A. Suppose that a two-qbit state $|\psi\rangle$ enters the CNOT gate unentangled. Show that the state that emerges from the CNOT is entangled — except in rare special cases, which you should explicitly enumerate.

B. Consider Deutsch's algorithm to solve Deutsch's problem. What happens if, instead of feeding $|1\rangle\,|1\rangle$ into the circuit, we feed $|0\rangle\,|0\rangle$ into the circuit? Does the algorithm still solve the problem, or does it solve another problem, or does it do nothing of value?

C. Consider Deutsch's algorithm to solve Deutsch's problem. What if we replace the latter $H \otimes H$ with $H \otimes I$? Does the algorithm still solve the problem, or does it solve another problem, or does it do nothing of value?

D. Prove the identity $(A \otimes B)^* = A^* \otimes B^*$ claimed in lecture, working from either of the equivalent definitions of the tensor product.