A Comparison of Optimization Methods for Multi-Objective Constrained Bin Packing Problems

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Outline

1. The Wedding Seating Problem
2. Existing Methods
3. Constraint Programming Model

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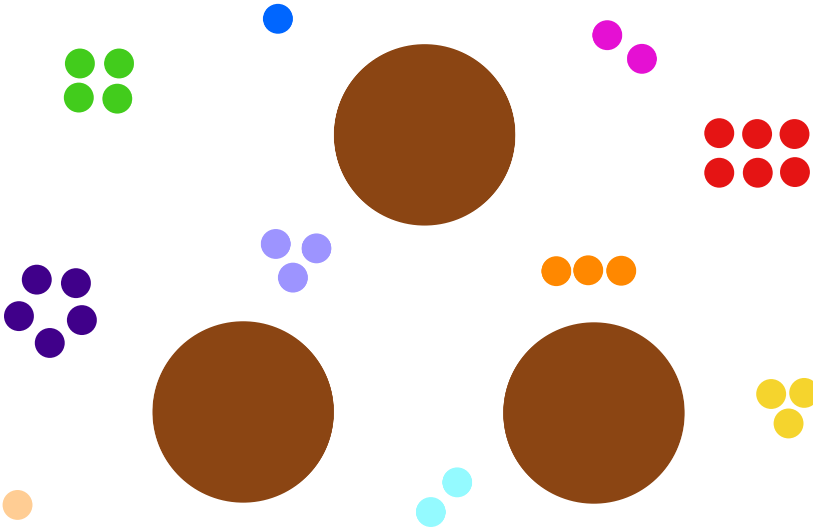
The Wedding Seating Problem



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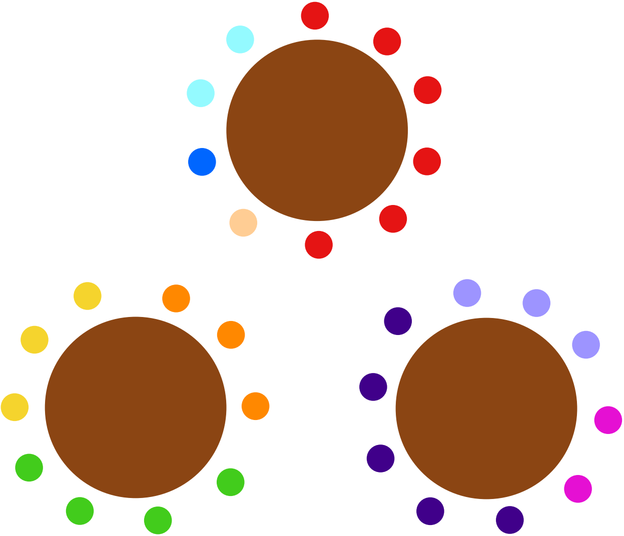

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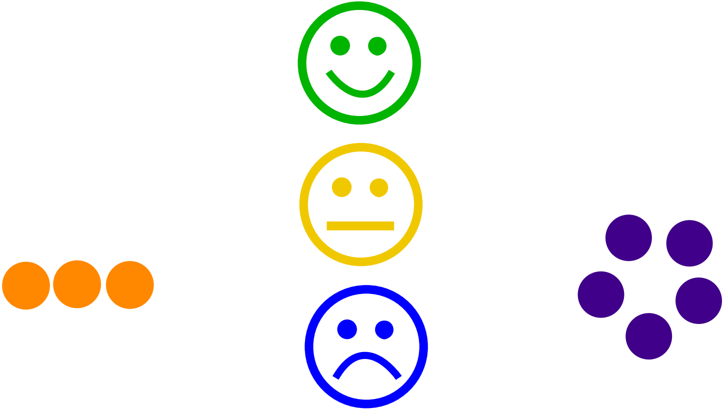

