Writeup

Extinction Probability

Using a branching process as an approximation

$\tau = G_X(\tau)$

We're interested in $E[\tau_i]$ for individual i with riskiness ρ_i.

$$G_X(s) = P(X = 0) + P(X = 1)s^1 + P(X = 2)s^2 + \dots$$

$$P(X = 0) = \rho_i \prod_j (1 - \rho_j \alpha_r) \prod_j (1 - \alpha_c) + (1 - \rho_i) \prod_j (1 - \alpha_c)$$

$$\begin{aligned} E[P(X = 0)] &= E[\rho_i \prod_j (1 - \rho_j \alpha_r) \prod_j (1 - \alpha_c) + (1 - \rho_i) \prod_j (1 - \alpha_c)] \\ &= E[\rho_i] \prod_j (1 - E[\rho_j]\alpha_r) \prod_j (1 - \alpha_c) * (1 - E[\rho_i]) \prod_j (1 - \alpha_c) \end{aligned}$$

The same result will hold for all $P(X = x)$, so $E[G_X(\tau_i)] = E[\tau_i]$ depends only on $E[\rho]$