

Memetic Algorithms for Break Scheduling

EPILOG

Magdalena Widl

02.12.2010



FAKULTÄT
FÜR INFORMATIK

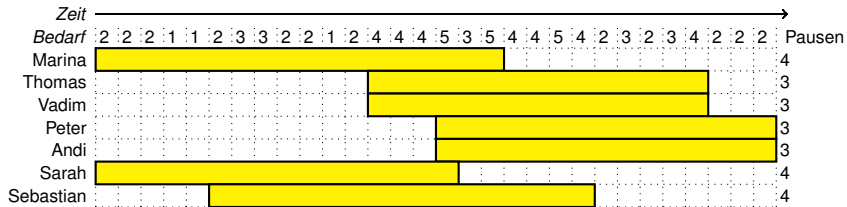
Faculty of Informatics



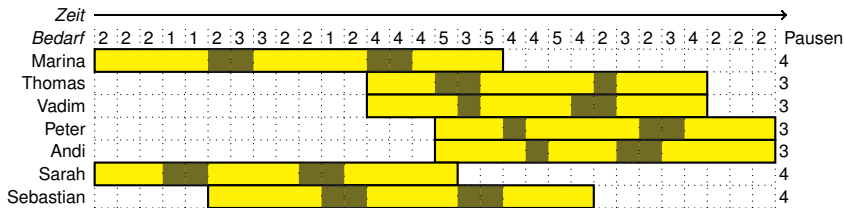
Fluglotsin Marina hatte heute keine Pause.



