Binomial Distribution - Intro

Weather → Good / Bad

observe the weather 7 days

$D = \{B, B, G, B, G, G, G\}$ → 4 out of 7 days good.

↳ What is the probability for that?

$W \sim \text{Bern}(\theta) = \theta^{W} \cdot (1-\theta)^{1-W}$

θ ↑ prob. of good weather

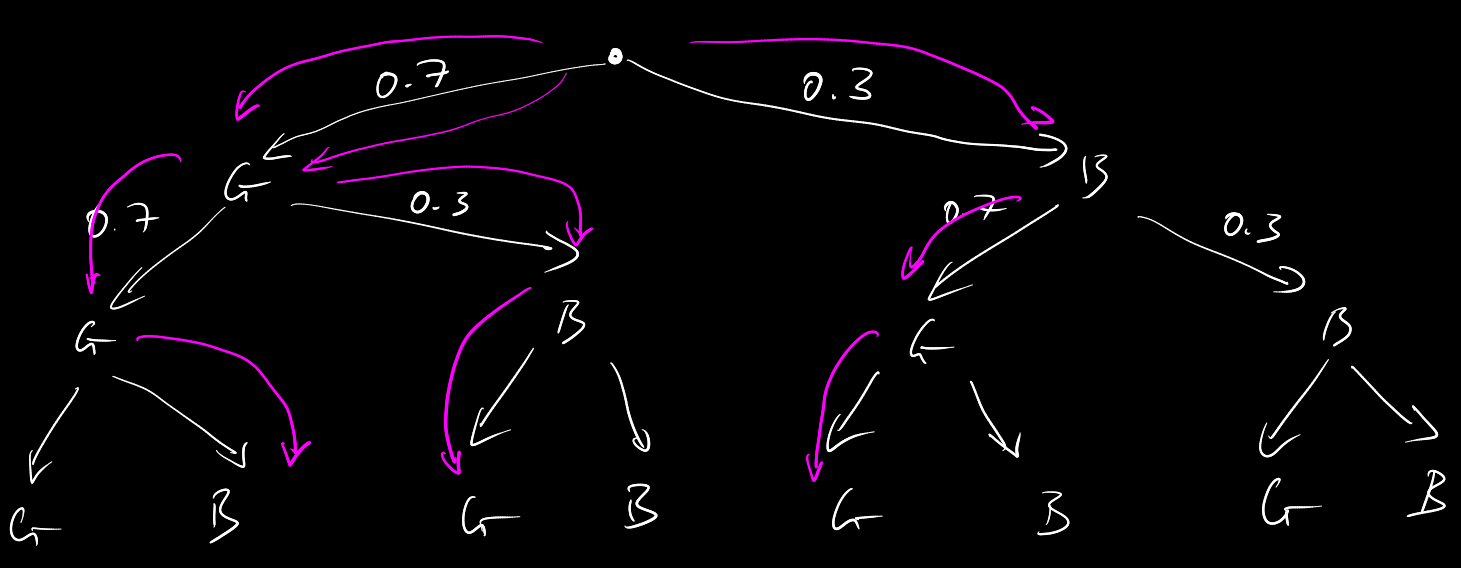
e.g. $\theta = 0.7$

$p(D) = \prod_{i=0}^{N-1} p(W = w^{(i)}) = 0.7^4 \cdot 0.3^3 = 0.0065$

→ wrong?

↳ there are multiple paths

Consider 3 days only



What is the prob of observing 2 out of 3 days good weather?

↳ 3 paths

$D = \{G, G, B\}$ $p(D) = 0.147$

$p(k=2) = 0.147 \cdot 3$

0.147 ← the prob of a path; 3 ← number of paths

Binomial Distribution

k ... the number of days with good weather out of n total days

$$k \sim \text{Binomial}(\theta, n) = \theta^{k} \cdot (1-\theta)^{n-k} \cdot \binom{n}{k}$$

Binomial coefficient

$$\binom{n}{k} = \frac{n!}{k!\,(n-k)!}$$

$k \in \{0, 1, 2, \ldots, n\}$

To save:

θ ... prob of good weather

n ... number of days of observation

How does a dataset look like for the Binomial

$n = 7$

$D = \{3, 4, 3, 5, 7, 6, 3, 1, 5\}$

N observations of n days each