Optimization of Bootstrapping in Circuits

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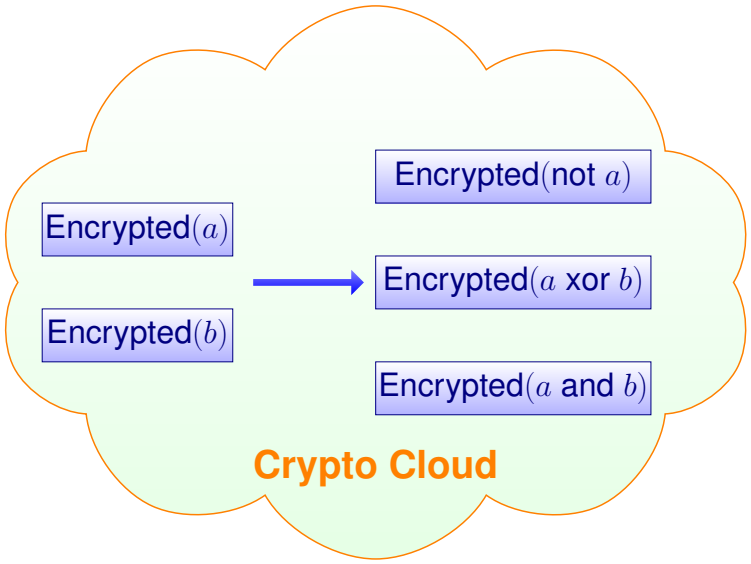
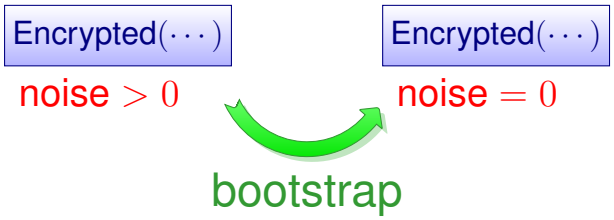


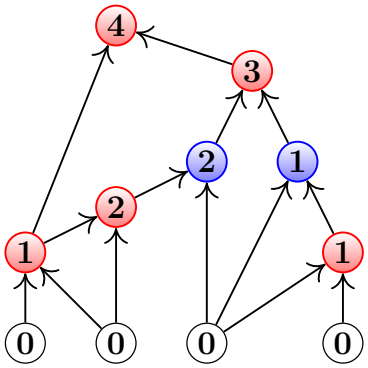
In *fully homomorphic encryption*, the noise grows during the computation. To reduce the noise, we use bootstrap operations.

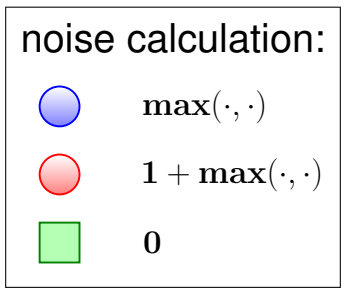


Problem

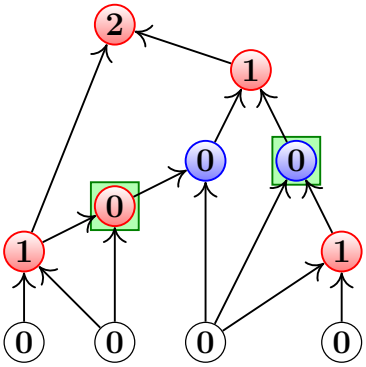
Minimize the number of bootstrap operations so that the noise is at most $L \in \mathbb{N}$ at every gate.

Input (with $L = 2$):





Output:



Our Results (Benhamouda, Lepoint, Mathieu, Zhou, SODA'17)

- Polynomial-time L-approximation algorithm
- NP-hard for $(L-\epsilon)$-approximation under the Unique Games Conjecture

Technical novelty: new rounding scheme for the standard linear program

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