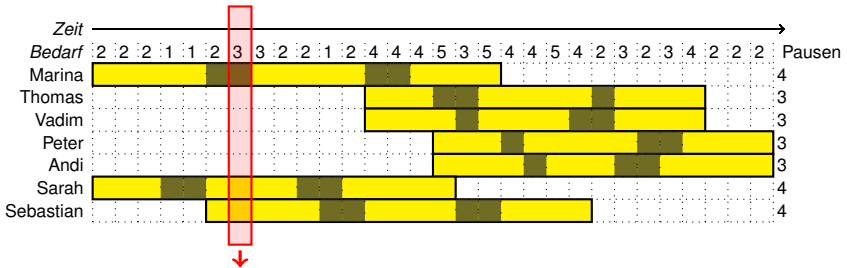
Break Scheduling Problem



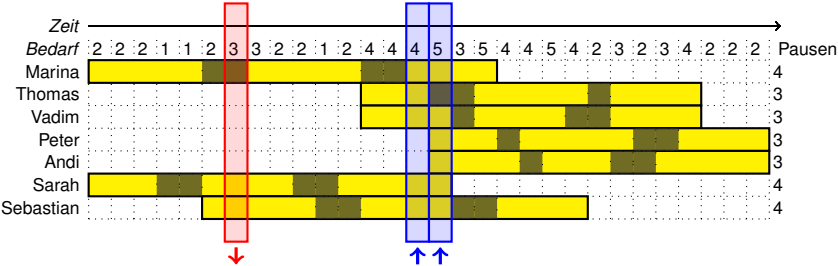
Break Scheduling Problem



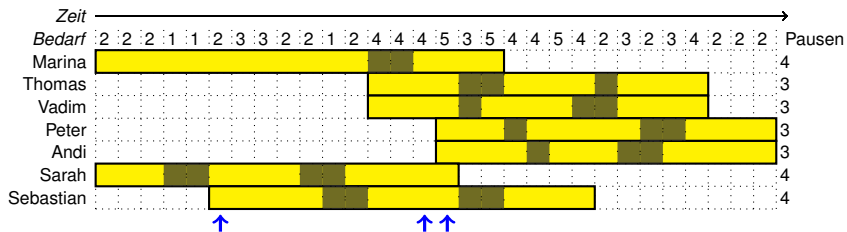
Break Scheduling Problem



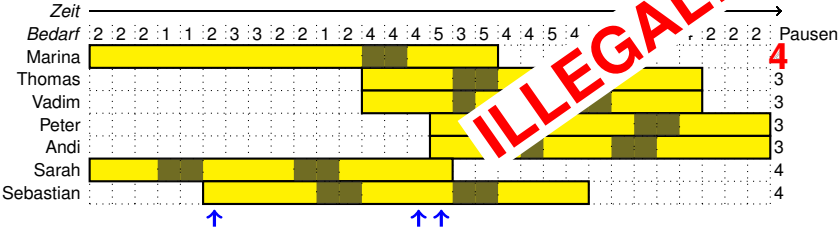
Break Scheduling Problem



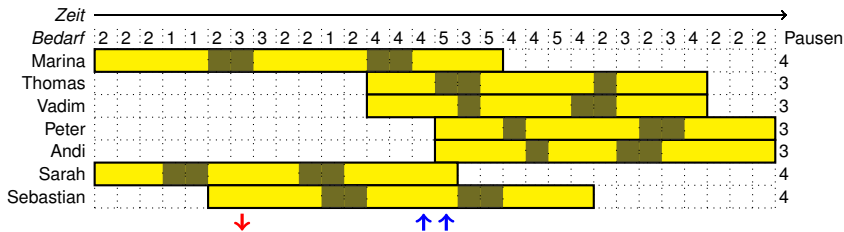
Break Scheduling Problem



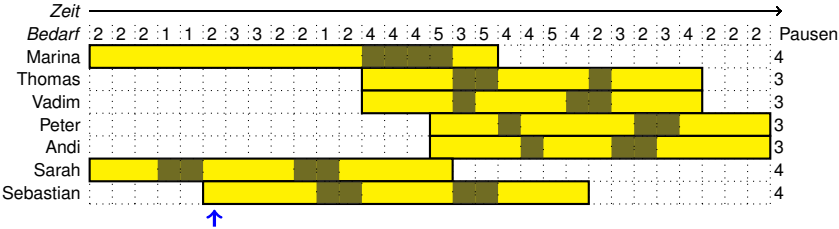
Break Scheduling Problem



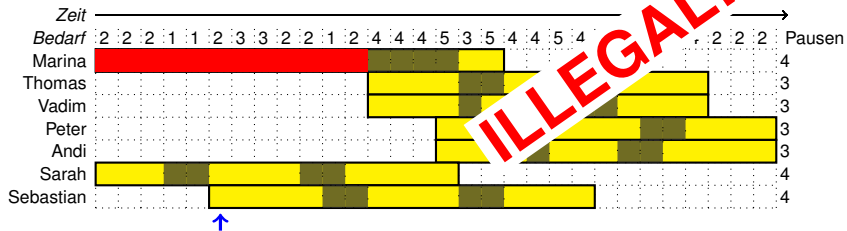
Break Scheduling Problem



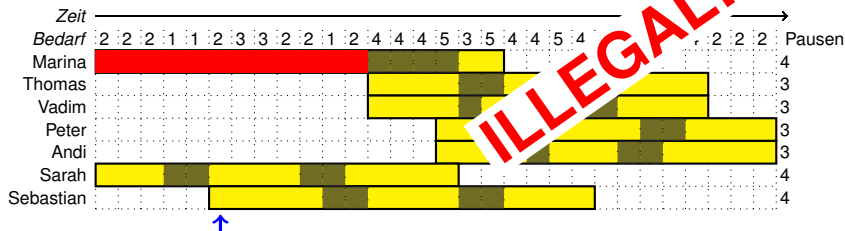
Break Scheduling Problem



Break Scheduling Problem

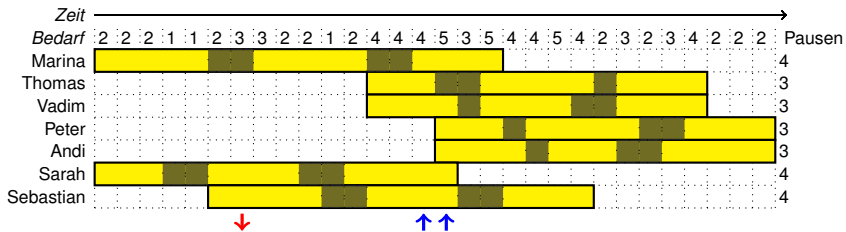


Break Scheduling Problem

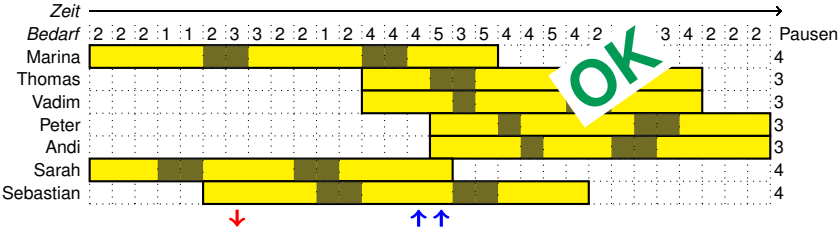


Min/max Arbeits- und Pausenzeit

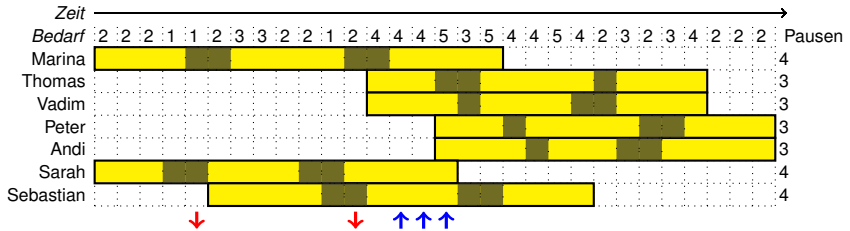
Break Scheduling Problem



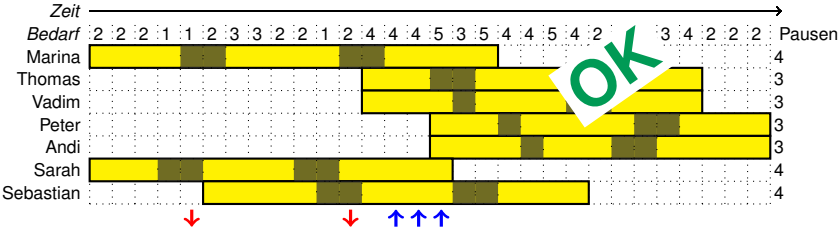
Break Scheduling Problem



Break Scheduling Problem



Break Scheduling Problem



Break Scheduling Problem



Break Scheduling Problem



Break Scheduling Problem



Break Scheduling Problem



5 h > **2.500**

8,5 h > **10^5**

12 h > **10^9**

Break Scheduling Problem



5 h > **2.500**

8,5 h > **10^5**

12 h > **10^9**

n Schichten à 8,5 h: **10^{5n}**

100 Schichten à 8,5 h: **10^{500}**

10^{80} Atome im Universum

10^{500} Lösungskandidaten

- ▶ Komplexität?

► Komplexität?

Beweis für NP-Vollständigkeit (Reduktion von Exact-Cover-By-3-Sets)



Under review: M. Widl, N. Musliu. Memetic Algorithms for Break Scheduling. Journal of Heuristics.

- ▶ Komplexität?

Beweis für NP-Vollständigkeit (Reduktion von Exact-Cover-By-3-Sets)



Under review: M. Widl, N. Musliu. Memetic Algorithms for Break Scheduling. Journal of Heuristics.

- ▶ Verbesserung der state-of-the-art Resultate?

- ▶ Komplexität?

Beweis für NP-Vollständigkeit (Reduktion von Exact-Cover-By-3-Sets)



Under review: M. Widl, N. Musliu. Memetic Algorithms for Break Scheduling. Journal of Heuristics.

- ▶ Verbesserung der state-of-the-art Resultate?
Ja, mit memetischem Algorithmus

Memetik – Evolution von Ideen

Basierend auf Werken von R. Dawkins und S. Blackmore

Memetik – Evolution von Ideen

Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur

Memetik – Evolution von Ideen

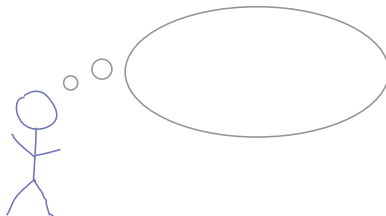
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



Memetik – Evolution von Ideen

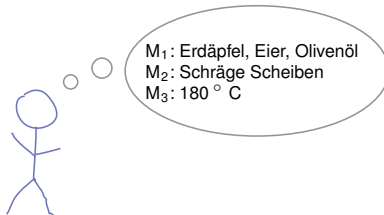
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



