ETH Zürich, Dept. Informatik
WS 03/04

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Introduction to Quantum Computation
Übung 5

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5.1 [**NC**], problems 4.41–4.44

5.2 In a Hilbert space V, for any two vectors $\alpha, \beta \in V$, define the linear transformation $A_{(\alpha,\beta)} : V \to V : v \mapsto \langle\beta|v\rangle\,\alpha$ (this is usually written $A = |\alpha\rangle\langle\beta|$). Show that $tr A_{(\alpha,\beta)} = \langle\beta|\alpha\rangle$. (*Hint:* choose an appropriate o.n.b.)

5.3 Show that for all density matrices ρ, we have $tr\rho^2 \leq 1$ and $tr\rho^2 = 1$ if and only if ρ is a pure state.