SEMI-GREEDY HEURISTICS FOR ACADEMIC COURSE SCHEDULING

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We consider an academic course scheduling problem, which is based on the following assumptions: Let W denote the planning horizon (e.g. one week with $W = 5$ days). $w = 1, \dots, W$ represents macro-periods (days). Each macro-period w is subdivided into p_w micro-periods (e.g. hours). Thus we have $t = 1, \dots, T$ periods (time slots) with $T = \sum_w p_w$. $r = 1, \dots, R$ categories of rooms are given, with λ_{rt} being the number of rooms of category r available in time slot t . There are $z = 1, \dots, Z$ zones, the rooms belong to; H_z denotes the set of rooms in zone z . Changing from a room in zone z to a room in zone z' , $z \neq z'$, in subsequent time slots is feasible only, if there is enough travel (setup) time. Let $j = 1, \dots, J$ denote assignments of room categories to time slots ($J = R \cdot T$), in short room-periods. $i = 1, \dots, I$ subjects have to be scheduled, where subject i has a duration of τ_i micro-periods. Let $J_i \in \{1, \dots, J\}$ denote the set of feasible assignments of subject i to room-periods. c_{ij} denotes the "cost" (teachers preferences) of assigning subject i to room-period $j \in J_i$. V_i denotes the set of subjects i' which have to be scheduled in parallel with subject i . There are $d = 1, \dots, D$ teachers (professors) available; in addition, there are $s = 1, \dots, S$ groups of students (classes) attending the subjects (more than one class may belong to one subject). $\Theta_{dt}(\Gamma_{st})$ denotes the "availability level" (e.g. 0 or 1) of teacher d (class s) in time slot t .

The problem under consideration is modelled as an integer programming model with binary variables with the following structure: Maximize the sum of assignment preferences s.t. the following constraints: subject (job) completion, subject parallelism, room/class/professors availability, travel time restrictions. In addition, an upper bound on the maximal number of subjects scheduled per professor, class, and day has to be observed. Note that, in contrast to other course scheduling models (cf. e.g. [1]), we already have an assignment of teachers to subjects.

It should be noticed, that the course scheduling problem considered here is closely related to preemptive multi-mode resource-constrained project scheduling where the resources are partially renewable.

The problem is solved to suboptimality with the aid of specially designed semi-greedy heuristics based on randomized regrets [2]. In addition, benchmark solutions are provided via LP-based heuristics.

References

- [1] Dinkel, J.J., Mote, J., Venkataramanan, M.A., "An efficient decision support system for academic course scheduling", *Operations Research*, Vol. 37 (1989), pp. 853-864.
- [2] Drexl, A., "Scheduling of project networks by job assignment", *Management Science*, Vol. 37 (1991), pp. 1590-1602.