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Conference scheduling — A personalized approach☆,☆☆

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ABSTRACT

Scientific conferences have become an essential part of academic research and require significant investments (e.g. time and money) from their participants. It falls upon the organizers to develop a schedule that allows the participants to attend the talks of their interest. We present a combined approach of assigning talks to rooms and time slots, grouping talks into sessions, and deciding on an optimal itinerary for each participant. Our goal is to maximize attendance, taking into account the common practice of *session hopping*. On a secondary level, we accommodate presenters' availabilities. We use a hierarchical optimization approach, sequentially solving integer programming models, which has been applied to construct the schedule of the MathSport (2013), MAPSP (2015 and 2017) and ORBEL (2017) conferences.

1. Introduction

Scientific conferences have become an essential aspect of (academic) life. They allow researchers (i) to present their work and receive feedback, (ii) to learn from attending talks, poster sessions, or discussion panels, and (iii) to meet with colleagues, thereby inducing new collaborations. However, attending a conferences requires a considerable effort in terms of time (e.g. preparing talks, traveling time) and money (e.g. registration fees, traveling expenses, hotels) from their participants. Conferences also have a non-negligible environmental impact [2]. In fact, there is some debate about the value of scientific conferences, see e.g. [3], and how to lessen the carbon footprint of a conference [4]. Obtaining exact figures with respect to the amount of money involved in organizing scientific conferences seems difficult; it is written in [5] that "an estimate of more than 100.000 medical meetings per year may not be unrealistic ... the cumulative cost of these events worldwide is not possible to fathom". Note that this figure applies to medical conferences alone.

Given these considerations and investments, it is the responsibility of the organizers to maximize the value of a conference as much as possible. Here we focus on the construction of a conference schedule that allows participants to maximally benefit from participating. Or, making this even more concrete, the schedule should enable participants to attend the talks of their interest. This clearly benefits speakers as well, potentially increasing both the size and the level of interest of their audience. Typically, a conference schedule groups talks into *sessions* (a set of talks taking place consecutively in the same room); consecutive sessions are separated by a break. Furthermore, the vast majority of conferences feature several sessions taking place at the same moment in time, i.e. sessions are scheduled *in parallel*. Consequently, a participant may be confronted with times where several attractive talks compete for his/her attendance (i.e. a *scheduling conflict*), while at other times (s)he finds nothing of interest in the schedule. A small example is given in Fig. 1, which depicts two alternative conference schedules. In schedule 1, the participant needs to choose between preferred talks A/C, and J/L. In other words: that participant can only see half the talks he or she actually wants to see. This is not the case in schedule 2.

One popular approach to schedule conferences is *track segmentation* [6]. The organizer groups talks that cover a similar topic or method into tracks or clusters, which are then assigned to a room and scheduled in parallel. Note that a track can consist of multiple sessions. If a participant were only interested in talks from a single track, then (s)he can stay in that track's room for the duration of the conference without experiencing any scheduling conflict. However, apart from difficulties in forming meaningful clusters, track

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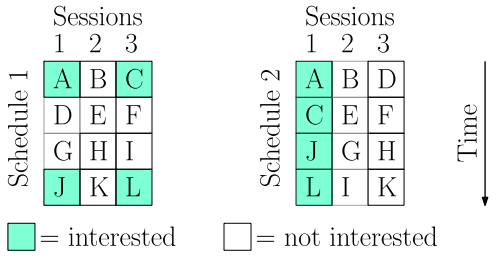

Fig. 1. The impact of the schedule on attendance.

segmentation is not very effective if the participant's preferences are diverse, and not restricted to one particular topic.

In this work, a participant is expected to provide a list of preferred talks, which he or she would like to attend. Our goal is to develop a conference schedule that maximizes the participants' satisfaction. Primarily, this means we want to avoid scheduling conflicts, thereby maximizing total attendance. Next, as a secondary goal, we want to minimize *session hopping*. Indeed, confronted with multiple talks of interest scheduled in different sessions, a participant is forced to move between several sessions in order to attend as many of his or her preferred talks as possible. We call this phenomenon session hopping, and its presence is a clear indication of the existence of strong preferences of participants. Session hopping can be perceived as disturbing by presenters and their audiences. Moreover, the session hopper still tends to miss parts of the preferred talks, due to the time it takes to switch rooms and presenters not always starting at exactly the scheduled time. Finally, motivated by practical considerations, we also take presenter availabilities into account.

