4. First we show that crossword $\in$ NP.

   This is easy to see as we can nondeterministically choose letters from L to input to the board. Therefore $\in$ NP

   Proof crossword is NP-complete using a polynomial time reduction f fro, 3SAT to crossword.

   Let $\emptyset = (a_1 \vee b_1 \vee c_1) \wedge (a_2 \vee b_2 \vee c_2) \wedge ... \ (a_k \vee b_k \vee c_k)$

   Each word that is separated by a pound horizontally is represented by a clause inside $\emptyset$

   Each word that is separated by a pound vertically is represented by a clause inside $\emptyset$

   Build a board by setting the num columns = |clauses + variables| rows = |variables|

   make a language L where every word has to have an A.

   Check every word in word inside the board and if it evaluates to true there must be an a in the word and therefore there must be a satisifiable assignment to 3SAT.