# Scheduling EURO Conference Copenhagen 2024

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**Abstract.** The EURO conference is the second largest Operations Research (OR) conference in the world, typically having more than 700 presentations belonging to one of 70 subject streams and more than 2000 participants. This article briefly explains how the EURO-2024 was scheduled.

**Keywords:** Scheduling, Conference planning, Mathematical Programming

## 1 EURO conference planning

The EURO series of conferences is the second largest OR conference in the world, only dwarfed by the INFORMS (US) conferences. The EURO conferences always take place in Europe, but are every third year replaced by the IFORS conference. Last year the IFORS conference took place in Santiago in Chile, hence no EURO conference 2023 was held. In 2024, the EURO conference took place in Copenhagen, 30/6-3/7. This abstract is on how the conference scheduling was optimized in 2024. A previous article has already been published on scheduling the EURO conferences, but it has been substantially improved since 2018, see [1].

### 1.1 Top level and low level planning

Given the size of the EURO conferences, the centralized scheduling only makes an overall schedule of the assignment of sessions for streams, to time-slots and rooms. A stream is an overall theme of research, with one or two assigned stream organisers. When an article is submitted, it is either submitted to a specific stream or assigned by the program chair to the most appropriate stream. Examples of streams are: "Behavioural OR", "Discrete Optimization and Algorithms (contributed)" or "ORAHS: OR in Health and Healthcare". Here the stream "Discrete Optimization and Algorithms (contributed)" consists of submissions, not to any specific stream, but allocated by the program chair to this stream.

The stream organisers are typically leading researchers in the topic and they are in charge of the detailed management of the stream. Each stream is allocated a number of sessions, corresponding to the number of submissions divided by 4 rounded up. In 2022 the stream "Behavioural OR" had 35 submissions and was assigned 9 sessions. The division of labor between the scheduling team, Thomas Stidsen and Dario Pacino (Local Chair of EURO-2024), is then to assign a timeslot out of the 12 possible timeslots and

a room to each of the 9 sessions. The stream organiser will then have to assign each of the 35 presentations to one of the 9 sessions. This division of planning responsibilities have served the EURO conferences well for many years.

### 1.2 Schedule goals

The ultimate goals for the scheduling is to make the conference as pleasant and economical as possible for the participants. This is however a goal which needs to be quantified. Hence a number of different objectives exist:

- Sessions of the same stream in same room (making finding the sessions easier)
- Sessions of the same stream consecutive, i.e. if timeslot 3 has a session of a stream, if that stream has more sessions, there is either a session of the stream in timeslot 2 or 4.
- Streams which are similar in topic should not overlap in time. This cannot be avoided, but should be minimized. How similarity is defined, is detailed below.
- Streams belonging to the same Area should take place in nearby rooms
- Size of the rooms should be of sufficient size, but not too big.

## 2 Schedule Data

The data for the schedule is given as a set of streams $s \in S$, a set of timeslots $t \in T$ and a set of rooms $r \in R$. Each stream $s$ has a number of submissions $SUB_s \in Z^+$ which leads to a number of sessions for a stream $Session_s = \lceil \frac{SUB_s}{T} \rceil$. Finally we need an estimate of the number of conference participants who will join the stream to listen to the presentations. This is a number which is hard to approximate and as a very simple approximation, we simply assume that all the presenters also participate in the stream.

At EURO-2018 in Valencia, we started using a new type of model, where the concept of a pattern was used. The idea is simple: Instead of simply assigning each session each own binary variable to decide when and where to place it, we instead generate a number of patterns for each stream, see Table 1 below, where 4 patterns are found for a stream that cannot be started up in time-slot 1. Given a stream with 8 sessions, where it is not possible to have a session in the first timeslot, these 4 patterns are the only possible patterns. The big advantage of this approach is that the two first requirements of the above list of objectives are automatically obtained. It can also lead to the need for more rooms, but usually this is not problematic.

Finally, we need to quantify the relatedness of different streams. All articles submitted to a stream are allocated up to 3 keywords. Then all the keywords used for the articles of a stream is saved in a set $K_s \in Z^+$ and the number of times each keyword of a stream is used is saved in $c_{s,k} \in Z^+ \; \forall \; k \in K_s$. Then the average number of times a keyword appears in a stream is calculated: $\overline{c_s} = \frac{\sum_{k \in K_s} c_{s,k}}{|K_s|}$. Finally, the co-variance of the number of times a keyword compared to the average no of keywords appears in two different streams is calculated: $CoV_{s_1,s_2} = \frac{\sum_{k \in K} \left(c_{s_1,k} - \overline{c_{s_1}}\right)\left(c_{s_2,k} - \overline{c_{s_2}}\right)}{\sqrt{\left(\sum_{k \in K} \left(cs_1,k - \overline{c_{s_1}}\right)^2\right)\left(\sum_{k \in K} \left(c^- s_2,k - \overline{c_{s_2}}\right)^2\right)}}$

| Pat | MA | MB | MC | MD | TA | TB | TC | TD | WA | WB | WC | WD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | X | X | X | X | X | X | X | X | | | |
| 2 | | | X | X | X | X | X | X | X | X | | |
| 3 | | | | X | X | X | X | X | X | X | X | |
| 4 | | | | | X | X | X | X | X | X | X | X |

Table 1: Patterns for an 8 session stream

## 3 Schedule Model

The basic decision for the overall scheduling of the conference is hence to choose a pattern for a session $s$ and select a room $r$. This is represented by the binary variable $x^s_{t,r} \in \{0, 1\}$ which takes the value 1 if stream $s$ uses the pattern with the first time-slot use $t$ in room $r$.

This leads to the following, relatively simple model:

$$\min \sum_{s1,s2,tp1,tp2,r} CoV_{s1,s2} \cdot pat\_overlap^{s1,s2}_{t1,t2} \cdot x^{s1}_{tp1,r} \cdot x^{s2}_{tp2,r}$$

Such that:

$$\sum_{tp,r} x^s_{tp,r} = 1 \qquad \forall\, s$$

$$x^s_{tp,r} \in \{0, 1\}$$

The above model is quadratic, but is easily linearized. Since the actual planning is not yet finalized at the time of abstract submission, we expect more objectives and constraints to be added, and these will also be presented. At EURO-2022 in Finland additional constraints were implemented to optimize the co-location of related streams in nearby rooms. The selection of rooms was also optimized.

## References

1. Stidsen, Thomas, David Pisinger, and Daniele Vigo. Scheduling euro-k conferences. *European Journal of Operational Research*, 270(3):1138–1147, 2018.