots \bmod L_1 L_2 \bmod L_1 \right] \\ \dots \\ x_i = \left[(I \bmod \prod_{k=1}^{d-1} L_k \bmod \prod_{k=1}^{d-2} L_k \bmod \dots \bmod \prod_{k=1}^{i} L_k) / \prod_{k=1}^{i-1} L_k \right] \\ \dots \\ x_{d-1} = \left[(I \bmod \prod_{k=1}^{d-1} L_k) / \prod_{k=1}^{d-2} L_k \right] \\ x_d = \left[I / \prod_{k=1}^{d-1} L_k \right] \end{cases}$$