The approach to the 3rd track of ITC2007

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A tabu search method is employed, which is briefly outlined in Algorithm 1.

Representation: A solution is represented as a timetable matrix X and an unscheduled-lecture list UL, where $x_{ij} \in X$ denotes the course scheduled in period i and room j, and $x_{ij} = 0$ if no course is scheduled there.

Objective function: The objective function is defined as the weighted sum of the hard and soft constraint violations ($hcvs(S)$ and $scvs(S)$, respectively), i.e., $f(S) = w * hcvs(S) + scvs(S)$, where $w \gg 1$ indicates the priority of $hcvs(S)$.

Initialization: Our approach is initialized with an insertion heuristic followed by a local search process. Concretely, X is first set to empty with all the lectures unscheduled. At each step of the insertion heuristic, the unscheduled lecture that is the hardest to insert is chosen and inserted in the optimal empty position of the current X. After the insertion heuristic, the local search process is applied in order to further improve the initial solution.

Move operators: During the local search and tabu search process, new solutions are generated by three move operators: single insertion, swap and period swap. "Single insertion" moves a lecture to another empty position. In "swap", two lectures belonging to different courses are swapped. In "period swap", the scheduling of two periods (i.e., two rows of X) are swapped.

Diversification: The diversification is conducted based on a metric called occurrence frequency. Among all the lectures in the current timetable matrix, the lecture that occurs most frequently in its position during previous search process is moved to another empty position.

Criteria: The algorithm terminates when a predefined time budget has been reached. Diversification will be conducted if the best solution has remained unchanged for a number of predefined iterations.

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Initialization (Using an insertion heuristic and a local search process);
while stopping criterion is not met do
    generate new solutions with three move operators;
    select the best non-tabu solution;
    repair the selected solution;
    solution and tabu list updating;
    if diversification criterion is met then
        do diversification;
    end
end
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Algorithm 1: Outline of the tabu search approach