PRESENTER
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Mixed integer linear programming in SciPy 1.9.0 assigned reviewers to submissions for SciPy 2022.

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Background

Who cares? The SciPy library has powerful new features for mixed integer linear programming (MILP) that can solve challenging assignment problems in research, engineering, and everyday life.

Methods

256 Submissions
1 CSV from EasyChair

332 Reviewer Entries
10 CSVs from EasyChair

DATA PROCESSING
- Load data with pandas
- Eliminate reviewers who have not logged into EasyChair
- Deduplicate reviewers using email addresses

→106 Unique Reviewers

PROBLEM DEFINITION
- Set bounds on decision variables due to conflicts of interest and domains of expertise
- Create upper-bound constraints on number of reviews per reviewer
- Assemble constraints on number of reviews per submission

SOLUTION with SciPy
Solve with `scipy.optimize.milp`.
If problem is feasible, lower the maximum number of reviews per reviewer and re-solve.

POSTPROCESSING
- Check solution
- Generate reviewer assignment CSVs for upload to EasyChair
- Generate reviewer assignment CSVs for humans

Other Examples

- Assigning shifts to bartenders at the Thirsty Ear Pub
- Assigning students to senior project teams at Cal Poly

Acknowledgments

Thanks to Julian Hall and team for the HiGHS linear programming software wrapped by SciPy:
Huangfu, Qi, and JA Julian Hall. "Parallelizing the dual revised simplex method." *Mathematical Programming Computation* 10.1 (2018): 119-142. https://doi.org/10.1007/s12532-017-0130-5

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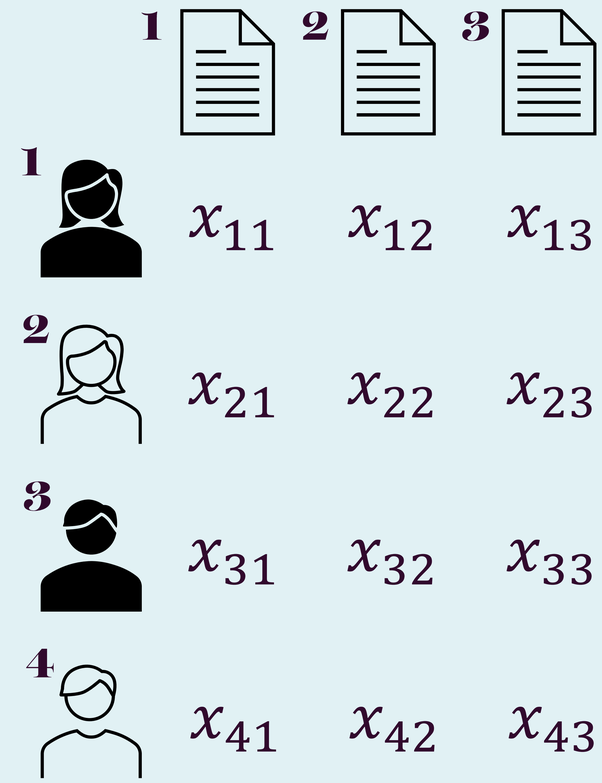
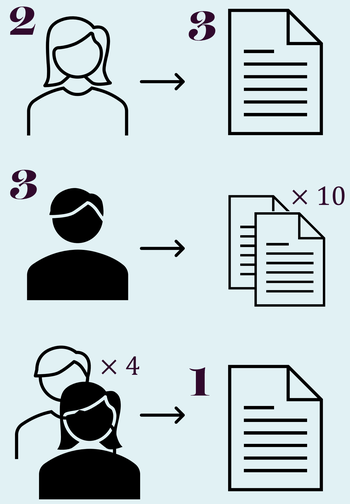
Decision Variables (27,136)



Constraints (362)



Tutorial

Binary Integer Linear Program

Minimize the maximum number of submissions assigned to a reviewer under constraints:

- *Conflicts of interest*
- *Domains of expertise*
- *All submissions get at least four reviews*

$$\min_x c^T x$$
$$s.t.\ A_e x = b_e$$
$$A_i x \leq b_i$$
$$x_{ij} \in \{0, 1\}$$

Code

```
scipy.optimize.milp(c, *, integrality, bounds, constraints)
```