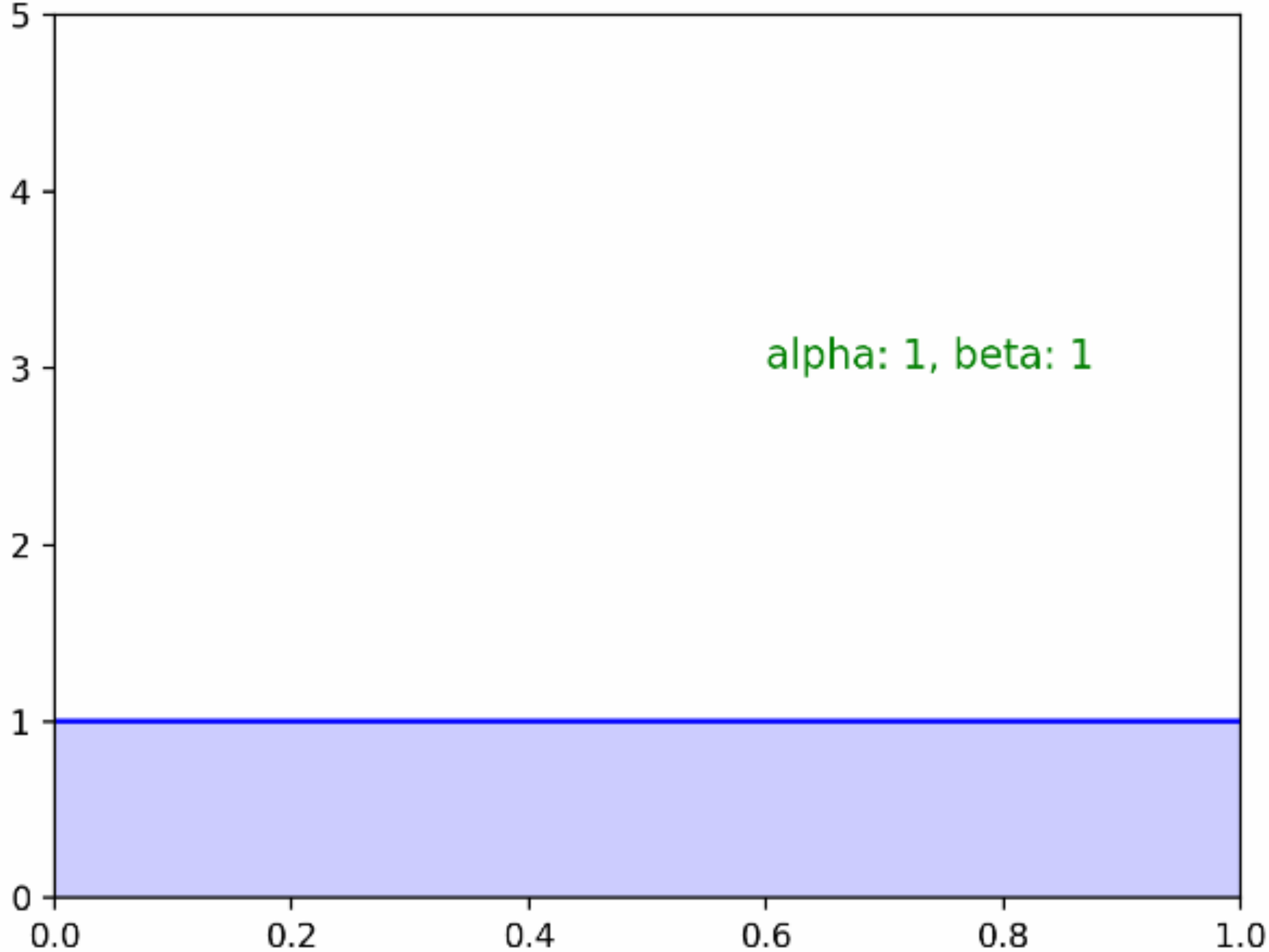