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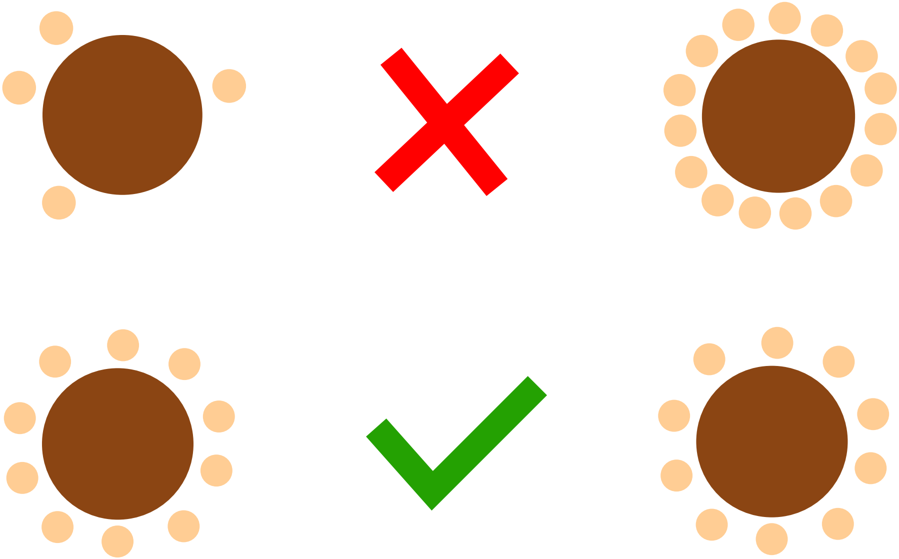

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Existing Methods

Overview

- Original IP model [Bellows and Petersen, *Annals of Improbable Research*, 2012].
- Two-stage algorithm using tabu search [Lewis, *WorldComp International Conference Proceedings*, 2013].
- Improved IP model [Lewis and Carroll, *Journal of the Operational Research Society*, 2016].

Existing Methods

Two-stage algorithm using tabu search [Lewis, 2013]

Build a graph where nodes represent groups, edges represent relations, and colors represent tables.

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- Stage 1: Color nodes to find an initial feasible solution

Existing Methods

Two-stage algorithm using tabu search [Lewis, 2013]

Build a graph where nodes represent groups, edges represent relations, and colors represent tables.

- Stage 1: Color nodes to find an initial feasible solution
- Stage 2: Improve this feasible solution with a tabu search

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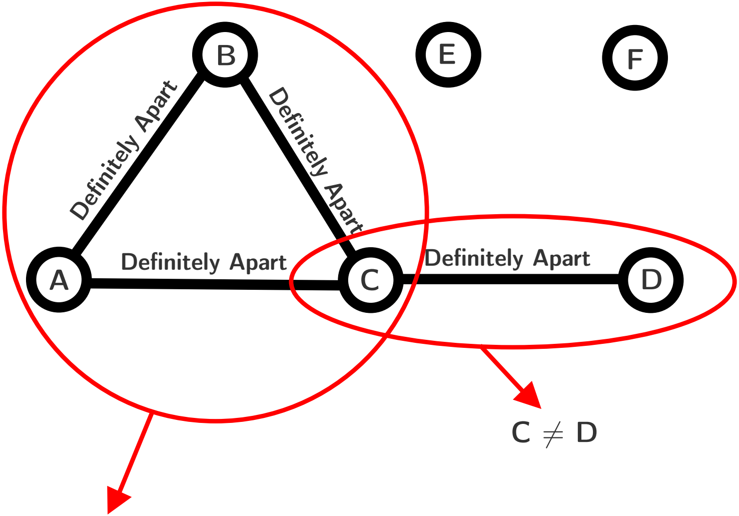
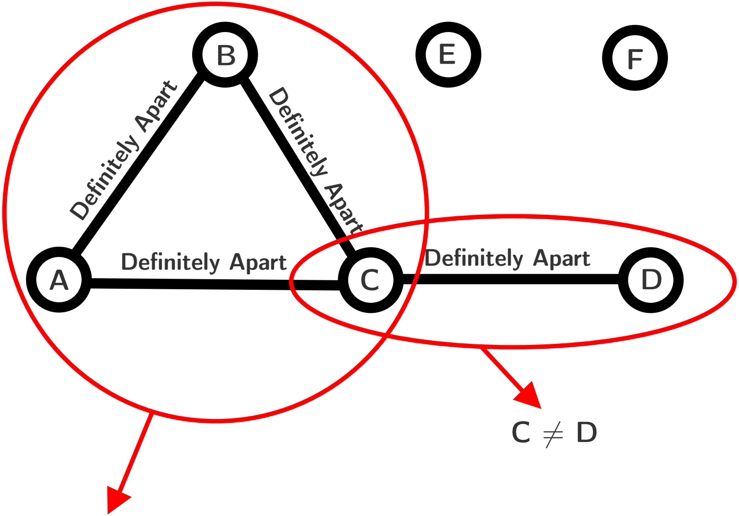
Constraint Programming Model



