Maximum-expectation matching under recourse

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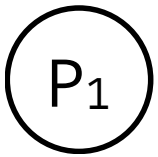
Introduction: background



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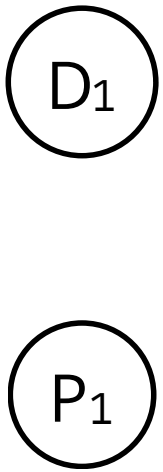

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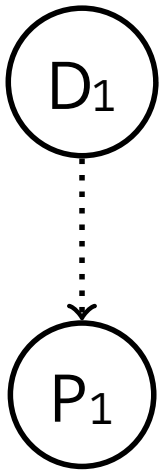

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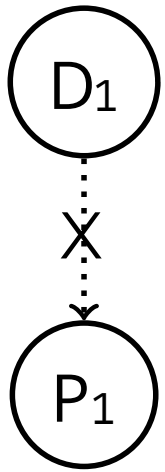

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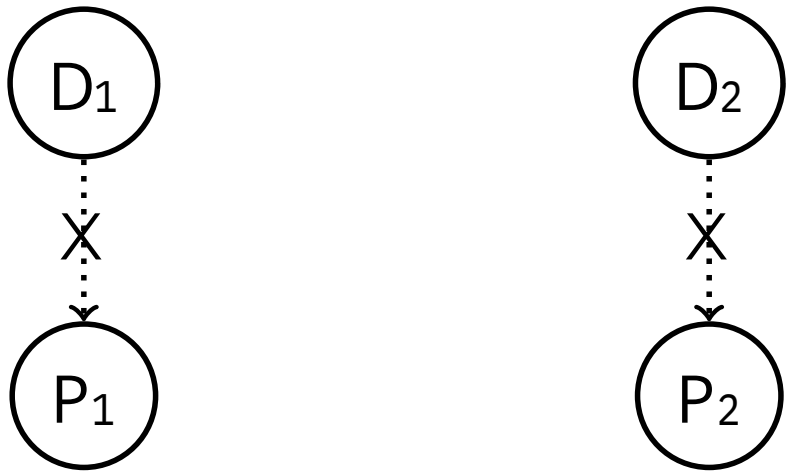

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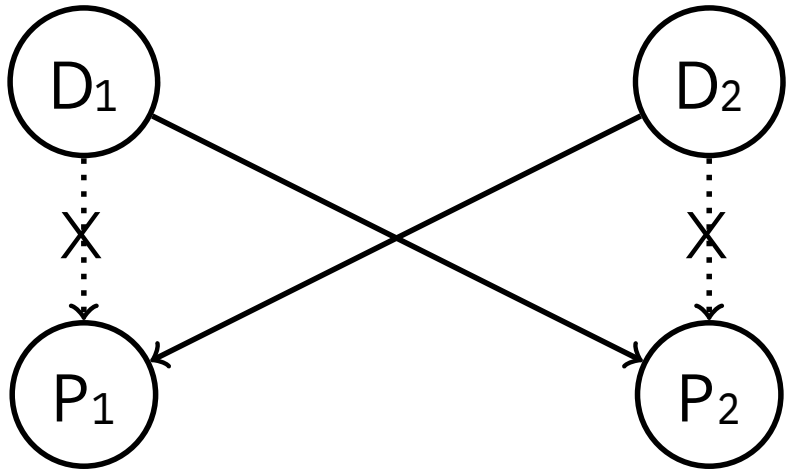
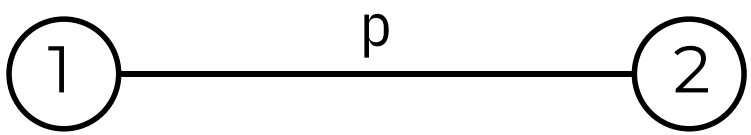
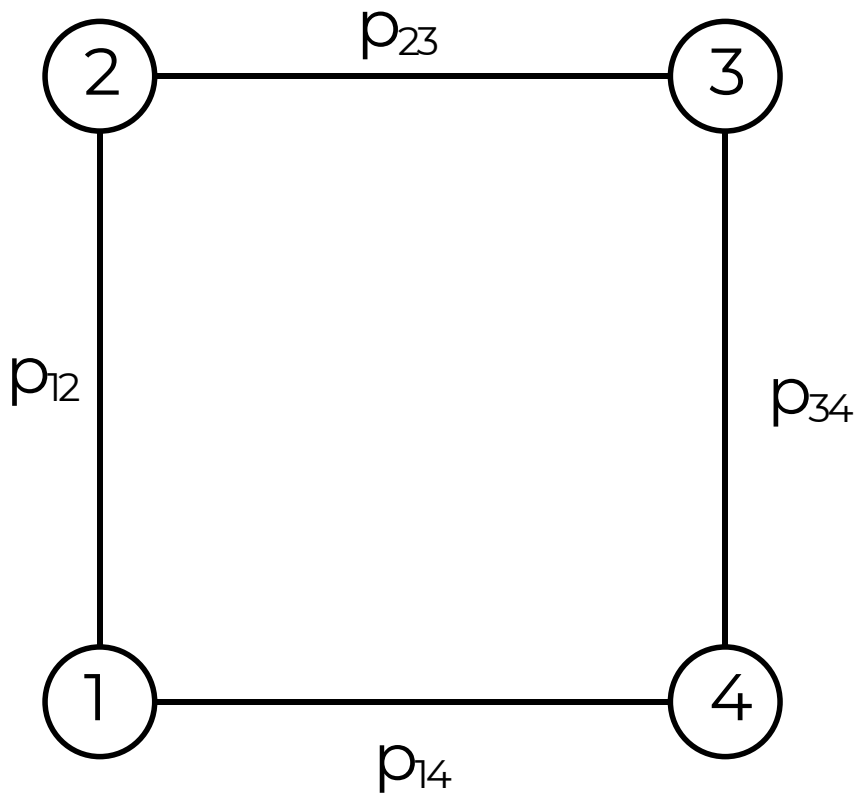




