## Modified binomial model

Let us consider **binomial distribution** with parameters $p$ and $N_b$

$$\binom{N_b}{x} p^x (1-p)^{N_b - x},\ x = 0, 1, \cdots, N_b$$

### Estimation of binomial model

The **modified binomial distribution** corresponds to this binomial distribution but with values 1,2,$\cdots, N$ and number of values $N$. It means binomial $x$ is $x-1$ and binomial $N_b$ is $N-1$.

Model

$$f(x|p) = \binom{N-1}{x-1} p^{x-1} (1-p)^{N-x},\ x = 1, 2, \cdots N$$

Generation

$$b = \text{binomial(p,N-1)}$$

$$x = \text{sum(cumsum(b)<randu())+1}$$

The first row generates pf of binomial dist. with $p$ and $N$.

The second one generates from inverse dist. function of binomial. As we add 1, the values are from 1.

Update of statistics

$$S_t = S_{t-1} + x_t$$

$$\kappa_k = \kappa_{k-1} + 1$$

is a standard update.

Point estimate of $p$

$$\hat{p}_t = \frac{S_t - \kappa_t}{(N-1)\,\kappa_t}$$

and from it the statistics for initial parameter $\hat{p}_0$ is

$$S_0 = \hat{p}_0\,(N-1)\,\kappa_0 + \kappa_0$$

Program and its description

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