TEÓRIA HROMADNEJ OBSLUHY

KATEDRA MATEMATIKY A TEORETICKEJ INFORMATIKY

Vzorce

Rozdelenie	Bi(n,p)	HG$(M,\, K,n)$	Poiss(λ)	Unf$(a,\, b)$	Exp(λ)	N$(\mu,\, \sigma)$
E(X)	$n \cdot p$	$\dfrac{n \cdot K}{M}$	λ	$\dfrac{(a+b)}{2}$	λ	μ
D(X)	$n \cdot p \cdot q$	$\dfrac{n \cdot K \cdot (M-K) \cdot (M-n)}{M^2 \cdot (M-1)}$	λ	$\frac{(a+b)^2}{12}$	λ^2	σ^2
Predpis	$\binom{n}{x} \cdot p^x \cdot q^{n-x}$	$\dfrac{\binom{K}{x} \cdot \binom{M-K}{N-x}}{\binom{M}{N}}$	$\dfrac{\lambda^x \cdot \mathrm{e}^{-\lambda}}{x!}$	$\dfrac{1}{b-a}$ $\dfrac{x-a}{b-a}$	$\dfrac{1}{\lambda} \cdot \mathrm{e}^{-\frac{x}{\lambda}}$ $1-\mathrm{e}^{-\frac{x}{\lambda}}$	$\dfrac{1}{\sigma \cdot \sqrt{2\pi}} \cdot \mathrm{e}^{-\frac{(x-\mu)^2}{2\sigma^2}}$

;

$$\vec{p}(n+1) = \vec{p}(n) \cdot P; \quad \vec{p}(n+1) = \vec{p}(0) \cdot P^{n+1}; \quad \vec{a} = \vec{a} \cdot P; \quad Z = [I - (P-A)]^{-1} = I + \sum_{n=1}^{\infty} (P^n - A); \quad \sum_{i=1}^{n} a_i = 1;$$

$$P = \begin{pmatrix} Q & 0 \\ R & S \end{pmatrix}; \quad P = \begin{pmatrix} 0 & P_1 \\ P_2 & 0 \end{pmatrix}; \quad P = \begin{pmatrix} I & 0 \\ R & Q \end{pmatrix}; \quad P = \begin{pmatrix} P_1 & 0 \\ 0 & P_2 \end{pmatrix}; \quad M = P \cdot (M - \widehat{M}) + E;$$

$$M = (I - Z + E \cdot \widehat{Z}) \cdot \widehat{M}; \quad N = (I-Q)^{-1}; \quad B = R + Q \cdot B; \quad B = N \cdot R; \quad B = (N - I) \cdot \widehat{N}^{-1}.$$

$$F(z) = \vec{p}(0) \cdot (I - z \cdot P)^{-1}; \quad F(z) = \vec{p}(0) \cdot (s \cdot I - A)^{-1}; \quad \vec{p}_n(t) = \frac{(\lambda \cdot t)^n}{n!} \cdot \mathrm{e}^{-\lambda t};$$

$$\vec{p}(t + \Delta t) = \vec{p}(t) \cdot P(t, t+\Delta t); \quad \vec{p}(t+\Delta t) = \vec{p}(t) \cdot (I + A(t) \cdot \Delta t).$$

$$p(t+\Delta t) = \vec{p}(t) \cdot P; \quad p_0 = 1 - \frac{\lambda}{\mu} = 1 - \rho; \quad P(N > n) = \rho^{n+1}; \quad P(N > 0) = \rho = 1 - p_0; \quad \overline{T} = \frac{\overline{n}}{\lambda}; \quad \overline{T}_f = \overline{T} - \frac{1}{\mu};$$

$$\overline{n} = \rho \cdot (1-\rho) \cdot \sum_{n=1}^{\infty} n \cdot \rho^{n-1}; \quad \overline{n} = \frac{\rho}{1-\rho} = \frac{\lambda}{\mu - \lambda}; \quad \overline{n}_f = \overline{n} - (1 - p_0) = \frac{\rho^2}{1-\rho} = \frac{\lambda^2}{\mu \cdot (\mu - \lambda)};$$

