Source task and conventions

Identify the axis measured by length for an arbitrary-shaped tensor.

Conventional solution and proof

For a NumPy array with at least one axis and shape $(d_0, \ldots, d_{k-1})$, $\mathrm{len}(X) = d_0$. This includes $d_0 = 0$, which gives zero. A zero-dimensional scalar array has no leading axis and raises a type error when length is requested. Thus the claim requires positive rank.

Structural or analytic derivation

The indexing domain is a product of k finite sets. The array is a sequence indexed by the first set, whose cardinality is d_0. This gives a representation-level proof of the rule and explains the scalar exception.

Comparative cost and preferred method

The answer is an $O(1)$ metadata lookup, independent of the total entry count. No analytic transformation improves the output contract. The conventional representation is retained.