

Poisson:

$$\text{pmf}(k) = \frac{\lambda^k}{k!} e^{-\lambda}$$

where λ is the average number of other choices appearing between occurrences of the marked choice.

Average reward given to the marked choice is

$$\begin{aligned} \bar{R} &= \sum_{k=0}^{\infty} \frac{1}{k+1} \frac{\lambda^k}{k!} e^{-\lambda} \\ &= \sum_{k=0}^{\infty} \frac{\lambda^k}{(k+1)!} e^{-\lambda} \\ &= \frac{1}{\lambda} \sum_{k=1}^{\infty} \frac{\lambda^k}{k!} e^{-\lambda} \\ &= \frac{1}{\lambda} (1 - e^{-\lambda}) \end{aligned}$$

Sanity check:

$$\begin{aligned} \lim_{\lambda \rightarrow 0} \bar{R} &= 1 \\ \lim_{\lambda \rightarrow \infty} \lambda \bar{R} &= 1 \end{aligned}$$

In other words, the relaxed reward computed by the algorithm increases with selection rate of the marked choice. In the equilibrium distribution, choices are selected according to their relaxed rewards.