15-252

Assignment 9 Due: April 13, 2018.

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1 MinMax Trees (100)

Background

Recall from lecture the circuits defined by

$$T_1(x_1, x_2, x_3, x_4) = (x_1 \vee x_2) \wedge (x_3 \vee x_4)$$

$$T_{k+1}(\boldsymbol{x}_1, \boldsymbol{x}_2, \boldsymbol{x}_3, \boldsymbol{x}_4) = T_1\left(T_k(\boldsymbol{x}_1), T_k(\boldsymbol{x}_2), T_k(\boldsymbol{x}_3), T_k(\boldsymbol{x}_4)\right)$$

Our goal is to evaluate the circuit T_k reading as few bits of the given truth assignment $\alpha : \mathbf{2}^{4^k} \to \mathbf{2}$.

Task

A. Prove the monotonicity property of the claim on slide 22.

   No, the picture on slide 23 is not enough. Think about trying to convince a theorem prover, a notoriously blind contraption.

B. Prove the lemma on slide 19.

   Induction might be a good idea.