Component — Paytable (r, p, simplex)

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Purpose

Define outcome multipliers (payout vector) and their probabilities as the state to optimize.

Objects and Domain

Let $r \in \mathbb{R}^{k+1}_{\geq 0}$ be the payout (multiplier) vector and $p \in \Delta^k$ the probability vector, where the simplex is

$$\Delta^k := \Big\{ p \in \mathbb{R}^{k+1}_{\geq 0} \;\Big|\; \sum_{i=0}^{k} p_i = 1 \Big\}. \tag{1}$$

Define the win-mask $w_i := \mathbf{1}[r_i > 0]$ so that the hit-rate is $h(p) = \sum_i w_i p_i$.

Invariants (Guardrails)

With bands on RTP and Hit-rate,

$$L_\mu \leq \mu(p) := \sum_i r_i p_i \leq U_\mu, \qquad L_h \leq h(p) := \sum_i w_i p_i \leq U_h, \tag{2}$$

and any hard cap encoded by the support of r.

Inputs / Outputs / Tests

- Inputs: r, initial $p^{(0)} \in \Delta^k$, bands $[L_\mu, U_\mu], [L_h, U_h]$.
- Outputs: updated $p^{(t)} \in \Delta^k$ respecting bands (post-projection).
- Tests: $\sum_i p_i = 1$, $p_i \geq 0$; μ, h inside bands; index alignment between r and p.