This homework is due Thursday, February 13th at the beginning of class.

**Problem 1.** Prove that every perfect matching is a minimum edge cover.

**Problem 2.** Prove that for any graph $G = (V, E)$ with maximum matching $E' \subseteq E$, there exists a minimum edge cover $E''$ with $E' \subseteq E''$ and $|E''| - |E'| = |V| - 2|E'|$. That is, every maximum matching can be extended into a minimum edge cover by adding one edge per vertex.

**Theorem 1.** The 3-regular vertex cover problem is NP-hard.

**Problem 3.** Prove that the 3-uniform hypergraph edge cover problem is NP-hard (hint: use Theorem 1).