Quantum Computing
Problem Set 9

Prof. Dr. Michael J. Hartmann

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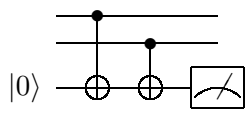
Problem 1: Parity measurements

Show that 2-qubit parity can be measured via the circuit,



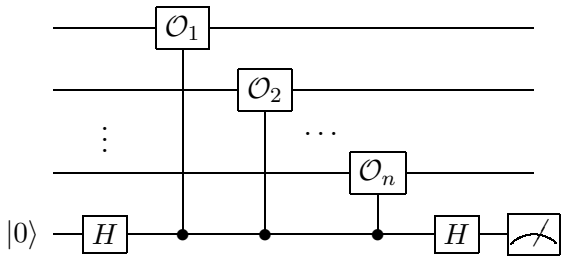
(1)

Problem 2: Stabilizer measurements

Show that the a n qubit stabilizer

$$P = \mathcal{O}_n \otimes \mathcal{O}_{n-1} \otimes \cdots \otimes \mathcal{O}_1 \tag{2}$$

where $\mathcal{O}_j = X, Y$, or Z, can be measured via the circuit



(3)

Problem 3: 7-qubit code

Consider the 7-qubit code defined by the 6 stabilizer elements

$$S_1 = Z_1 Z_3 Z_5 Z_7 \tag{4}$$
$$S_2 = Z_2 Z_3 Z_6 Z_7 \tag{5}$$
$$S_3 = Z_4 Z_5 Z_6 Z_7 \tag{6}$$
$$S_4 = X_1 X_3 X_5 X_7 \tag{7}$$
$$S_5 = X_2 X_3 X_6 X_7 \tag{8}$$
$$S_6 = X_4 X_5 X_6 X_7 \tag{9}$$

Show that this code protects against arbitrary single qubit phase (Z) and flip (X) errors.