

ME 201/APh 250, Homework 2:

Assigned: Friday, Apr 12, 2019

Due: Friday, Apr 19, 2019

1. N&C Exercises 4.8, 4.17, 4.32, 4.33
2. **Partial trace.** Suppose we have a state as

$$|\psi\rangle = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{pmatrix} \quad (1)$$

We can think of this state over a bipartite system with subsystems A and B. Compute (a) the density matrix of the entire system, and (b) the partial trace with respect to subsystem B. The alternate expression for partial trace I gave in class will be helpful.

3. **Beginnings of phase estimation.** Show that

$$H^{\otimes n} |x_1\rangle |x_2\rangle \dots |x_n\rangle = \frac{1}{\sqrt{2^n}} \sum_{z_1, z_2, \dots, z_n \in \{0,1\}^n} (-1)^{x_1 z_1 + x_2 z_2 + \dots + x_n z_n} |z_1\rangle \dots |z_n\rangle \quad (2)$$