$$p_k = \frac{\lambda_{k-1} \cdot \lambda_{k-2} \cdot \dots \cdot \lambda_1 \cdot \lambda_0}{\mu_k \cdot \mu_{k-1} \cdot \dots \cdot \mu_2 \cdot \mu_1} \cdot p_0; \quad p_0 = \frac{1}{1 + \sum\limits_{k=1}^{\infty} \frac{\lambda_{k-1} \cdot \lambda_{k-2} \cdot \dots \cdot \lambda_1 \cdot \lambda_0}{\mu_k \cdot \mu_{k-1} \cdot \dots \cdot \mu_2 \cdot \mu_1}}.$$

$$\vec{p}(t+\Delta t) = \vec{p}(t) \cdot P; \quad p_n = p_0 \cdot \frac{\rho^n}{n!}; \quad p_n = p_0 \cdot \frac{\rho^n}{S^n} \cdot \frac{S^S}{S!}; \quad p_0 = \left[\sum_{k=0}^{S-1} \frac{\rho^k}{k!} + \frac{\rho^S}{S!} \cdot \frac{1}{1 - \frac{\rho}{S}} \right]^{-1}; \quad \overline{n} = \overline{n}_f + S - \overline{S};$$

$$\overline{S} = \sum_{n=0}^{S} (S-n) \cdot p_0; \quad \overline{S} = S - \rho; \quad \overline{n}_f = \sum_{n=S+1}^{\infty} (n - S) \cdot p_n; \quad \overline{n}_f = p_0 \cdot \frac{\rho^{S+1}}{(S-1)!} \cdot \frac{1}{\left(1 - \frac{\rho}{S}\right)^2};$$

$$P(N \geqq S) = p_0 \cdot \frac{\rho^S}{S!} \cdot \frac{1}{1 - \frac{\rho}{S}}; \quad \overline{T}_f = \frac{\overline{n}_f}{\lambda}; \quad \overline{T} = \frac{\overline{n}}{\lambda} = \overline{T}_f + \frac{1}{\mu}.$$

$$p_n = \left(\frac{\lambda}{\mu}\right)^n \cdot p_0; \quad p_0 = \frac{1-\rho}{1-\rho^{N+1}}; \quad p_0 = \frac{1}{N+1}; \quad p_n = 0; \quad p_n = \frac{(1-\rho) \cdot \rho^n}{1 - \rho^{N+1}}; \quad p_n = \frac{1}{N+1}; \quad \lambda^\star = \lambda \cdot (1 - p_N);$$

$$p_N = \frac{(1-\rho) \cdot \rho^N}{1 - \rho^{N+1}} = p_0 \cdot \rho^N; \quad \overline{n} = \sum_{n=0}^{N} n \cdot p_n = \frac{\rho \cdot \left[1 - (N+1) \cdot \rho^N + N \cdot \rho^{N+1}\right]}{(1-\rho) \cdot (1 - \rho^{N+1})}; \quad \overline{n} = \sum_{n=0}^{N} n \cdot p_n = \frac{N}{2};$$

$$\overline{n}_f = \overline{n} - \frac{\rho \cdot (1 - \rho^n)}{1 - \rho^{N+1}}; \quad \overline{T} = \frac{\overline{n}}{\lambda^\star}; \quad \overline{T}_f = \frac{\overline{n}_f}{\lambda^\star}.$$

$$p_n = \frac{1}{n!} \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot p_0 = p_0 \cdot \frac{(S \cdot \rho)^n}{n!}; \quad p_n = \frac{1}{S! \cdot S^{n-S}} \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot p_0 = p_0 \cdot \frac{S^S \cdot \rho^n}{S!}; \quad \overline{T}_f = \frac{\overline{n}_f}{\lambda^\star}; \quad \overline{T} = \overline{T}_f + \frac{1}{\mu};$$