Memetik – Evolution von Ideen

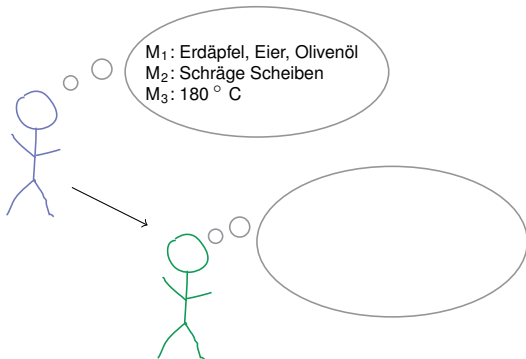
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



Memetik – Evolution von Ideen

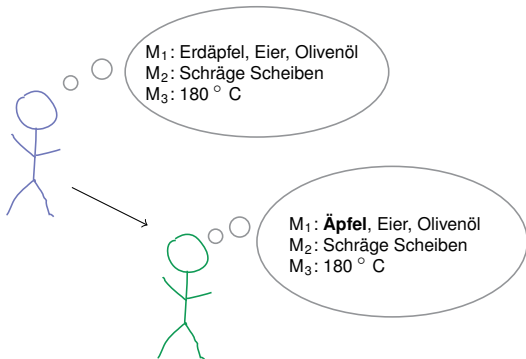
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



Memetik – Evolution von Ideen

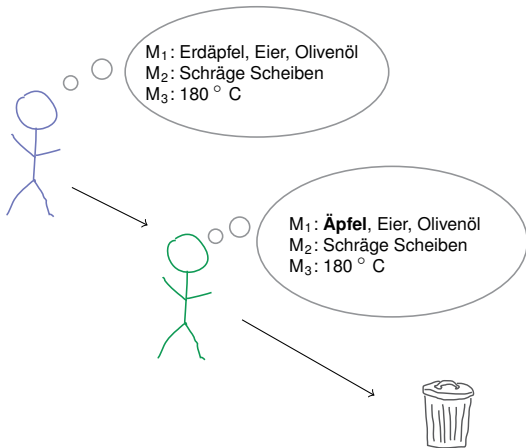
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

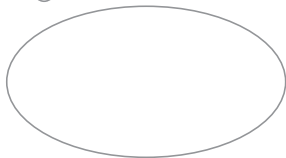
Mem 3: Brattemperatur



Memetik – Evolution von Ideen

Basierend auf Werken von R. Dawkins und S. Blackmore

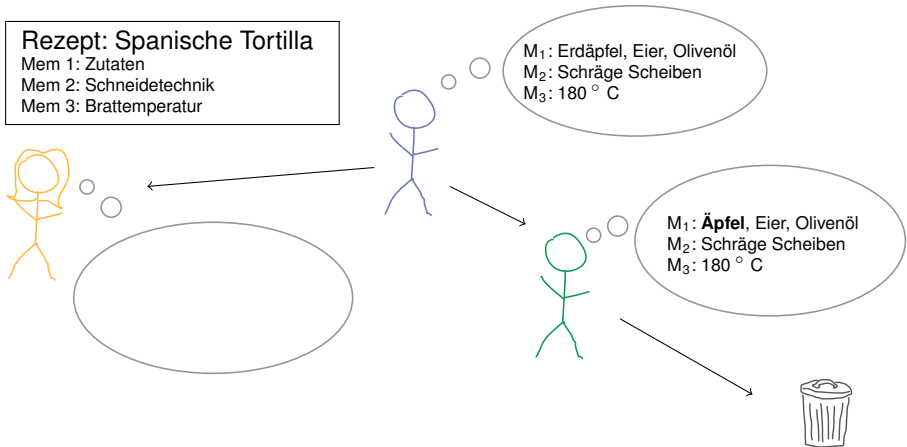
Rezept: Spanische Tortilla
Mem 1: Zutaten
Mem 2: Schneidetechnik
Mem 3: Brattemperatur



M₁: Erdäpfel, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



M₁: **Äpfel**, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



Memetik – Evolution von Ideen

Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



M₁: Erdäpfel, Eier, Olivenöl
M₂: **Stäbchen**
M₃: 180 ° C



M₁: Erdäpfel, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



M₁: **Äpfel**, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



Memetik – Evolution von Ideen

Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



M₁: Erdäpfel, Eier, Olivenöl
M₂: **Stäbchen**
M₃: 180 ° C



M₁: Erdäpfel, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



M₁: **Äpfel**, Eier, Olivenöl
M₂: Schräge Scheiben
M₃: 180 ° C



Memetik – Evolution von Ideen

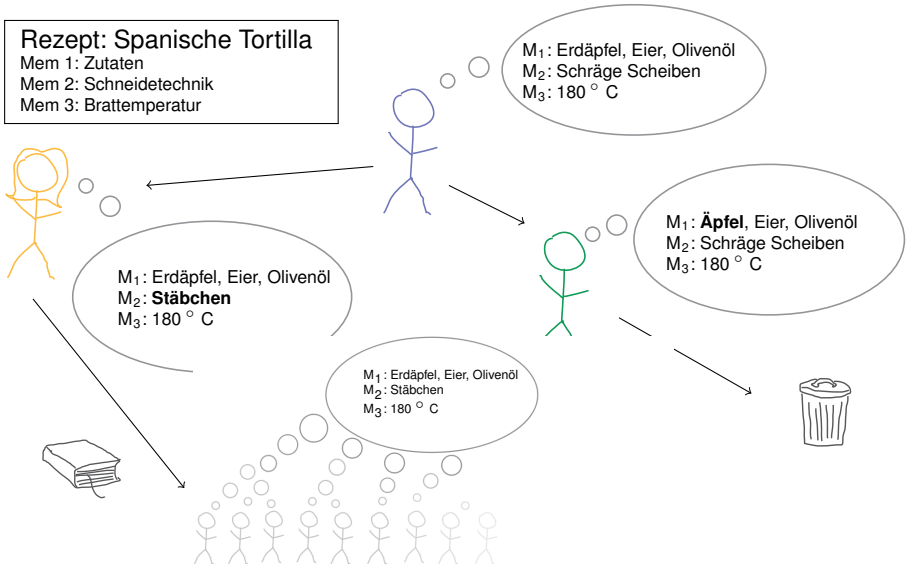
Basierend auf Werken von R. Dawkins und S. Blackmore