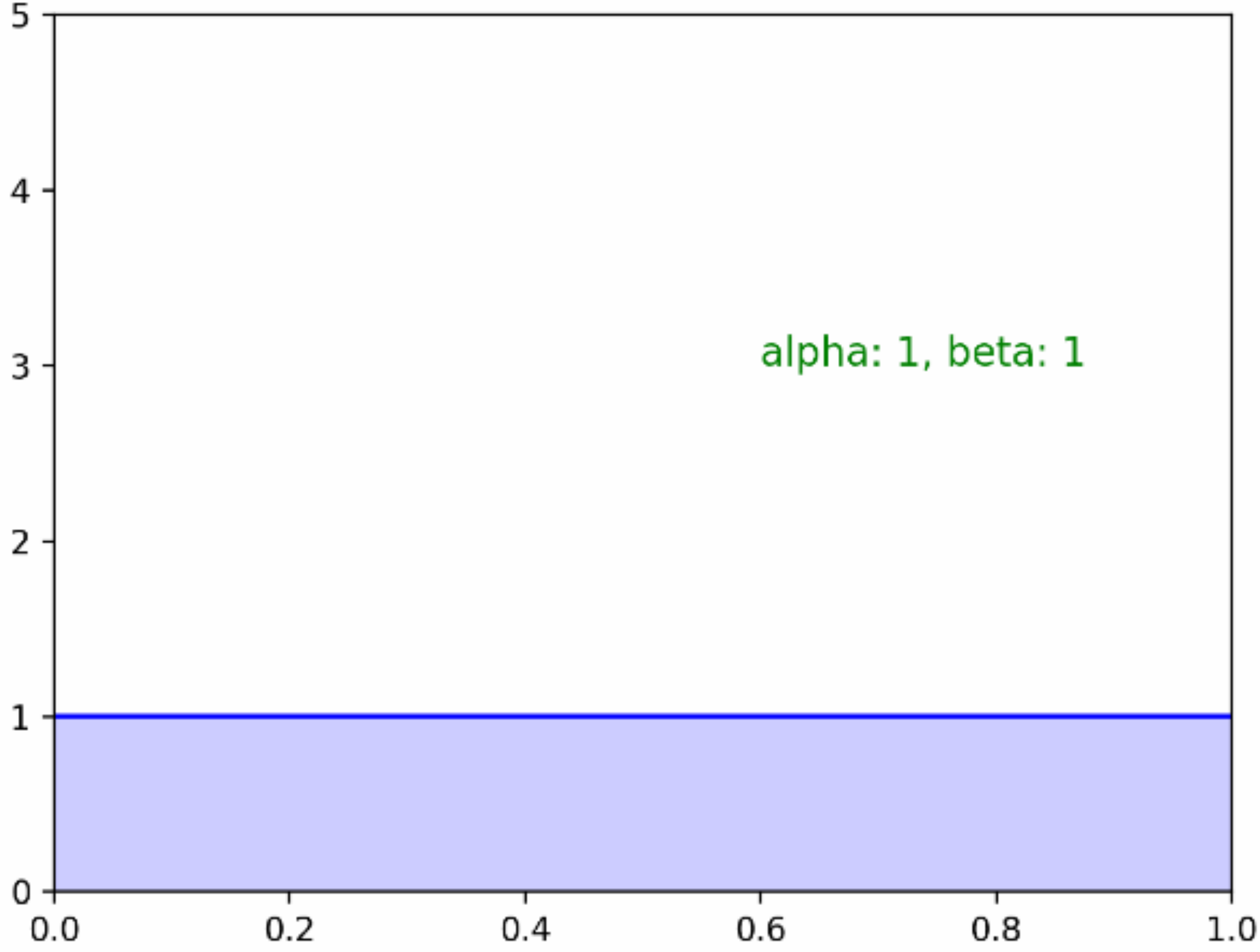
Background: beta distribution