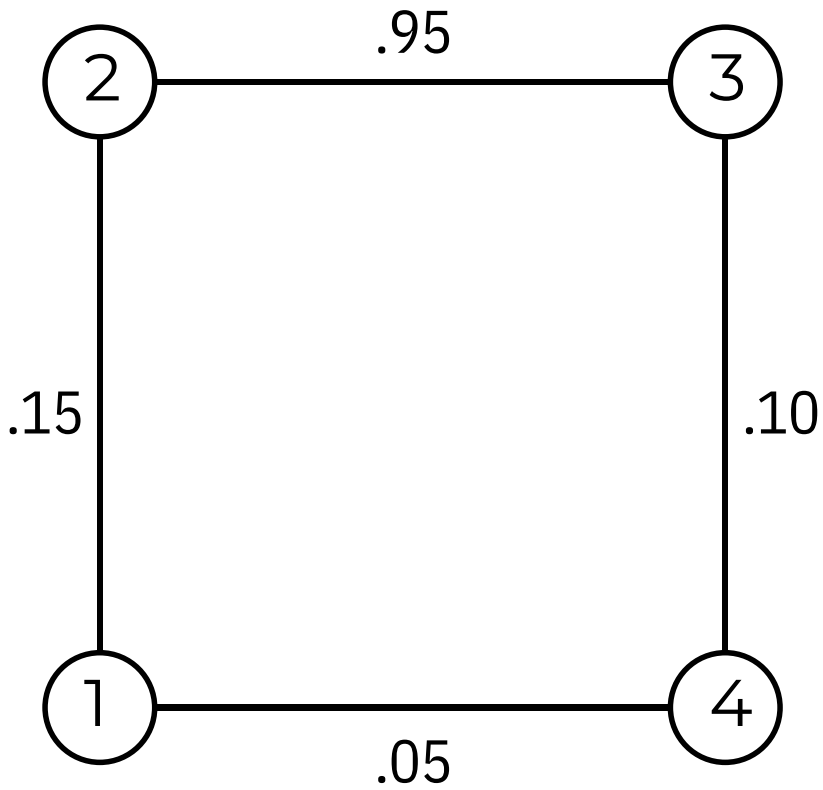
- p is probability of failure based on preliminary tests