Rezept: Spanische Tortilla

Mem 1: Zutaten

Mem 2: Schneidetechnik

Mem 3: Brattemperatur



Rezept: Spanische Tortilla

Memetischer Algorithmus

Rezept: Spanische Tortilla



Memetischer Algorithmus

Rezept: Spanische Tortilla



M_1 : Zutaten

M_2 : Schneidetechnik

M_3 : Brattemperatur

Memetischer Algorithmus

Rezept: Spanische Tortilla



M_1 : Zutaten

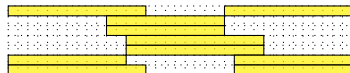
M_2 : Schneidetechnik

M_3 : Brattemperatur



Memetischer Algorithmus

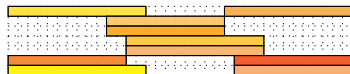
Rezept: Spanische Tortilla




M_1 : Zutaten

M_2 : Schneidetechnik

M_3 : Brattemperatur

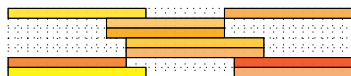
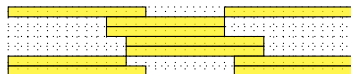



 M. Widl, N. Musliu, W. Schafhauser. A Memetic Algorithm for a Break Scheduling Problem. 8th Metaheuristic Int. Conference, 2009.

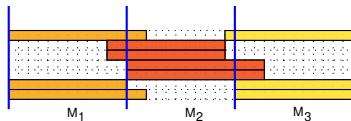
Memetischer Algorithmus

Rezept: Spanische Tortilla

M_1 : Zutaten
 M_2 : Schneidetechnik
 M_3 : Brattemperatur



 M. Widl, N. Musliu, W. Schafhauser. A Memetic Algorithm for a Break Scheduling Problem. 8th Metaheuristic Int. Conference, 2009.



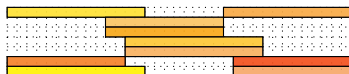
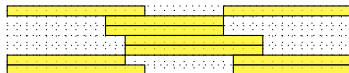
Memetischer Algorithmus


Rezept: Spanische Tortilla

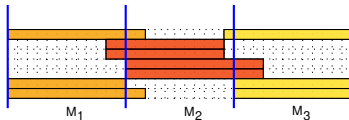
- M₁: Zutaten
- M₂: Schneidetechnik
- M₃: Brattemperatur



M 1: Erdäpfel, Eier, Olivenöl
M 2: Schräge Scheiben
M 3: 180 ° C



 M. Widl, N. Musliu, W. Schafhauser. A Memetic Algorithm for a Break Scheduling Problem. 8th Metaheuristic Int. Conference, 2009.



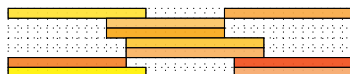
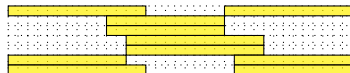
Memetischer Algorithmus


Rezept: Spanische Tortilla

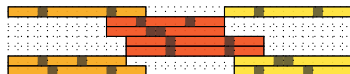
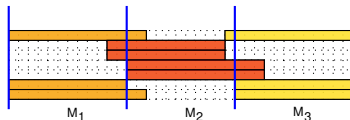
M₁: Zutaten
M₂: Schneidetechnik
M₃: Brattemperatur



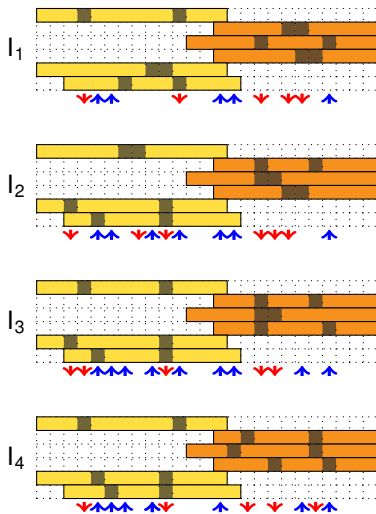
M 1: Erdäpfel, Eier, Olivenöl
M 2: Schräge Scheiben
M 3: 180 ° C



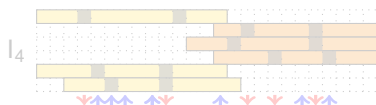
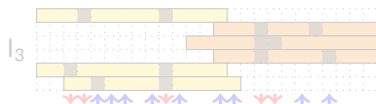
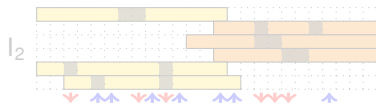
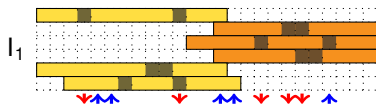
 M. Widl, N. Musliu, W. Schafhauser. A Memetic Algorithm for a Break Scheduling Problem. 8th Metaheuristic Int. Conference, 2009.



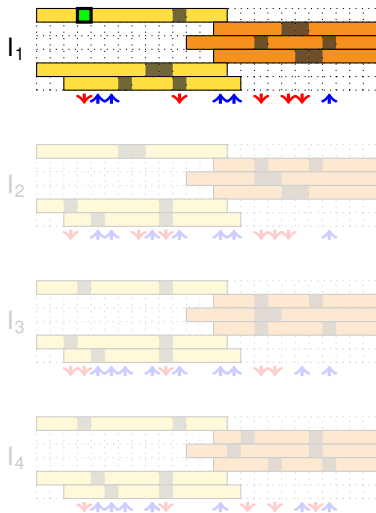
Mutation



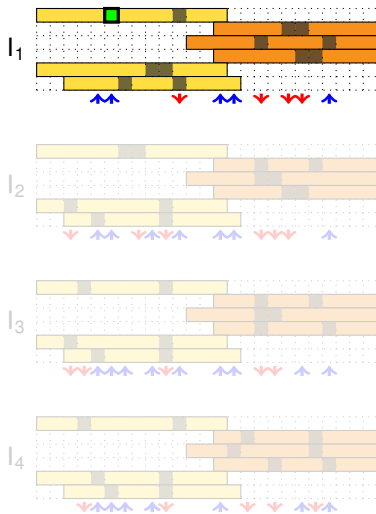
Mutation



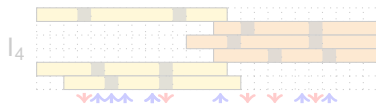
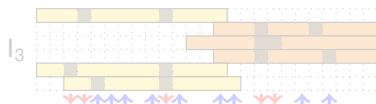
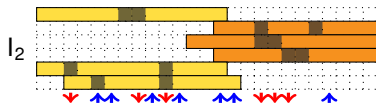
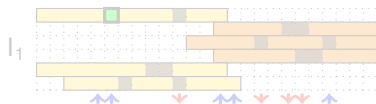
Mutation



