1. Show that if you can factor N then you can efficiently and classically find the period of a periodic function mod N.

2. Show that phase estimation is complete for BQP.

3. Let v be the maximally entangled state on a d dimensional space H, i.e. $v = \frac{1}{\sqrt{d}} \sum_{i=1}^{d} |i> |i>$. Given two unitaries U, V acting on H, conclusively establish the relationship between the these two quantities: $< (U \otimes V)v, v >$ and $tr(UV)$, using tensor networks. (I.e. your thinking and proof should feature pictures!).

4. a. Recall that the given a vector $v \in H \otimes H$, the Schmidt decomposition of v is of the following form:

   - $v = \sum_i d_i a_i \otimes b_i$, $a_i, b_i \in H$ and d_i non-negative numbers, such that
   - $\{a_i\}$ and $\{b_i\}$ are each orthonormal sets.

   Draw the tensor network picture of the Schmidt decomposition and write down (as pictures) the conditions for orthonormality.

   b. Suppose you have a decomposition of the form $v = \sum_i f_i c_i \otimes d_i$, such that $\{c_i\}$ and $\{d_i\}$ are orthogonal sets but not normal, and f_i are complex numbers. Can you easily realize this as a Schmidt decomposition. . . how do you do that?