2.111/8.370/18.435 Problem Set 7 Solutions

Due: November 19, 2015

0. **Survey RSA.**

1. **Given $U = \sum_j e^{i\phi_j}|j\rangle\langle j|$, $e^{i\phi_j}$'s are eigenvalues (ϕ_j's are real), $|j\rangle$'s are corresponding eigenvectors. Show that U is unitary.**

   $U^\dagger = \sum_j e^{-i\phi_j}|j\rangle\langle j|$. Thus $U^\dagger U = \sum_{j,j'} e^{-i\phi_j}e^{i\phi_{j'}}\langle j|j'\rangle|j\rangle\langle j'| = I$.

2. **(Optional) Construct the output of of quantum phase estimation when $k\phi_j/2\pi$ is not an integer. Provide a formula for the expected error in estimating $\phi_j/2\pi$.**

   See Nielsen and Chuang p.223–224.