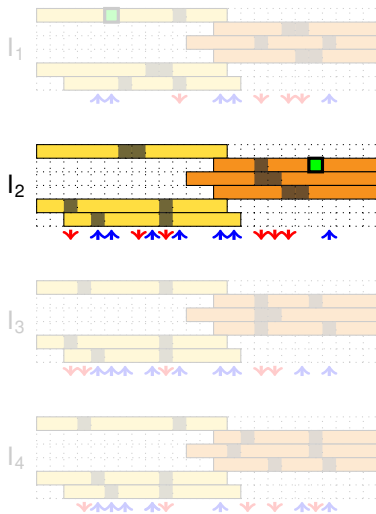
Mutation



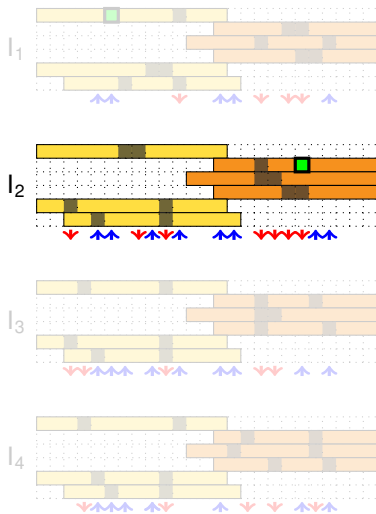
Mutation



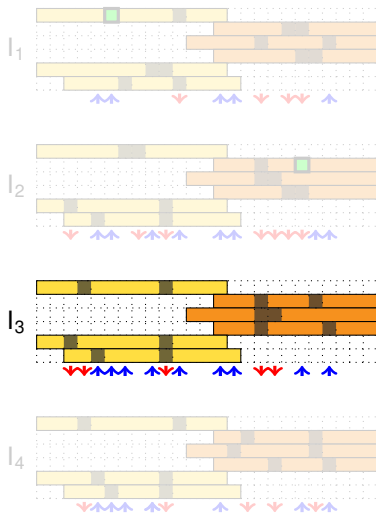
Mutation



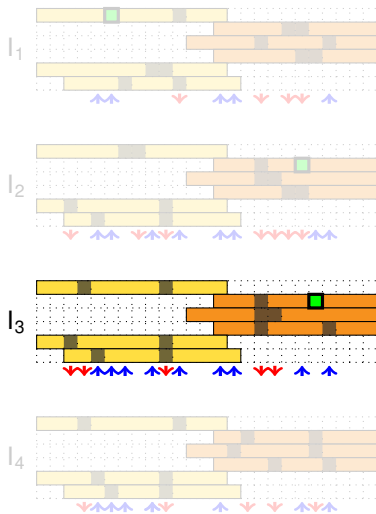
Mutation



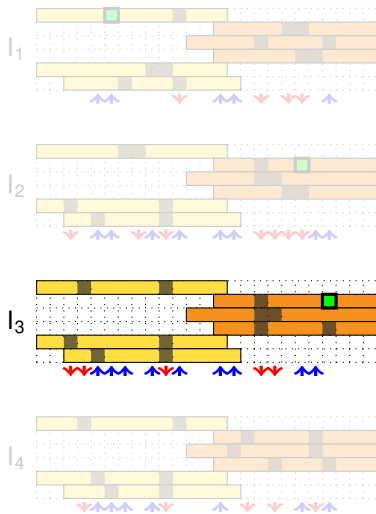
Mutation



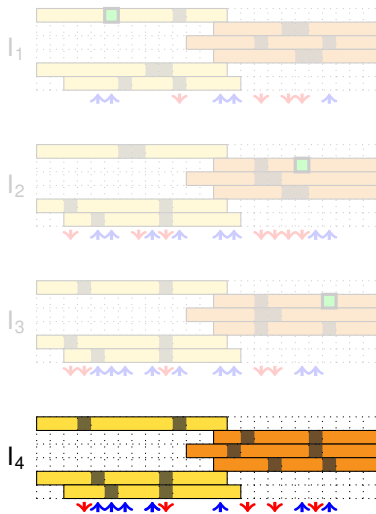
Mutation



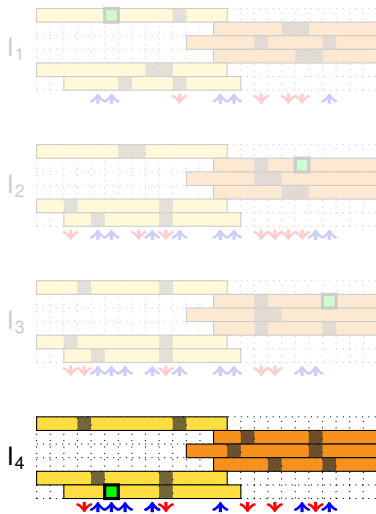
Mutation



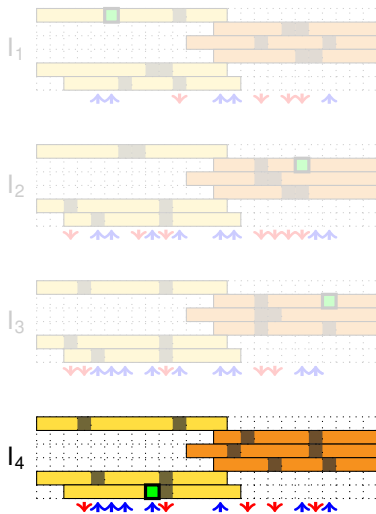
Mutation



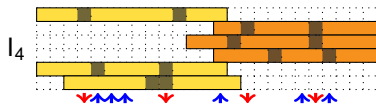
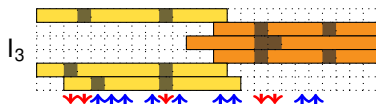
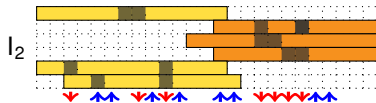
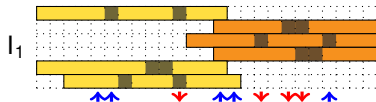
Mutation



