Entropy on convex sets

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On the simplex of probability distributions information divergence is characterized as a Bregman divergence that satisfies a certain sufficiency condition. Bregman divergences are associated with convex optimization and the sufficiency condition means that the optimal decision is not influenced by irrelevant information. For quantum systems the simplex of probability distributions is replaced by a convex set of density matrices, but in some cases our knowledge of a system may be represented even more general convex sets. For any convex set it is possible to define a function that generalizes the well-known Shannon entropy defined on the simplex, but only special convex sets have the property that the corresponding Bregman divergence satisfies a generalized sufficiency condition. These problems lead to a strengthened version of Caratheodory's theorem and some open problem related to the foundation of quantum mechanics.