to be an easy task. Even in the commutative case, we need much more than mere commutativity. If $\mathfrak{A}$ is a commutative C^*-algebra with identity, then its spectrum is automatically compact T_2, but in general it can be very " unsmooth ". (See [8] p. 273 for an example of extreme pathological behavior). The proof of Kuchnirenko's theorem uses very strongly the fact that the spectrum of a bounded classical system is a compact C^∞- manifold. In any case, we wish to give a rather trivial example of this theorem in a quantum mechanics context which covers finite lattices or a system of a finite number of spins :

5.2. THEOREM. If $\mathcal{H}_\rho$ is finite-dimensional, $h(T)$ is finite.

Proof. Let dim $\mathcal{H}_\rho = N$. If $N = 1$, $h(\alpha) = 0$ for any α, so the case $N = 1$ is trivial. Assume $N > 1$. From Proposition 2.1 we have that $h(\alpha) \leq \log_2 n$ where n is the cardinality of α. But $n \leq N$, so $h(\alpha) \leq \log_2 N \leq N$. By Corollary 2.3 and Lemma 3.1

$$h(\alpha \vee T\alpha \vee \dots \vee T^{k-1}\alpha) \leq \sum_{i=0}^{k-1} h(T^i\alpha) = \sum_{i=0}^{k-1} h(\alpha) \leq Nk$$

Thus $h(\alpha, T) \leq N$. Q.E.D.

We wish to propose the following question as an unsolved problem to this date: What are the weakest conditions on $\mathfrak{A}$ that guarantee that $h(T)$ is finite ?

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