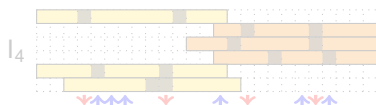
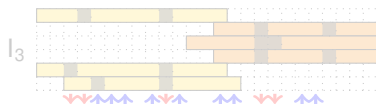
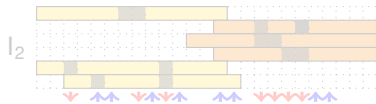
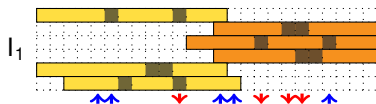
Mutation



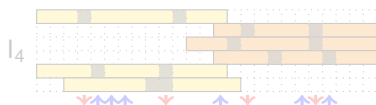
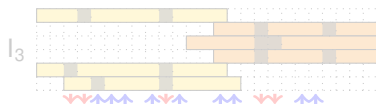
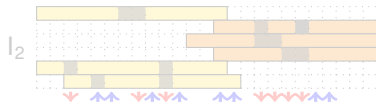
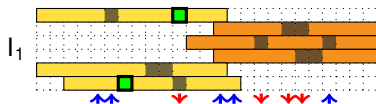
Verbesserung



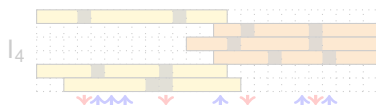
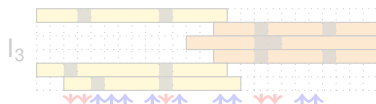
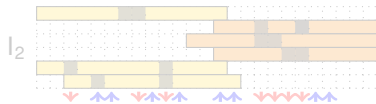
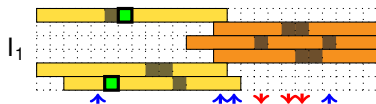
Verbesserung



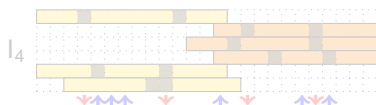
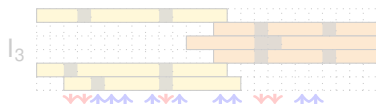
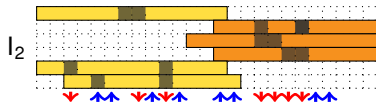
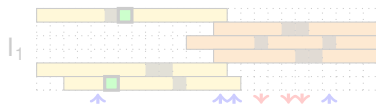
Verbesserung