Our problem

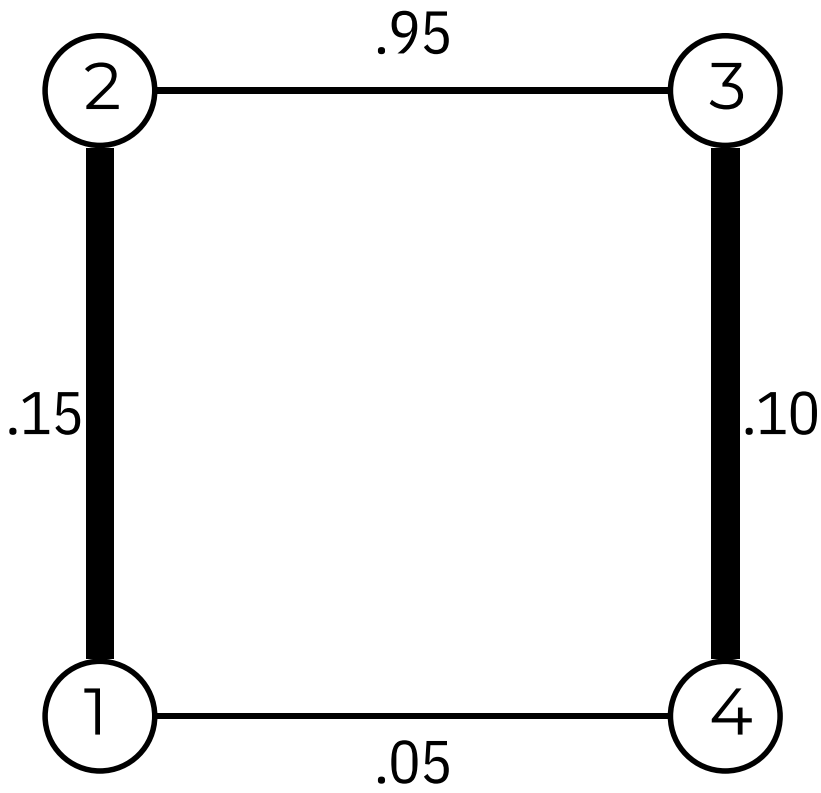


- propose maximum expectation matching taking recourse into account

Instance

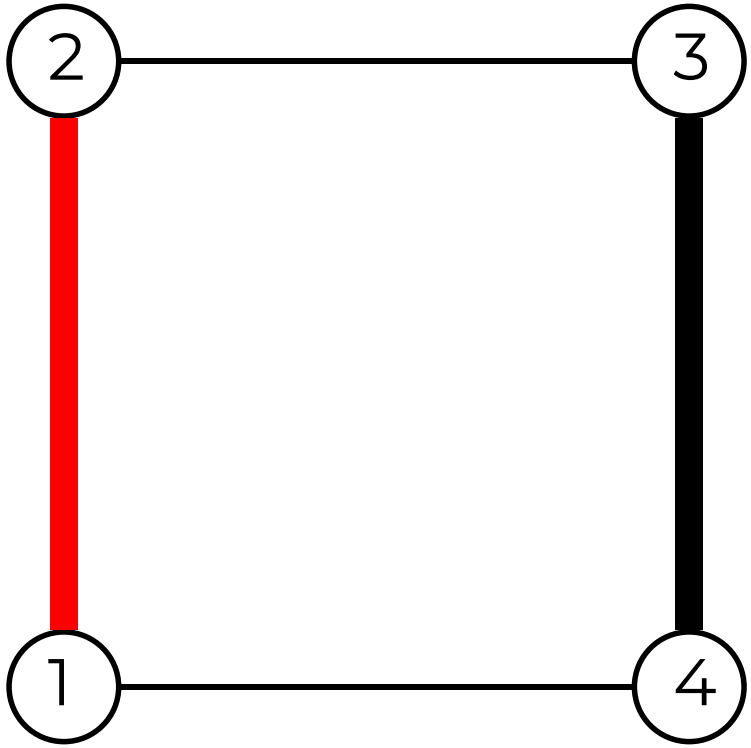


Why recourse makes a difference



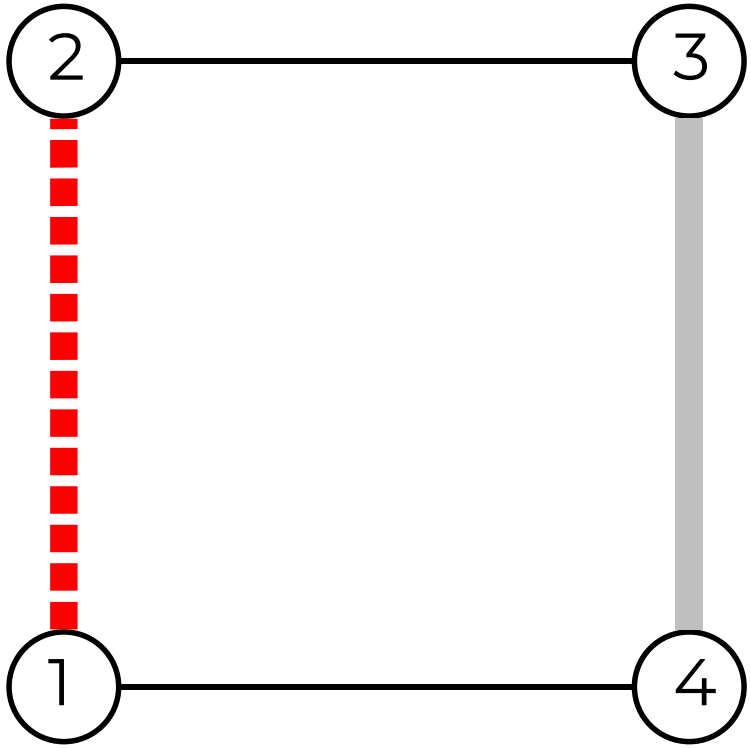
- thick arrows → maximal matching proposal

