

$$\begin{aligned}
q_t &= \binom{N-1}{t-1} P_h^{t-1} (1 - P_h)^{N-t} \\
&= \binom{N-1}{t-1} \left(\frac{k-1}{N-1} \right)^{t-1} \left(1 - \frac{k-1}{N-1} \right)^{N-t} \\
&= \frac{(N-1)!}{(t-1)!(N-t)!} \frac{(k-1)^{t-1}}{(N-1)^{t-1}} \left(\frac{N-k}{N-1} \right)^{N-t} \\
&= \frac{(N-1) \cdots (N-t+1)}{(t-1)!} \frac{(k-1)^{t-1} (N-k)^{N-t}}{(N-1)^{N-1}} \\
&= \frac{a * b * c}{d * e}
\end{aligned}$$

$$a = (N-1) \cdots (N-t+1)$$

$$b = (k-1)^{t-1}$$

$$c = (N-k)^{N-t}$$

$$d = (t-1)!$$

$$e = (N-1)^{N-1}$$

$$Q^- = \sum_{t=1}^{k-1} q_t$$

$$Q^+ = 1.0 - (q_k + Q^-)$$