

18.435/2.111 Homework # 6

Due Thursday, October 23.

1: If you perform Grover's algorithm on two qubits, with exactly one marked state, how many iterations do you need? What is the chance of getting the right answer? Write down a circuit for ~~Simon's~~ Grover's algorithm in this case. Choose one of the four states, and suppose it is marked. What is the intermediate state of the quantum computer after all the gates?

2: (Does a watched pot ever boil?) Consider Grover's algorithm where there are M marked states and $N = 2^n$ states total. Assume that $M \ll N$. Suppose some impatient operator of the quantum computer measures the state of the quantum computer after every Grover iteration to see whether the computer has found the marked state yet? That is, they project the computer onto one of the two subspaces with basis states { all marked states } and with basis states { all unmarked states }. Approximately how long will it take the computer to find the marked state now?