$C \neq D$

alldifferent(A, B, C)

Constraint Programming Model



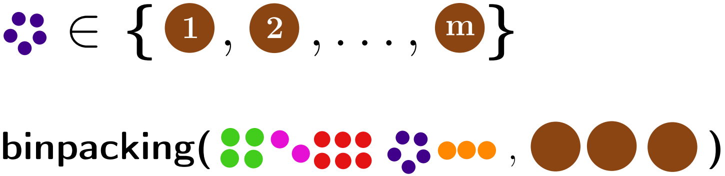
$C \neq D$

alldifferent(A, B, C) → Needs 3+ tables

Constraint Programming Model

⁘ ∈ {①, ②, …, ⓜ}

Constraint Programming Model



Constraint Programming Model

$⁙ \in \{①, ②, \ldots, ⓜ\}$

binpacking(∷ ⁚ ⠿ ⁙ ••• , ● ● ● **)**

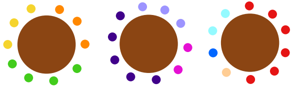
alldifferent(☹ **)**

Constraint Programming Model

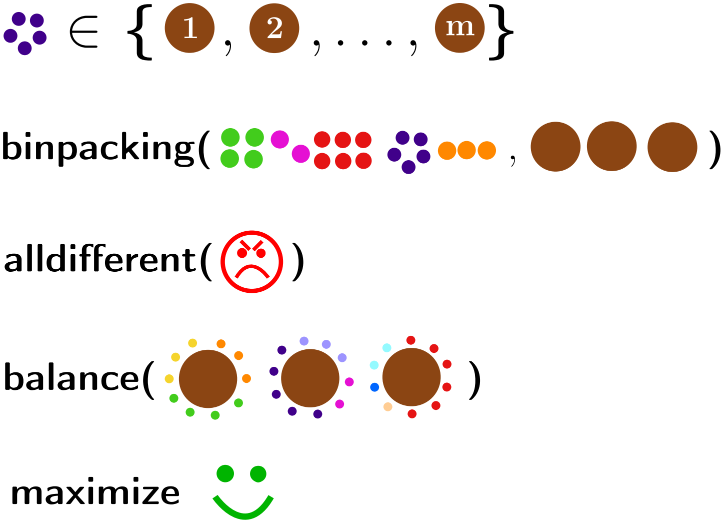
$\in \{$ ❶, ❷, …, ⓜ $\}$

binpacking(,)

alldifferent( )

balance()

Constraint Programming Model



$\in \{ 1, 2, \ldots, m \}$

binpacking(,)

alldifferent( )

balance( )

maximize

Constraint Programming Model

Branching Heuristic

Similar to *best fit decreasing*:

Constraint Programming Model

Branching Heuristic

Similar to *best fit decreasing*:

1. Pick the largest group yet unassigned

Constraint Programming Model

Branching Heuristic

Similar to *best fit decreasing*:

1. Pick the largest group yet unassigned
2. Sit that group at the best possible table

Constraint Programming Model

Branching Heuristic

Similar to *best fit decreasing*:

1. Pick the largest group yet unassigned
2. Sit that group at the best possible table
3. If no table has enough room, start a new table