ETH Zürich, Dept. Informatik
WS 03/04

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Introduction to Quantum Computation
Übung 7

19.12.2002

7.1 Show that the quantum syndrome computation for the Steane code is unitary. Recall this is the operation

$$|v\rangle \otimes |0\rangle_{anc} \mapsto |v\rangle \otimes |H_{PC}v\rangle_{anc}$$

where H_{PC} is the parity-check matrix of the code.

7.2 Convince yourself that all the circuits given in class for the Steane code do what they are advertised as doing.

7.3 Go through all the considerations given in class about the Steane code, in our design and discussion of a useful QECC, for the Shor 9-bit code in [**NC**].

7.4 Write out the quantum circuit for syndrome measurement and bit-flip error correction for the Steane code. It will be big and complex, the three classical bit lines from the measurement will control quantum gates doing the error correction....

7.5 Verify that the tensor product of seven copies of the Hadamard matrix does the same thing on the coded basis $\{|0\rangle_{code}, |1\rangle_{code}\}$ of the Steane code as a single Hadamard does on a single qubit in the computational basis (e.g., $H^{\otimes 7}|0\rangle_{code} = \frac{1}{\sqrt{2}}(|0\rangle_{code} + |1\rangle_{code})$).