Lecture #12:
Data Availability

COMS 4995-001:
The Science of Blockchains

URL: https://timroughgarden.org/s25/

Tim Roughgarden

Goals for Lecture #12

1. Data availability committees.
   – offload storage responsibilities from validators to third parties
2. Verifiable information dispersal (VID).
   – use Merkle trees and Reed-Solomon codes to get minimal overhead
3. Data availability sampling.
   – how can an end user be confident that data is available?
   – idea: repeatedly download small random chunks

Validator Responsibilities, Revisited

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Data availability (DA) problem: how to be sure that data really is being stored as intended?

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Implicit assumption: honest validators: (i) store entire blockchain; and (ii) upload past blocks to others on request.

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- example: Arbitrum AnyTrust (e.g., n=12, f=10)

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Solution: add redundancy to the m_i's using an erasure code.

– in effect, every server will store a little bit of info about every m_i

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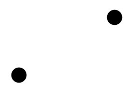

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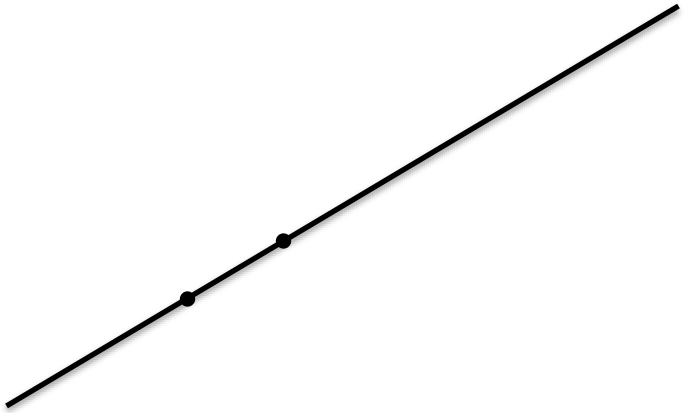

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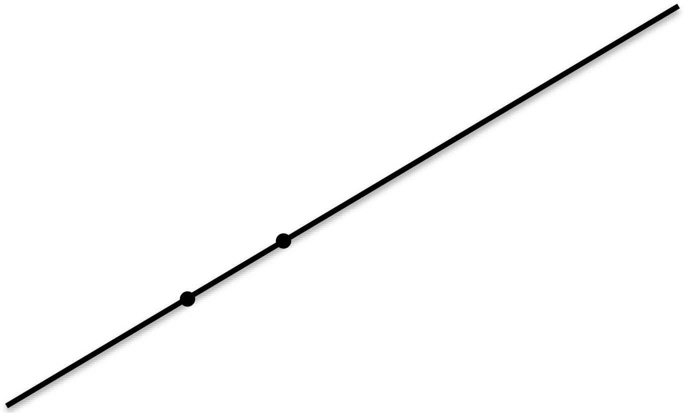

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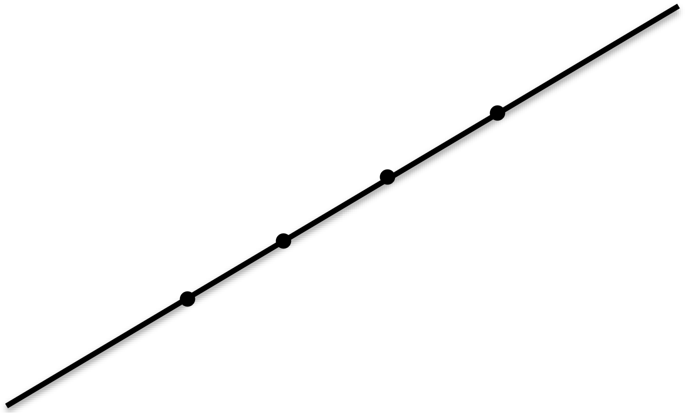

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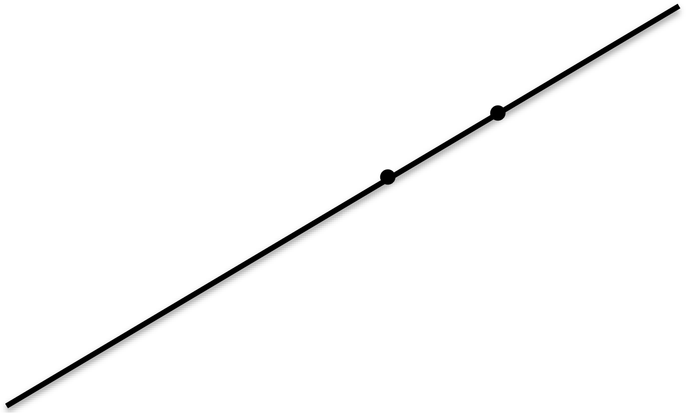
  - – if later remember only (3,14) and (4,19), can still recover line 5x-1



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- if store n > d+1 evaluations of f, can recover f from any d+1 of them
- easy to compute f from evaluations, e.g. via Lagrange interpolation
- corresponds to a *Reed-Solomon code* with parameters n and k=d+1

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– compute Merkle tree with values f(1),f(2),…,f(n) at leaves, check root = r

  - if not, sender committed to polynomial w/degree > k-1 (fail)

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- ideally, reconstruct chunks whenever they're detected as missing