- Bounded distribution between [0,1] with parameters α and β denoted as beta(α, β)

- Mean = $\dfrac{\alpha}{\alpha+\beta}$ and variance = $\dfrac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$


alpha: 1, beta: 1
5
4
3
2
1
0
0.0
0.2
0.4
0.6
0.8
1.0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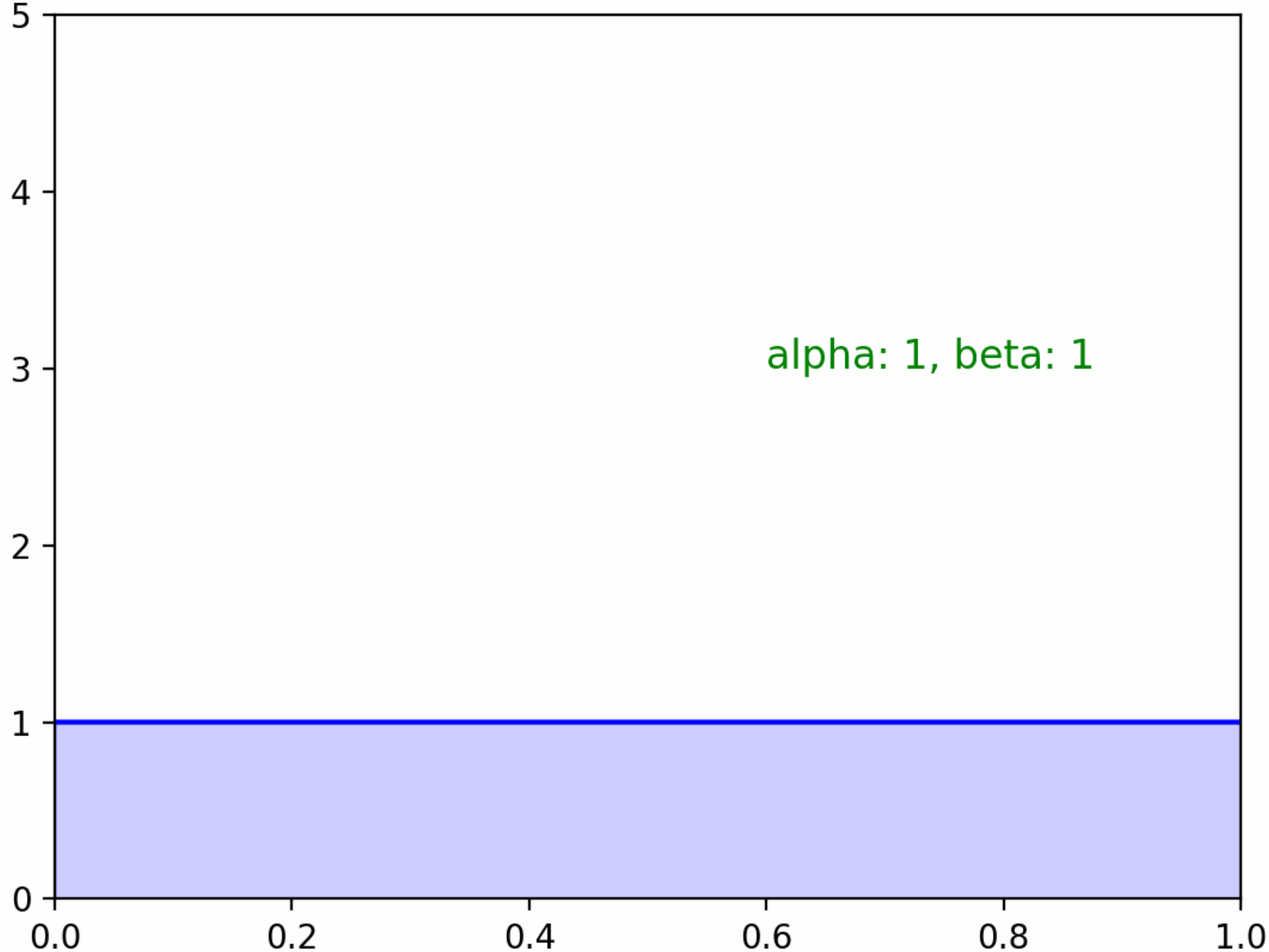

