Memetic Algorithms for Break Scheduling

Masterstudium: Computational Intelligence

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Algorithm

Memetic Representation

Meme $m$ $P(m)$
Set of shifts that largely overlap in time
Weighted sum of over/undercover violations in period covered by $m$

Individual $I$ $F(I)$
Shiftplan with break assignment, set $M$ of memes
Weighted sum of over/undercover violations

Population $I$ $Z$
Set of individuals

Initialisation

For each individual $I$
- Assign a break pattern out of previously computed patterns to each shift
- Improve breaks randomly with single assignment moves

Interaction and Selection

Create one individual using memes with best fitness $F(I)$, remaining individuals by replication of memes with low $P(I)$

Mutation and Improvement

Each individual determines a set $M'$ containing memes with low $P(I)$
- select shift at random
- perform some shift assignment moves (mutation rate)

Improvement
- select a break $b$ in $M'$ at random
- select a break $b'$ in $M'$ at random
- perform a move that does not worsen $F(I)$
- terminate when for a number of iterations no such move could be found (local search intensity)

Break Scheduling Problem

This air controller did not take sufficient break time

Input
- Shiftplan
- Values describing temporal constraints (i.e. amount of breaktime, limits for durations of breaks/worktime and time windows for lunch breaks)
- Staffing requirements for each timeslot

Objective
Find a break assignment such that
- temporal constraints are satisfied
- satisfaction of staffing requirements is optimised

Results

- NP-completeness if possible break patterns are given explicitly
- Two different memetic representations
- Three memetic algorithms based on the representations
- Parameter evaluation for all algorithms
- Improved solutions for 28 out of 30 instances from literature

Instances evaluated

<table>
<thead>
<tr>
<th>Instances</th>
<th>2007 instances</th>
<th>2008 instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over/undercover violation weight</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Mutation rate

<table>
<thead>
<tr>
<th>Instance</th>
<th>Double assignment (random 1-24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-RW 1</td>
<td>1,475,034</td>
</tr>
<tr>
<td>MA</td>
<td>1,133,795,593</td>
</tr>
</tbody>
</table>

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