

Homework #4 - BDDs

ComS 412/512 - Due: **Monday**, March 11, 2024

This assignment assumes we are talking about functions of the form $\mathbb{B}^L \rightarrow \mathbb{B}$ encoded by BDDs.

1. **Write an algorithm that receives in input a QRBDD node p at level L encoding function f_p , and returns the the FRBDD node q encoding the same function, i.e., $f_p = f_q$.** 50pt
2. We have seen how to count the number of satisfying assignments $(i_L, \dots, i_1) \in \mathbb{B}^L$ for the function f_p encoded by a QRBDD node p at level L (Algorithm 7.5).
Write a similar algorithm to count the number of satisfying assignments $(i_L, \dots, i_1) \in \mathbb{B}^L$ for the function f_q encoded by an FRBDD node q , which can of course be at any level $k \in 0, 1, \dots, L$. 50pt
3. **Write an algorithm that receives in input a QRBDD node p at level L encoding function f_p , and returns the lowest satisfying assignment in lexicographic order for f_p , i.e., it returns the L bit vector (or sequence of L bits) $\min\{(i_L, \dots, i_1) \in \mathbb{B}^L : f_p(i_L, \dots, i_1) = 1\}$, where $(i_L, \dots, i_1) < (j_L, \dots, j_1)$ iff there is an index k s.t. $i_L = j_L, \dots, i_{k+1} = j_{k+1}$ and $i_k < j_k$; for example, $[0010010] < [0011100]$.** 25pt
4. (Question for 512 students, bonus for 412 students) **Write an algorithm that receives in input a QRBDD node p at level L encoding function f_p , and returns the lowest satisfying assignment in lexicographic reverse order for f_p , i.e., it returns the L bit vector (or sequence of L bits) $\min\{(i_L, \dots, i_1) \in \mathbb{B}^L : f_p(i_L, \dots, i_1) = 1\}$, where $(i_L, \dots, i_1) < (j_L, \dots, j_1)$ iff there is an index k s.t. $i_1 = j_1, \dots, i_{k-1} = j_{k-1}$ and $i_k < j_k$; for example, $[0011100] < [0010010]$.** 25pt

All homeworks should be typed using LaTeX. **Homeworks not typeset in LaTeX will receive 0 credit.** You may use this document as a starting point, and www.overleaf.com/learn/latex/Tutorials provides a number of good tutorials on basic Latex and TikZ Graphics tutorials. Additionally, an example TikZ diagram (recognize it?) is provided to help get you started - we recommend utilizing it!

Students in the class are allowed to discuss the homework problems in the public online forum for the course, or privately with me or with the TA, **but not with anybody else!** Unless stated otherwise, sharing of homework solutions (such as viewing or accessing someone else's files, hardcopy outputs, or handwritten notes), will be considered cheating. If you have even the slightest doubt about whether a certain activity is admissible, *ask before you do it!*

Your submission should include a .pdf version of your assignment. **Please name your submission $\langle \text{net-id} \rangle_hw4.pdf$ when you upload it to canvas.**