Homomorphic UC Commitments in Minicrypt

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Basic Structure

Setup: Cryptomania

Commit And Reveal:
Minicrypt

Related Works

- Up to this year:
  - Most efficient UC commitments required exponentiations in large groups [Lin11,BCPV13].
- Independent work in Eurocrypt 2014 [GIKW14]:
  - Optimal Rate.
  - Public key operations restricted to setup phase.
  - Relies specifically on [FY92] for encoding messages.

Our Work

- Many commitments from a fixed number of seed OTs of fixed length.

- Non-interactive commit and reveal phases requiring only a PRG and field arithmetic.

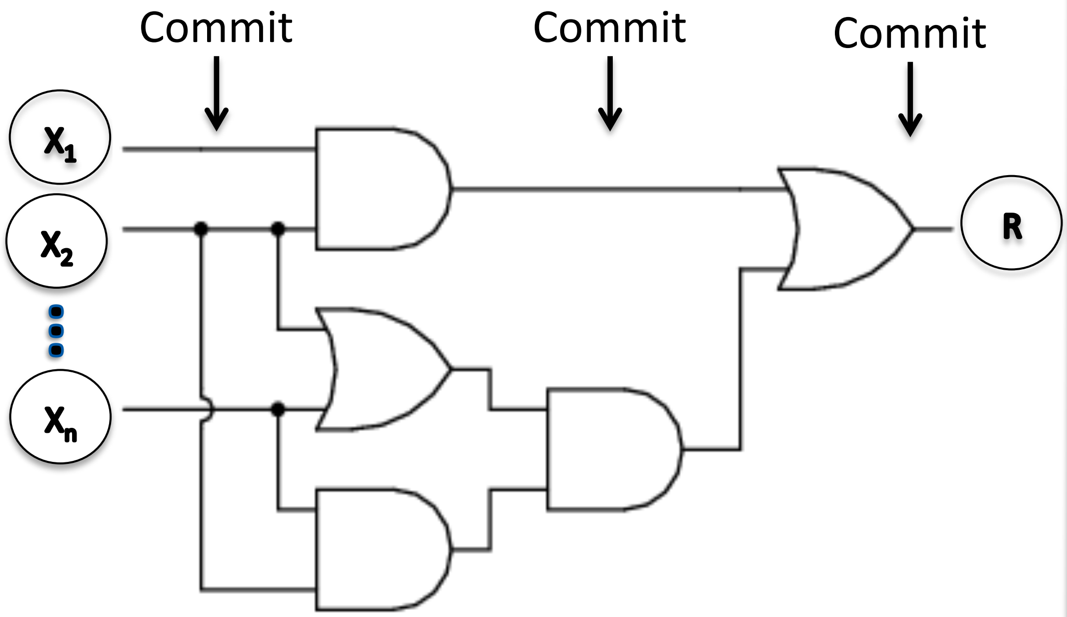
- Additive and multiplicative homomorphism.

- Constant rate even with constant size fields.

Applications

- Efficient Non-interactive UC zero-knowledge proof of knowledge for any NP relations. [DIK10]

Prover



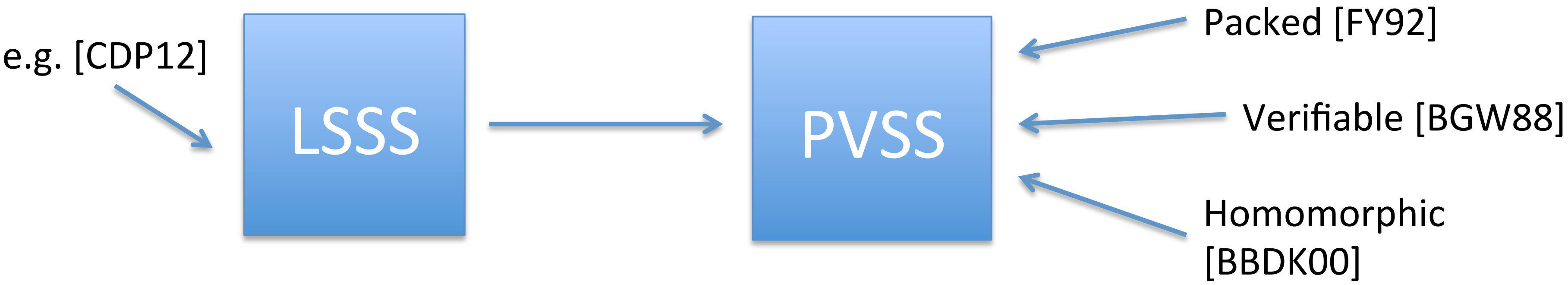
Circuit C checking relation:
C(x)=1 if relation holds

Verifier

- Verify relations between commitments
- Check opening of commitment to output R

Our New Tools

- General Packed Verifiable Secet Sharing:
  - Combined ideas from [FY92] and [BGW88].
  - Generalization of [CDM00] constructed from any LSSS.
  - Allows computation of linear functions and multiplications of shared secrets as in [BBDK00].



Basic Construction

- Setup:
  - Send t-out-of-n seeds for a PRG (e.g. [VZ12]) through OT as in [FJNNO13].
  - Run VSS in the head as in [IKOS09] with random strings as input and send the views one-time padded with the PRG outputs.
- Commit: Send the message one-time padded with a secret shared random string.
- Reveal: Send the shares for the random pad used for the commitment.

Thanks!