Question 7 : Equation for 2D coordinates to raster index

Consider the coordinates (x_1, x_2) for a plane with dimensions (L_1, L_2).

$$0 \leq x_1 < L_1 \quad \text{and} \quad 0 \leq x_2 < L_2 \qquad \text{Eq. 1}$$

Let I be the index of any given coordinate.

When $x_2 = 0$, $I = x_1$.

When $x_2 = 1$, $I = x_1 + L_1$ Therefore, for any $x_2 > 1$, $I = x_1 + x_2 L_1$

Equation for Index to 2D coordinates

$$x_2 = I \,//\, L_1 \qquad \text{(floor division)}$$

because, there are $y \times L_1$ indices $< I$.

$$x_1 = I - \left[\underset{\text{obj}}{I} L_1\right]$$

Extending to d-dimensions, $[x_1, x_2 \cdots, x_d]$

$$I_d = x_d (L_{d-1} \times L_{d-2} \times \cdots \times L_1) + \left[\begin{array}{l} x_{d-1} (L_{d-2} \times L_{d-1} \cdots \times L_1) + \\ \vdots \\ x_2 L_1 + \\ x_1 \end{array}\right]$$

$$[X_1, X_2 \cdots, X_d] = \left[\begin{array}{l} \\ \\ I_d - (I_d - L_{d-1} \cdots L_1 \end{array}\right]^T$$

$$\vdots$$

$$\frac{I_d}{L_{d-1} \times L_{d-2} \cdots L_1}$$

Subtracting iteratively

$$I_d \left(\frac{I_d}{L_{d-1} \times L_{d-2} \cdots \times L_1} \times L_{d-1} \times L_{d-2} \cdots L_1\right)$$