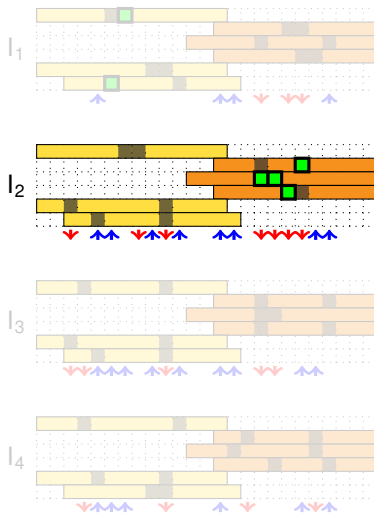
Verbesserung



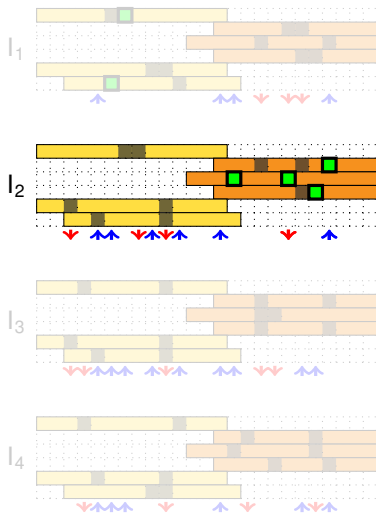
Verbesserung



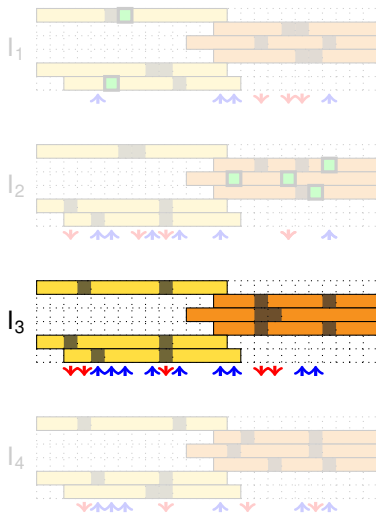
Verbesserung



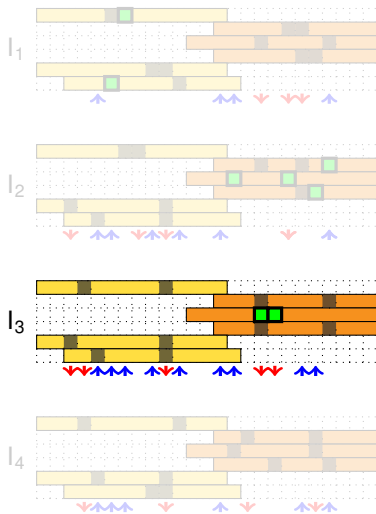
Verbesserung



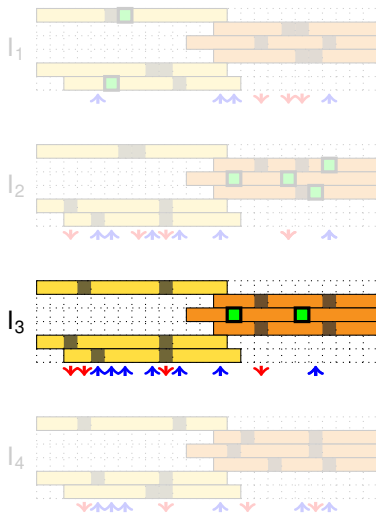
Verbesserung



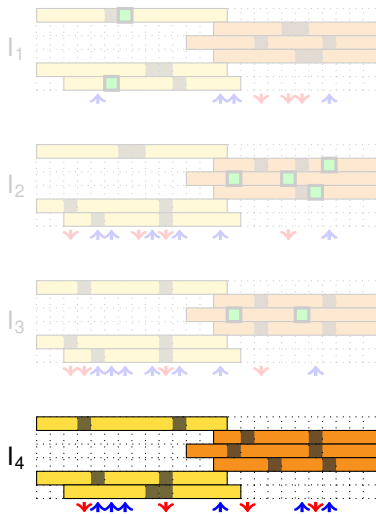
Verbesserung



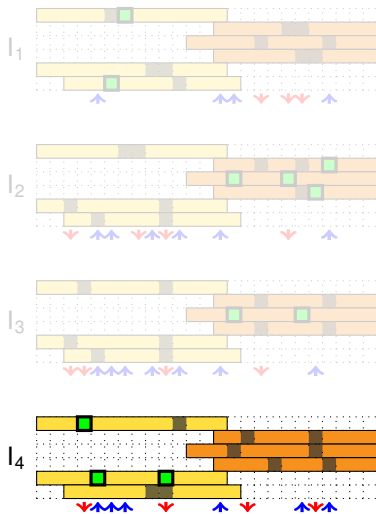
Verbesserung



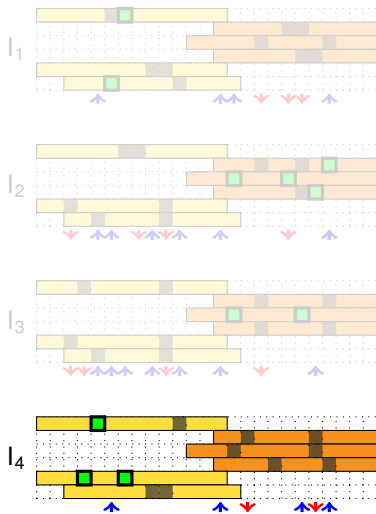
Verbesserung



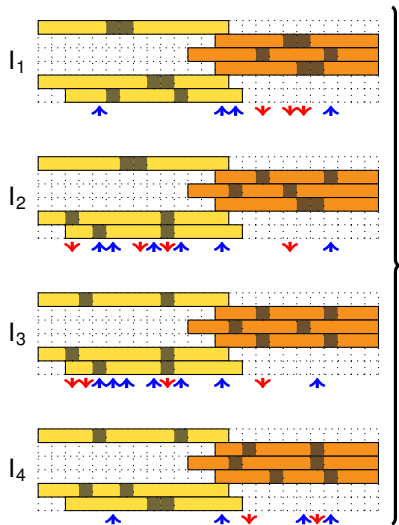
Verbesserung



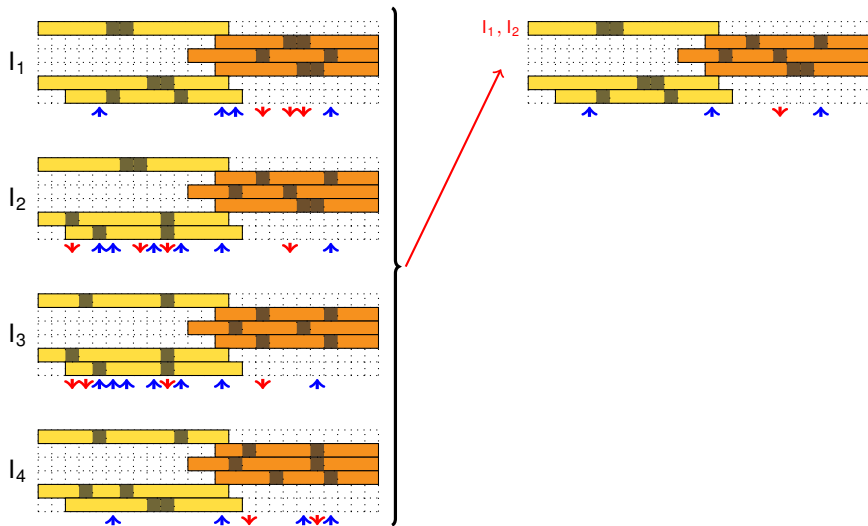
Verbesserung



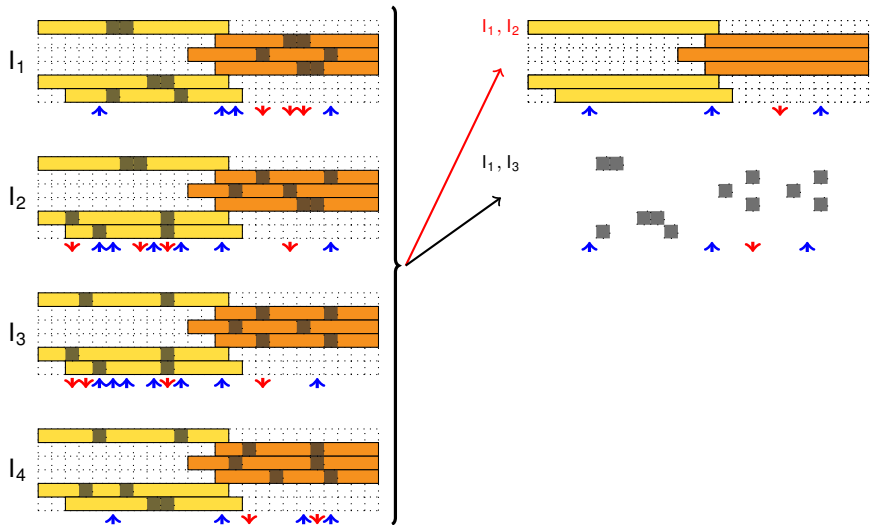
Selektion & Crossover



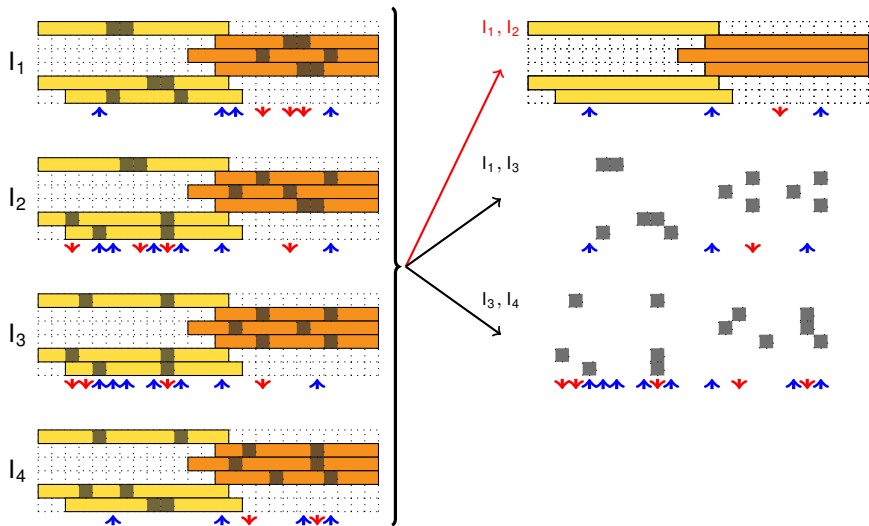
Selektion & Crossover



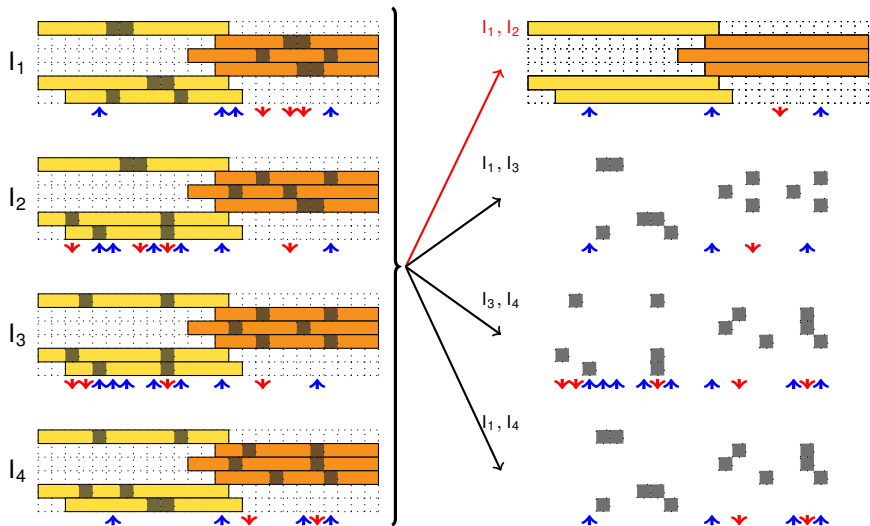
Selektion & Crossover



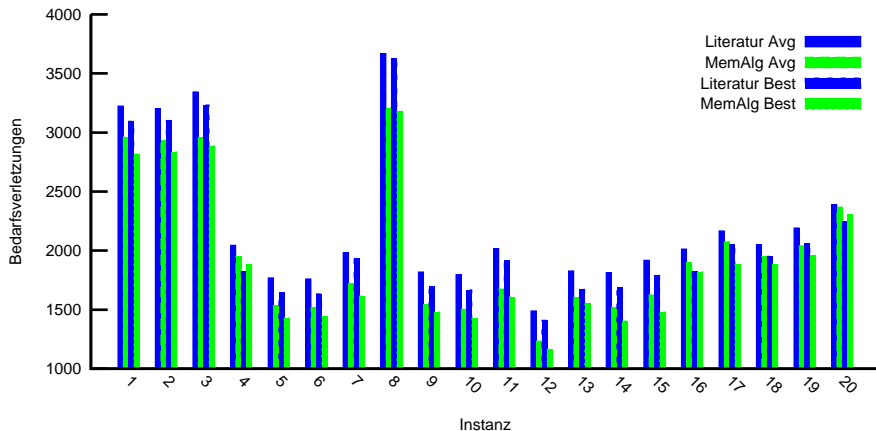
Selektion & Crossover



Selektion & Crossover



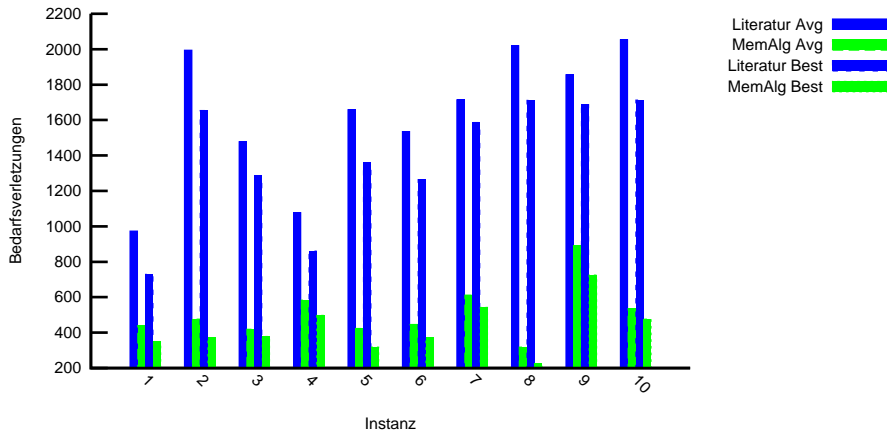
Experimente



10% Verbesserung


Neue untere Schranken für 18 von 20 Instanzen


Experimente





70% Verbesserung

