DOI: 10.20396/revpibic2720192324

Modelling a timetabling problem related to academic conferences and solutions throught exact method

Daniel G. Zem*, Cleber D. Rocco.

Abstract

This study has approched timetabling problems and use them in academic conferences in order to arrange the submitted papers to scheduled presentations, those have assigned one theme among several, to be presented in a given room and timeslot provided by the conference. Futhermore, applied timetabling problems were reviewd to gather knowledge in how those were mathematically modelled and which solution methods were used to solve them. In the case study conducted in a large scientific conference in Brazil, an optimization model was built and an exact method (Simplex by Gurobi solver) was employed to solve the problem. The outcomes are promissing and this study remains in the authors agenda.

Key words: *timetabling problems, mixed integer problem, academic conferences.*

Introduction

Design a timetable may be a complex task, even more if performed manually, because as a timetabling problem is classified as a combinatorial problem[1], there can be a considerable large number of variables and specially constraints to keep track on if they are being satisfied, hence the task would take a great amount of time and hard working to be accomplished and yet, the solution found may not be the best.

Moreover, timetabling problems may be applied on different areas, such as transportation, sports, medical, among other, in the educational field, there are three main classes: (i) School, (ii) Course and (iii) Examination timetabling problems[2]. Despite these three main classes, there are problems that can be viewed as a mix of them[2], for example, the timetable of an academic conference can be a modelled as a mix of School and Course timetabling problems.

The objective of this study was to develop a mathematical model that can obtain satisfactory solutions for a timetable of an academic conference, in a way to avoid that the theme of a paper changes from the one originally submitted by the author(s) and papers with the same theme must not be presented at the same time but in different rooms, among other constraints.

Results and Discussion

The Academic Conference Timetabling problem in this project was modelled mathematically and implemented in Python version 2.7, using the solver Gurobi version 8.1. The data used on the model are from the papers presented in the 50th Brazilian Operational Research Symposium (SBPO) and the model's results were compared with the timetable of the 50th edition of SBPO[3].

The model has 548592 variables and 29828 constraints, those assure that, in a room, the minimum and maximum number of papers within the same theme presented are respected and also that just one theme can be assigned to the room in a timeslot, besides those, the constraints regarding to the papers, they must have just one theme and be allocated just in one room and timeslot, lastly, if the theme assigned for a room changes on the consecutive timeslots, a penalty price is paid. On the objective function, a benefit is given if the theme assign for a paper is the same one submitted by the author(s) when they sign up and whether rooms with the same theme are allocated consecutively. For the costs, the penalty cost is accounted whether a room have its theme changed through consecutive timeslots. By solving it by exact method (Gurobi), with an executional time of 24 hours, it is returned a solution with a Gap of 3,14%.

The results show a timetable whose it has changed only nine papers' theme compared to the solution of the 50th SBPO[3], which eighteen papers' theme were changed. In addition, if someone from the public wanted to be in the presentations from all the papers with the same theme, they would have to change rooms between one timeslot and another 21 times and for some themes this would not be possible because for ten times there were papers with the same theme being presented on the same timeslots but in different rooms during the event, in the model formulated in this project, none of the both situations happen.

Conclusions

In conclusion, the model proposed here is simpler than the one use to generate the timetable for the 50th SBPO and it gives a better solution, but the time to get it is much longer. To continue this project, it is aimed to minimize the situations that the public would have to go from one room to another to watch the presentation of papers with the same theme and the amount of papers with their themes changed. In order to get a good solution in a short amount of time, it is being study through published papers to develop a solution method based on heuristics for the problem.

Acknowledgement

The authors would like to thank the scholarship from SAE-UNICAMP in the PIBIC program.

[1] Skoullis et al. Solving the high school timetabling problem using a hybrid cat swarm optimization based algorithm. Appl Soft Comput J [Internet]. 2017;52:277–89. Available from: http://dx.doi.org/10.1016/j.asoc.2016.10.038

[2] Schaerf, A. (1999). **Survey of automated timetabling**. Artificial Intelligence Review, 13(2), 87–127. https://doi.org/10.1023/A:1006576209967

[3] Correia, R., Subramanian, A., Huachi, P., & Penna, V. (2018). O Problema de Programaçao de Sessões Técnicas de Conferências: o caso do SBPO. Sbpo.