

Homework 1
CMSC 691R Quantum Computation
Due: Monday, February 21, 2000

1 Problem 1.

Let \mathcal{Q} be a quantum system with state given by the ket:

$$|\Psi\rangle = (|00\rangle + i|01\rangle - |11\rangle) / \sqrt{3}$$

What is the result of measuring \mathcal{Q} with respect to the observable:

$$\mathcal{O} = \begin{pmatrix} 0 & 0 & 1 & -i \\ 0 & 0 & i & -1 \\ 1 & -i & 0 & 0 \\ i & -1 & 0 & 0 \end{pmatrix}$$

1.1 Problem 2.

Let \mathcal{Q} be a quantum system with state given by the density operator:

$$\rho = \begin{pmatrix} \frac{1}{4} & -\frac{i}{12} & \frac{1}{12} & \frac{i}{12} \\ \frac{i}{12} & \frac{1}{4} & -\frac{i}{12} & \frac{1}{12} \\ \frac{1}{12} & \frac{i}{12} & \frac{1}{4} & -\frac{i}{12} \\ -\frac{i}{12} & \frac{1}{12} & \frac{i}{12} & \frac{1}{4} \end{pmatrix}$$

What is the result of measuring \mathcal{Q} with respect to the observable:

$$\mathcal{O} = \begin{pmatrix} 0 & -1 & -i & 0 \\ -1 & 0 & 0 & i \\ i & 0 & 0 & 1 \\ 0 & -i & 1 & 0 \end{pmatrix}$$