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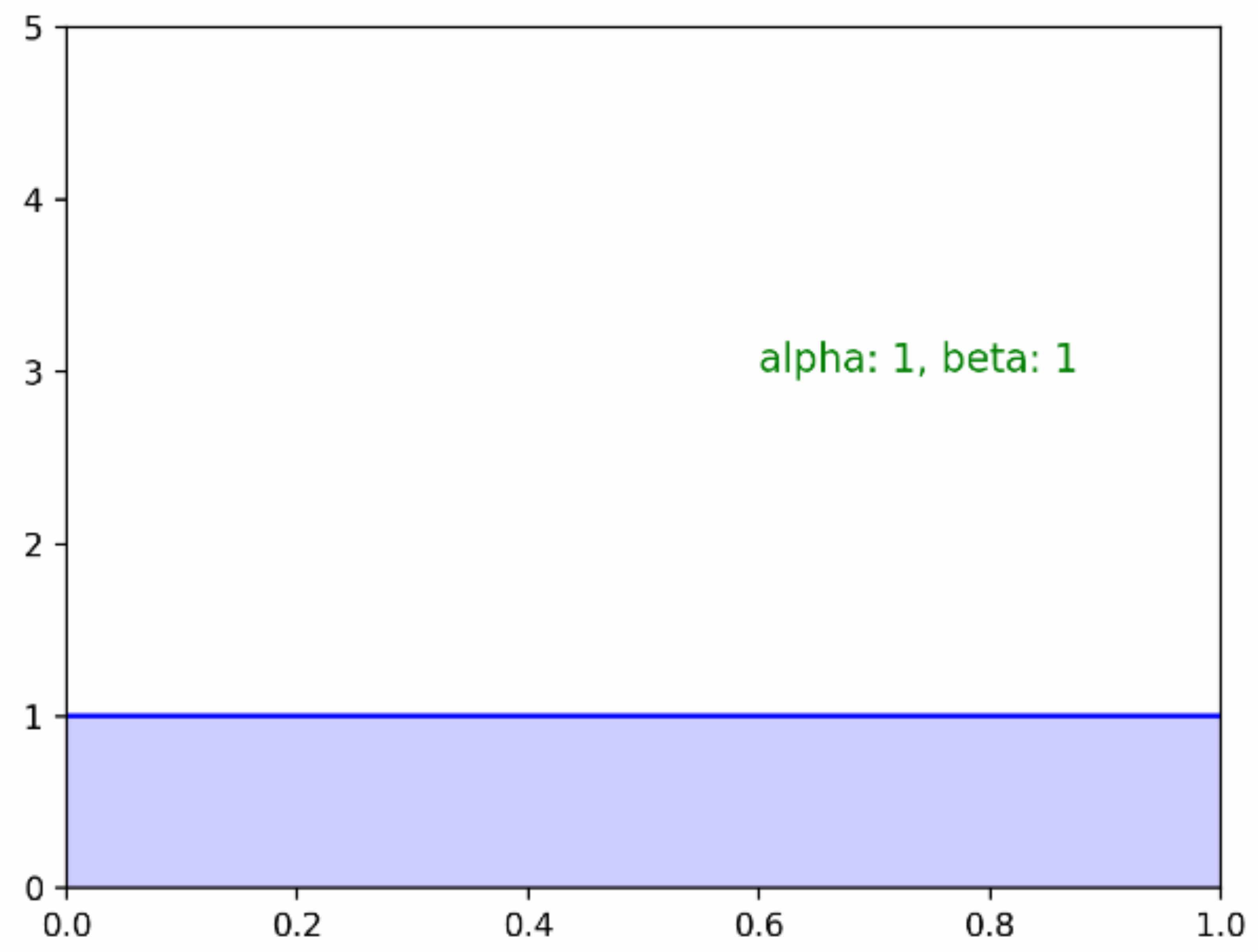

Bayesian Inference: Towards MAB

$$\mathbb{P}(\theta|\text{data}) = \frac{\mathbb{P}(\text{data}|\theta) \times \mathbb{P}(\theta)}{\mathbb{P}(\text{data})}$$

- Suppose that you want to estimate the bias θ (= probability of getting heads) of a coin using coin flips.

- Let the prior = Uniform distribution([0,1]) = beta($\alpha = 1, \beta = 1$)

- We interpret α = #tails and β = #heads

Suppose at time n,

α_n = #tails and β_n = #heads such that $\alpha_n + \beta_n$ = n.

Then if at time n+1, you get a

head then posterior = beta($\alpha_n, \beta_n + 1$)

tail then posterior = beta($\alpha_n + 1, \beta_n$)