Our main contribution is the description of a method for the planning of a (scientific) conference. Based on given preferences of the participants, our method schedules individual talks in order to maximize total attendance; this is in contrast to many other approaches that work on the level of sessions or streams. As a secondary, original criterion, we take session hopping into account, aiming for schedules that allow participants to stay within the same room during a session. We are the first to incorporate session hopping in our scheduling approach, as session hopping is either assumed to be forbidden or non-existing in the literature, as opposed to regular participant practice. Our method has been used to schedule four scientific conferences, namely MathSport 2013, MAPSP 2015, MAPSP2017 and ORBEL2017 — we give a detailed account of our experience with the method.

We provide an overview of related work in Section 2. A detailed problem definition, is given in Section 3, followed by computational complexity results in Section 4. Next, we describe our solution method in Section 5. Finally, we present case studies on the MathSport 2013, MAPSP 2015, MAPSP2017 and ORBEL 2017 conference in Section 6. We finish with conclusions in Section 7.

2. Literature review

Thompson [7] discerns two approaches to conference scheduling: a *presenter-based perspective* (PBP) and an *attender-based perspective* (ABP). With a PBP, the main goal is to meet time preferences and availability restrictions of the presenters. On the other hand, from an ABP, participants' preferences are solicited, in order to maximize their satisfaction. In the rest of this section, we will first discuss contributions that focus on the PBP, continue with papers that follow an ABP, and conclude with a few papers that solve subproblems of conference scheduling. Although we focus here on scheduling scientific conferences, there is also literature on scheduling meetings that are based on preferences of the participants; we mention Yingping et al. [8], Ernst et al. [9] and Ernst et al. [10].

2.1. Presenter-based perspective

Potthoff and Munger [11] discuss a problem where sessions need to be assigned to time periods (rooms are ignored). The authors assume that the clustering of talks into sessions has already been done, in a way that each session belongs to a subject area. The goal is to find a schedule that spreads the sessions for each subject area among the time slots as evenly as possible, ensuring that no presenter has other duties (e.g. being discussant) in simultaneous sessions. An IP formulation is presented and applied to a problem instance extracted from a past meeting of the Public Choice Society, including 96 sessions and over 300 participants. This problem is revisited by Potthoff and Brams [12], who extend the IP formulation to take into account presenter availabilities. Furthermore, their method is applied to schedule two Public Choice Society meetings, with 76 and 45 sessions.

Edis and Sancar Edis [13] consider a very similar problem, but at the level of talks instead of sessions. Each talk has a given topic, and should be assigned to a session and a time period, such that all talks in each session have the same topic, and the occurrence of simultaneous sessions with the same topic is minimized. Furthermore, the number of talks in different sessions with same topic should be balanced, and some talks cannot be scheduled simultaneously. The authors also discuss an extended setting where presenters have preferred and non-preferred days. An IP formulation is presented, which is used to solve a hypothetical instance, including 170 talks on one of 10 topics, to be scheduled into sessions of at most 5 talks, over 12 time periods.

Nicholls [14], like Potthoff and Munger [11], also assumes that papers have been assigned to sessions beforehand by the organizers, but includes room assignment. The problem at hand is to assign each session to a room and a time period, such that no presenter is scheduled at two sessions simultaneously. The goal is to maximize the number of presenter preferences (e.g. preferred day or time slot) met. Participant preferences are not elicited, but can be included implicitly by the program chair, for instance by allocating appropriate rooms to sessions based on expectations regarding attendance. The author presents an algorithm, which is essentially a step-wise constructive heuristic, complemented with a set of rules to accommodate preferences and resolve conflicts. Nicholls [14] applied his method to schedule a Western Decision Sciences Institute annual conference. This conference had over 300 participants, involving over 80 sessions and spanning 4 days.

2.2. Attender-based perspective

An early attempt to optimize participant satisfaction is by Eglese and Rand [15], who collect a list of 4 preferred sessions (and one reserve session) from each participant. In their conference scheduling problem, sessions need to be assigned to time periods and rooms such that the sum of the weighted violations of session preferences is minimized. Furthermore, sessions can be offered multiple times, a decision which is also part of the problem. Although the number of rooms is limited and some rooms are not equipped with the right facilities for some sessions, room capacity is assumed to be always sufficient. The paper reports the scheduling of the national Tear Fund conference, including 15 distinct sessions, over 4 time periods and 7 rooms. As an IP formulation for a problem of this size was deemed intractable at the time, the problem was solved using simulated annealing.

Sampson and Weiss [16] extend the Eglese and Rand [15] setting as they consider rooms with finite seating capacities. They present a heuristic procedure that simultaneously assigns session

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