$$p_0 = \left[\sum_{n=0}^{S-1} \frac{(S \cdot \rho)^n}{n!} + \sum_{n=S}^{N} \frac{(S \cdot \rho)^n}{S! \cdot S^{n-S}}\right]^{-1}; \quad \overline{n}_f = \sum_{n=S}^{N} (n-S) \cdot p_n;$$

$$\overline{n}_f = p_0 \cdot \frac{S^S \cdot \rho^{S+1}}{S! \cdot (1-\rho)^2} \cdot \left[1 - \rho^{N-S+1} - (1-\rho) \cdot (N-S+1) \cdot \rho^{N-S}\right].$$

$$p_n = p_0 \cdot \rho^n \cdot \frac{M!}{n! \cdot (M-n)!}; \quad p_n = 0; \quad p_0 = \left[\sum_{n=0}^{M} \rho^n \cdot \frac{M!}{n! \cdot (M-n)!}\right]^{-1}; \quad \overline{T} = \frac{\overline{n}}{\lambda \cdot (M - \overline{n})}; \quad \overline{T}_f = \frac{\overline{n}_f}{\lambda^\star} = \frac{\overline{n}_f}{\lambda \cdot (M - \overline{n})};$$

$$p_n = p_0 \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \binom{M}{n} = p_0 \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \frac{M!}{n! \cdot (M-n)!};$$

$$p_n = p_0 \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \binom{M}{n} \cdot \frac{n!}{S! \cdot S^{n-S}} = p_0 \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \frac{M!}{S! \cdot S^{n-S} \cdot (M-n)!}; \quad p_n = 0;$$

$$p_0 = \left[\sum_{n=0}^{S-1} \binom{M}{n} \cdot \left(\frac{\lambda}{\mu}\right)^n + \sum_{n=S}^{M} \binom{M}{n} \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \frac{n!}{S! \cdot S^{n-S}}\right]^{-1};$$

$$\overline{n}_f = p_0 \cdot \left[\sum_{n=0}^{S-1} n \cdot \binom{M}{n} \cdot \left(\frac{\lambda}{\mu}\right)^n + \sum_{n=S}^{M} n \cdot \binom{M}{n} \cdot \left(\frac{\lambda}{\mu}\right)^n \cdot \frac{n!}{S! \cdot S^{n-S}}\right];$$

$$\overline{n}_f = \sum_{n=S}^{M} (n-S) \cdot p_n = \overline{n} - S + p_0 \cdot \sum_{n=0}^{S-1} (S-n) \cdot \binom{M}{n} \cdot \left(\frac{\lambda}{\mu}\right)^n;$$

$$p_n = \sum_{m=0}^{n-1} \left(p_{(n-m),m,1} + p_{m,(n-m),2}\right) = (1-\rho) \cdot \rho^n; \quad p_0 = 1 - \rho; \quad \overline{T}_{f1} = \frac{\lambda}{\mu \cdot (\mu - \lambda_1)}; \quad \overline{T}_{f2} = \frac{\lambda}{(\mu - \lambda) \cdot (\mu - \lambda_1)};$$

$$\overline{n}_1 = \frac{\left(\frac{\lambda_1}{\mu}\right) \cdot \left(1 + \rho - \frac{\lambda_1}{\mu}\right)}{1 - \frac{\lambda_1}{\mu}}; \quad \overline{n}_{f1} = \frac{\rho\left(\frac{\lambda_1}{\mu}\right)}{1 - \frac{\lambda_1}{\mu}}; \quad \overline{n}_2 = \frac{\left(\frac{\lambda_2}{\mu}\right) \cdot \left(1 - \frac{\lambda_1}{\mu} + \rho \cdot \frac{\lambda_1}{\mu}\right)}{(1-\rho) \cdot \left(1 - \frac{\lambda_1}{\mu}\right)}; \quad \overline{n}_{f2} = \frac{\rho\left(\frac{\lambda_2}{\mu}\right)}{(1-\rho)\left(1 - \frac{\lambda_1}{\mu}\right)};$$