Why recourse makes a difference



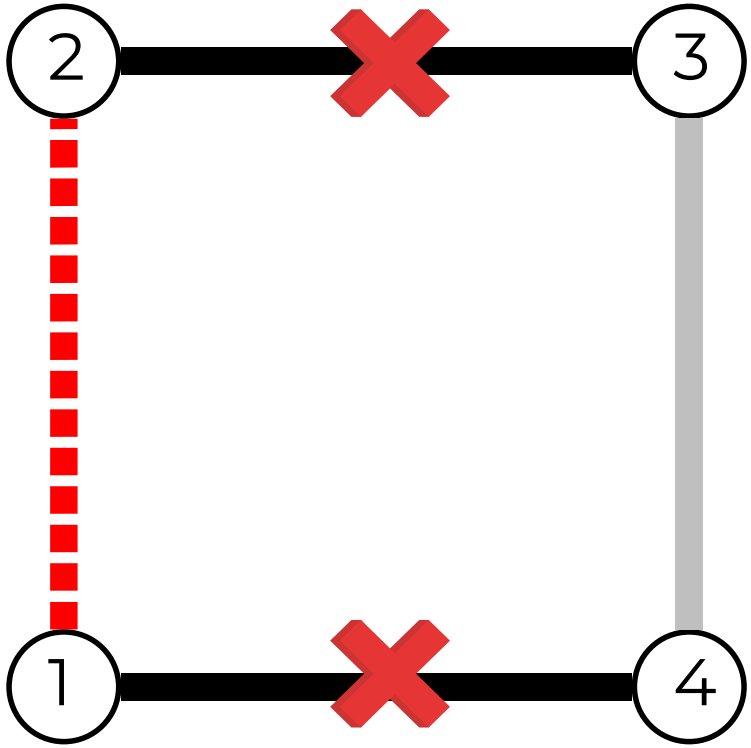
- edge between 1 & 2 failed

Why recourse makes a difference



- edge between 1 & 2 cannot be used again
- edge between 3 & 4 is locked

Why recourse makes a difference



- no other matching possible with only 1 success

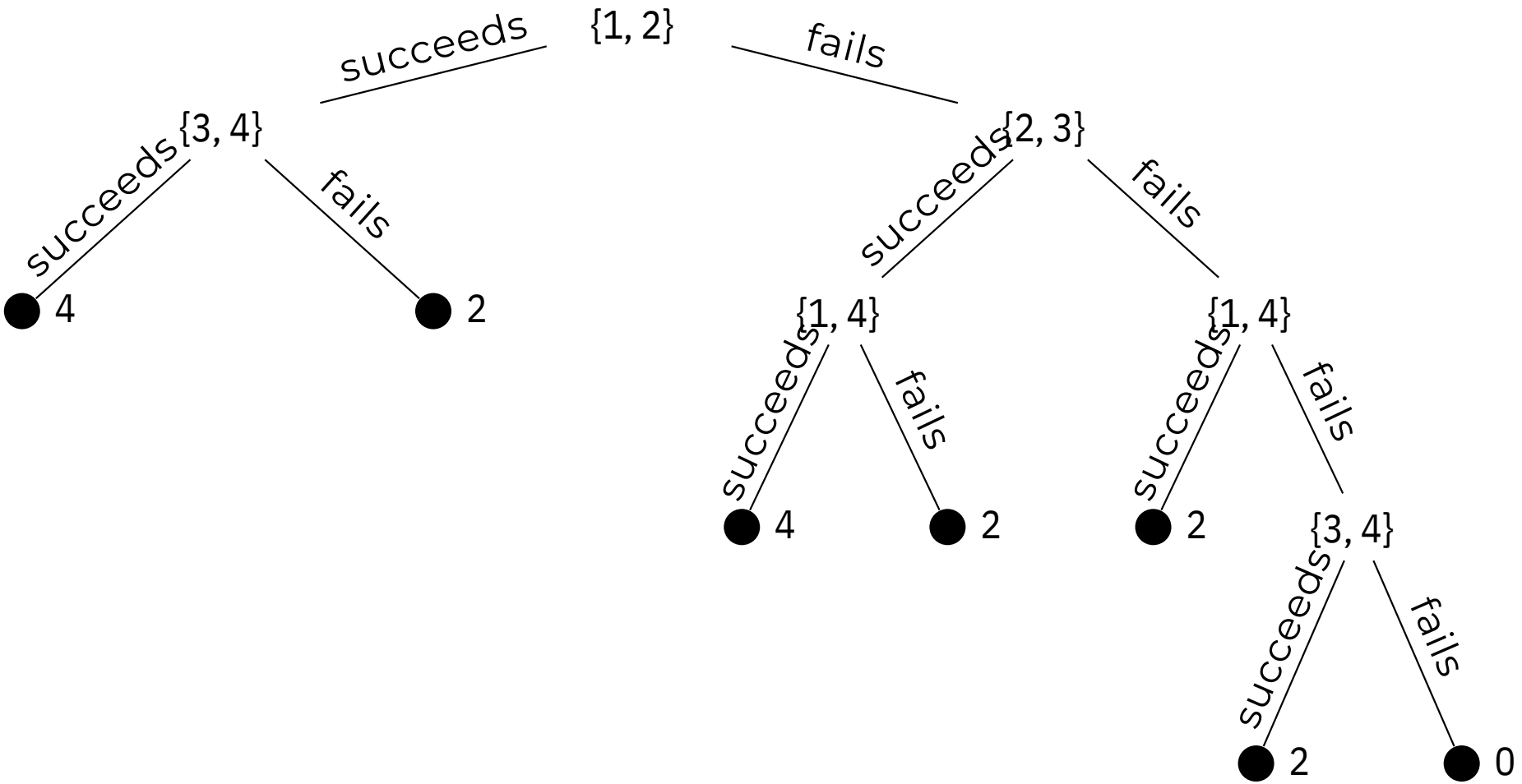
Variants

- Limited recourse rounds
- Vertex failure

Variants

- Number of recourse rounds
  - only 1 round
    - efficient solutions are known
  - unlimited recourse trials
    - optimum: one edge at a time
  - at most X rounds
    - optimum: a limited set of edges at a time
- Vertex Failure
  - like edges, vertices have a probability of failure

A complete solution



Current Exact Algorithm

- Base:
  - enumerate all possible matchings
  - evaluate each of them
  - do this recursively, until having no more matchings in residual graph
- Clearly intractable
  - but algorithm still able to provide optimal solutions to small instances

Greedy Approximation

1. Sort all edges in E by probabilities
   - say, $p_{e1} \geq p_{e2} \geq \ldots \geq p_{em}$
2. For i = 1, ..., | E | :
   - if the two endpoints of e_i are available, probe e_i

- evaluating expected number of successes is still exponential

Future Work

- Complexity class classification
- Approximation algorithms with guarantees
- Extension to Vertex Failure