Quantum Computing

Assessed Coursework

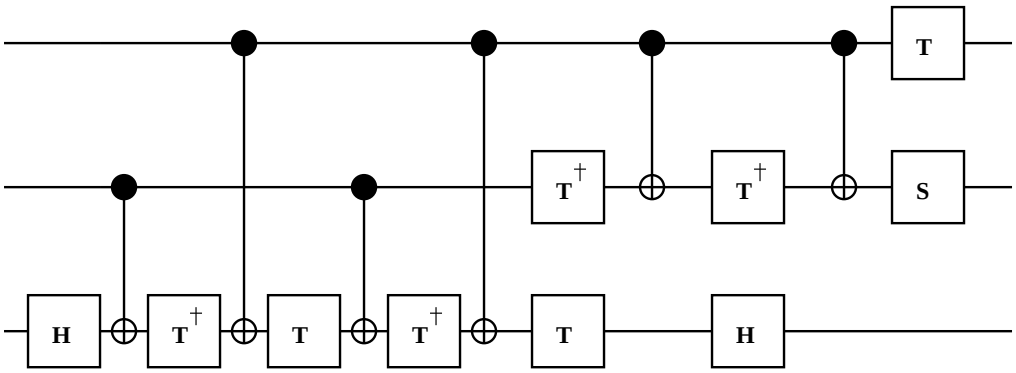
Handed Out: 1/02/05 To be Handed in: 22/02/05

1. Find the matrix representation of the CNOT gate in the basis

$$|++\rangle, |+-\rangle, |-+\rangle, |--\rangle$$

where

$$|+\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle), \qquad |-\rangle = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle).$$

2. Show that the network in the figure below implements the Toffoli gate using the Hadamard gate H, the CNOT gate and the phase gates

$$S = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\pi/2} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & i \end{pmatrix}, \qquad T = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\pi/4} \end{pmatrix}.$$