Discrete prior probabilities: the entropy principle

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Comments on 11.6

First of all, Lagrange multipliers method can give rigorous proofs. Of course the presentation in 11.6 is not rigorous, but that is a feature of the particular situation and presentation, not a general comment on Lagrange multipliers method.

Secondly, from "modern" perspective we see that the constraints $E_p[f_k] = F_k$ imply that the cross-entropy

$$H(p,u) = E_p[-\log u] =$$
$$E_p[\log Z(\vec{\lambda})] + E_p[\sum \lambda_i f_i] =$$
$$\log Z(\vec{\lambda}) + \vec{\lambda} \cdot \vec{F}$$

is fixed — and equal to $H(u)$.

Then

$$H(p) = H(p,u) - D_{KL}(p,u) =$$

$$H(u) - D_{KL}(p,u) \leq H(u)$$

with equality precisely when $p = u$.