

# QuikFix—A Repair-based Local Search Timetable Solver

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## 1 Background

The QuikFix entry for Track 3 of ITC 2007 uses heuristic local search for solving timetabling problems. It follows a tradition of local search that attempts to repair a selected broken constraint at each step of an iterative process. QuikFix has been developed and is being used for generating timetables of the Overseas Family School, a K–12 international school in Singapore.

## 2 Main Features

**Repair-based heuristic search.** In boolean satisfiability, WSAT [SKC94] pioneered repair-based local search, where an unsatisfied clause is chosen, which defines the neighborhood to be explored at each iteration. WSAT(OIP) extended WSAT to integer programming, representing the cost function as a collection of “soft constraints” [Wal98]. QuikFix adapts this approach to timetabling by directly modeling the timetabling constraints, instead of breaking them down to an integer programming model. Each step of the iterative search selects a broken timetabling constraint (soft or hard) and explores the neighborhood defined by moves that affect its degree of violation.

**Strategic oscillation.** QuikFix adapts strategic oscillation [LM97], a mechanism for escaping from local minima by modifying the weights of constraints, exploring the feasible/infeasible boundary.

**Rapid restarts.** QuikFix starts from a randomly generated assignment and applies repair-based search until it reaches a feasible region. It combines strategic oscillation with multi-starts from the currently best solution [BCFN07] and a tabu mechanism for moves to limit backtracking and to avoid re-evaluating bad moves.

**Move generation.** QuikFix uses a high-level solution variable model that is structurally constrained and is operated on by swap moves [Sch96]. Constraint-specific move generation strategies are employed to generate moves from the reduced domain that can repair the selected constraint.

**Software engineering.** QuikFix employs object-oriented design to factor constraint evaluation from neighborhood generation in a library of timetabling-specific constraint classes. Rapid reconfiguration of constraint implementations is crucial for exploring alternative implementations.

## 3 Implementation

QuikFix is a pure Java application, designed as a platform for easy experimentation and fine-tuning of the solver engine. An advanced graphical user interface allows for a runtime visualization of the timetabling process with color highlighting of broken constraints. An interactive mode allows for manual intervention to support semi-automated timetabling.

## References

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