Ergebnisse und Publikationen

-  M. Widl, N. Musliu, W. Schafhauser. A Memetic Algorithm for a Break Scheduling Problem. The 8th Metaheuristic International Conference, 2009.
 - ▶ Memetische **Repräsentation I**
 - ▶ **Memetischer Algorithmus** für memetische Repräsentation I
 - ▶ **Lokale Suche** basierend auf drei Nachbarschaften
 - ▶ **Parameterevaluierung**

-  M. Widl, N. Musliu. Memetic Algorithms for Break Scheduling. Journal of Heuristics. Submitted for publication
 - ▶ **NP-Vollständigkeitsbeweis**
 - ▶ Memetische **Repräsentation II**
 - ▶ **Memetischer Algorithmus** für memetische Repräsentation II
 - ▶ **Parameterevaluierung**

-  M. Widl, N. Musliu. An Improved Memetic Algorithm for Break Scheduling. HM 2010 - 7th International Workshop on Hybrid Metaheuristics. Lecture Notes in Computer Science, 2010.
 - ▶ **Verbesserter memetischer Algorithmus** für memetische Repräsentation II
 - ▶ **Strafpunktsystem**
 - ▶ **Parameterevaluierung**

-  Junior Scientist Conference 2010: Talk, Poster und Special Recognition Award

