1. N&C Exercises 4.8, 4.17, 4.32, 4.33

2. **Partial trace.** Suppose we have a state as

\[ |\psi\rangle = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{pmatrix} \]  

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

\[
H^\otimes n |x_1\rangle |x_2\rangle \ldots |x_n\rangle = \frac{1}{\sqrt{2^n}} \sum_{z_1, z_2, \ldots, z_n \in \{0,1\}^n} \left(-1\right)^{x_1 z_1 + x_2 z_2 + \ldots + x_n z_n} |z_1\rangle \ldots |z_n\rangle
\]