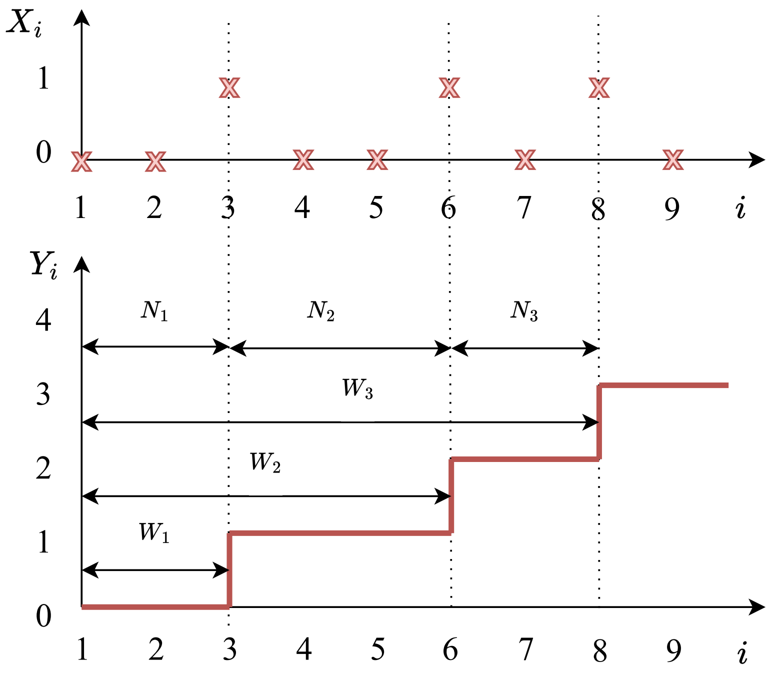
Bernoulli Process $(t; p)$

Parameters are discrete, states are discrete



The result of each trial (0 : failure ;1: success):

$$X_i \in \{0, 1\} \sim Bernoulli(p), p \in [0, 1]$$

PMF $p_{X_i}(x) = p^x(1-p)^{(1-x)}$
or $px + (1-p)(1-x), x \in \{0, 1\}$

$$F_{X_i}(x) = \begin{cases} 0, & x < 0 \\ 1-p, & x \in [0, 1) \\ 1, & x \geq 1 \end{cases}$$

$$\mu_{X_i} = p, \sigma_{X_i} = \sqrt{np(1-p)}$$

The total number of successes in n trials

$$Y_i \in \{0, 1, 2, \cdots, n\} \sim Binomial(n, p), p \in [0, 1], n \in \mathbb{Z}_{>0}$$

PMF $p_Y(y) = C_n^y p^y (1-p)^{n-y}$

$$C_n^y = \frac{n!}{y!(n-y)!}$$

$$\mu_Y = p, \sigma_Y = \sqrt{np(1-p)}$$

The number of trials between $(i-1)^{th}$ and i^{th} success:

$$N_i \in \{1, 2, \cdots\} \sim Geometric(p), p \in [0, 1]$$

PMF $p_{N_i}(n) = p(1-p)^{n-1}$

CDF $F_{N_i}(n) = 1 - p(1-p)^n$

$$\mu_{N_i} = \frac{1}{p}, \sigma_{N_i} = \frac{\sqrt{1-p}}{p}$$

The number of trials to get the k^{th} success:

$$W_k \in \{1, 2, \cdots\} \sim NegativeBinomial(p, k), p \in [0, 1], k \in \mathbb{Z}_{>0}$$

PMF $p_{W_k}(w) = C_{w-1}^{k-1} p^k (1-p)^{w-k}$

CDF$F_{W_k}(w) = \sum_{i=1}^{w} p_{W_k}(i)$

$$\mu_{W_k} = \frac{k}{p}, \sigma_{W_k} = \frac{\sqrt{k(1-p)}}{p}$$