ARGMAX NOTATION

Given a function $f: \mathcal{X} \to \mathbb{R}$, the argmax is the set

$$\underset{x \in \mathcal{X}}{\operatorname{argmax}} \; f(x) = \left\{ x^* \in \mathcal{X} : f(x^*) = \max_{x \in \mathcal{X}} f(x) \right\}$$

If this set only has a single element, then we can think of it as being the optimal point x^*.

Example

$$f(x) = \begin{cases} 2 & \text{if } x = 1 \\ 3 & \text{if } x = 2 \\ 4 & \text{if } x = 3 \end{cases}$$

$$f(x) = x + 1 \quad \text{for } x \in \{1, 2, 3\}$$

$$\max_{x \in \{1,2,3\}} f(x) = 4$$

$$\arg\max_{x \in \{1,2,3\}} f(x) = \left\{ x^* \text{ s.t. } f(x^*) = \max_{x \in \{1,2,3\}} f(x) \right\}$$

$$= \{3\}$$