Cryptography w/ certified deletion

Bartusek, Khurana '22

(rough notes)

Warmup: Secret sharing w/ certified deletion

story: We construct a 2-out-of-2 secret sharing

setup: dealer: Alice

wants to share a bit b b/w two parties

Bob

Charlie

s.t.

(1) (Secret sharing) • Individual views of Bob & Charlie, perfectly hide b

while

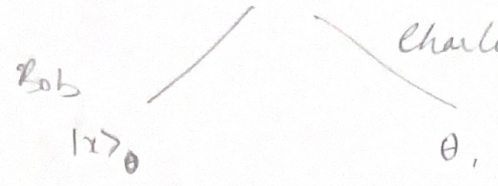
• Joint views of Bob & Charlie can be used to reconstruct b.

(2) (Certified Deletion). Bob may generate a certificate for Alice guaranteeing that b has been information theoretically removed from the joint view of Bob & Charlie.

Alice:

Scheme: $x \leftarrow \{0,1\}^\lambda$

[BK'22] $\theta \leftarrow \{0,1\}^\lambda$



[Story: Bob holds a quantum state — (a BB84 state in fact)
Charlie holds the basis info^ &
the bit b masked by the bits x
(of the quantum state) encoded in the
standard basis]

: To issue a deletion certificate: Bob measures all his qubits in the Hadamard basis, returns x'
: Alice checks results match, i.e. $x'_i = x_i$, whenever $\theta_i = 1$.

Claim: This scheme satisfies the two requirements.

Intuition: (1) Secret sharing: Bob has no info^ about b by def^.

Alice holds b padded by random bits

So neither can individually learn b.

But together, clearly, they can.

(2) Certified deletion: $i:\theta_i=0$ gets info^ theoretically erased.

If Bob produces a valid certificate w/o communicating w/ Charlie, then w.p. $1-\text{negl}$, he must have measured almost all his qubits in Hadamard & in that case, info^ about x_i on