



QueryComplexity

• Access to data as maybe restricted for efficiency:

• Query arbitrary entries

• Query matrix-vector products

• Query arbitrary *linear* measurements



A

$(i, j)$





$A_{i,j}$



*v*



*Av*



*u*



$u^T A \leftarrow$

$$= \sum_{i,j} S_{i,j} A_{i,j} = \langle \text{vec}(S), \text{vec}(A) \rangle$$

Measure

$A$

with

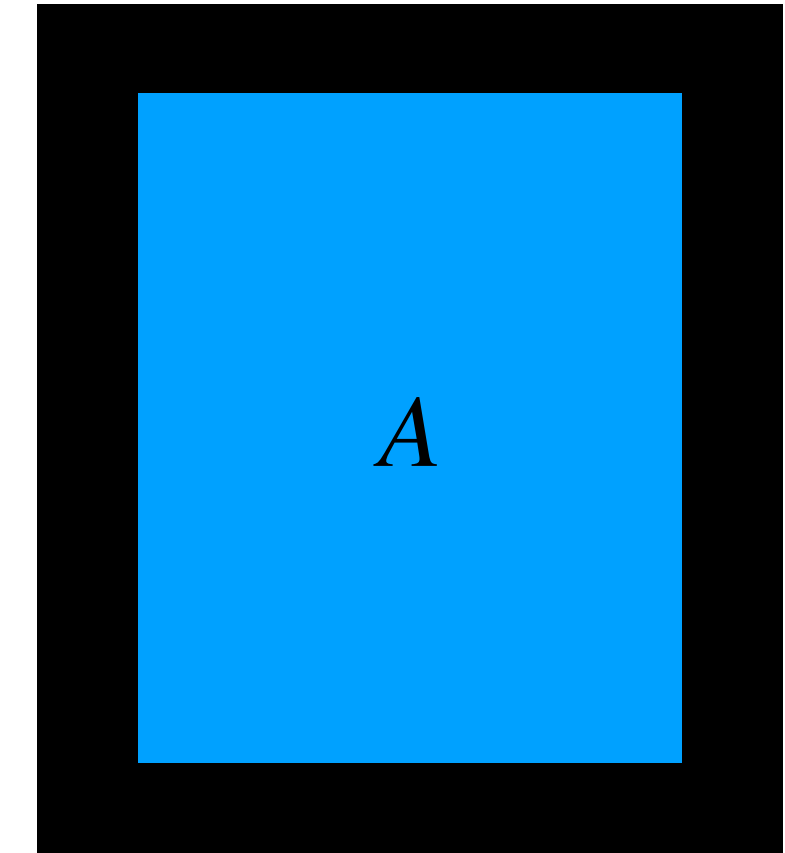
$S$

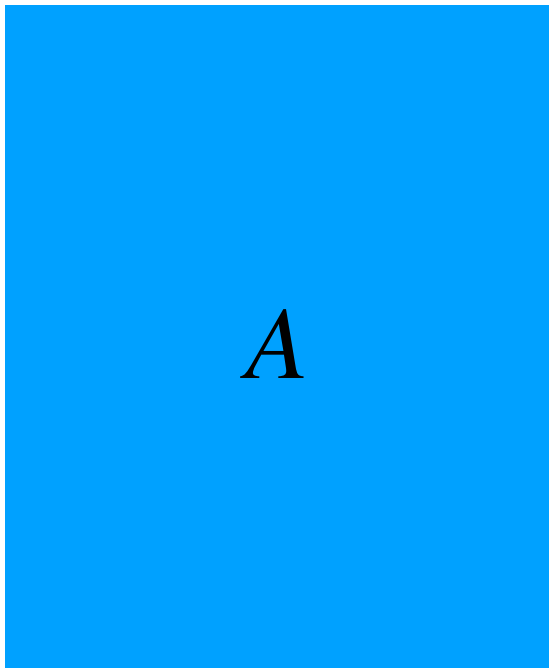
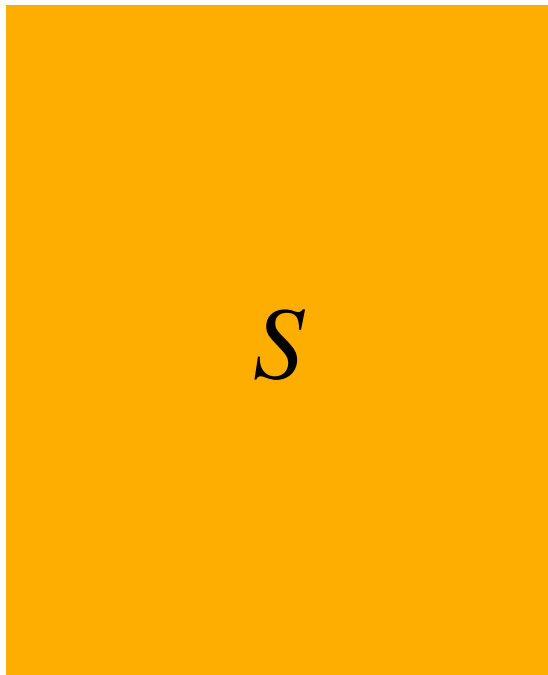
• How many queries do we need to solve a problem?



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Measure  with   $= \sum_{i,j} S_{i,j} A_{i,j} = \langle \text{vec}(S), \text{vec}(A) \rangle$

- How many queries do we need to solve a problem?

# Fast and Space Optimal Streaming Algorithms

with Mikkel Thorup, Rasmus Pagh and David Woodruff [FOCS '23]