

Introduction to Quantum Computation

Übung 5

05.12.2002

- 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 $A_{(\alpha, \beta)} : V \rightarrow V : v \mapsto \langle \beta | v \rangle \alpha$ (this is usually written $A = |\alpha\rangle\langle\beta|$). Show that $\text{tr} A_{(\alpha, \beta)} = \langle \beta | \alpha \rangle$. (*Hint*: choose an appropriate o.n.b.)
- 5.3** Show that for all density matrices ρ , we have $\text{tr} \rho^2 \leq 1$ and $\text{tr} \rho^2 = 1$ if and only if ρ is a pure state.