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## GUEST EDITORIAL

## Trends in Multi-Disciplinary Scheduling

Scheduling, as a research discipline, spans a variety of applications; including timetabling, project scheduling and vehicle routing, to name just a few. The problems that need to be addressed have become ever more complex as the world develops. Methodologies may now need to deal with issues that were not so important even just a few years ago. Examples include dealing with perishable goods, reverse logistics, healthcare applications of scheduling, reducing carbon emissions and addressing the Sustainable Development Goals (SDGs). As such, there is a need for methodologies to keep abreast of these developments and, increasingly, this requires expertise drawn from across different disciplines to tackle these complex problems. Therefore, it is timely to have a selection of papers that provide an insight into some of the advances being made in multi-disciplinary approaches to scheduling.

This Special Issue of the Journal of the Operational Research Society contains nine selected papers from the 2017 Multidisciplinary International Scheduling Conference: Theory and Applications (MISTA) that was held in Kuala Lumpur, Malaysia (5-8 December 2017). In addition, the conference chairs were invited to write a review paper in one of the areas addressed by the conference. Like the selected papers, this review paper was subject to the usual peer review process that would be expected from a journal such as this.

Following the conference, authors were invited to submit revised versions of their papers to a special issue of the Journal of the Operational Research Society. The papers selected here contribute to the current trends in multi-disciplinary scheduling, which includes scheduling, parallel machines for scheduling, flow shop scheduling, vehicle routing, assignment problems and project scheduling. The 10 accepted papers are those that received supportive reviews after undergoing a rigorous review process in keeping with the expectations of an internationally highly recognised journal.

Two of the papers in this special issue consider different aspects of scheduling problems. Soler et al. (2021) propose an efficient relax-and-fit procedure to address lot sizing and scheduling problems in the food industry in their paper, "MIP approaches for a lot sizing and scheduling problem on multiple production lines with scarce resources,
temporary workstations, and perishable products". Dealing with the passengers' point of view, Yang et al. (2021) work on improving the efficiency of an urban rail transit line with spatially unbalanced passenger demand in "Dynamic passenger demand-oriented train scheduling optimization considering flexible short turning strategy".

There are three papers that focus on parallel machines for scheduling problems. Li et al. (2021), in "Scheduling customer orders on unrelated parallel machines to minimise total weighted completion time", develop several optimality properties to address scheduling customer orders, bringing new perspectives to the management of differentiated customers in a complicated production environment. Rocholl and Mönch (2021) propose a biased random-key algorithm (BRKGA)-based decomposition scheme that is hybridized with a decomposition heuristic and integer programming with "Decomposition heuristics for parallel-machine multiple orders per job scheduling problems with a common due date". Lin et al. (2021) present their paper for "On-line scheduling with equal-length jobs on parallel-batch machines to minimise maximum flow-time with delivery times" where they search for the best possible online algorithm of different competitive ratio to address this problem.

There is one paper that addresses flow shop scheduling. Gilenson and Shabtay (2021), in "Multi-scenario scheduling to maximise the weighted number of just-in-time jobs", tackle the case where the processing times and weights are scenario dependent.

Two papers address the vehicle routing problem. In "Dispatch and conflict-free routing of capacitated vehicles with storage stack allocation", Thanos et al. (2021) propose a heuristic approach to minimize the total completion time of box pickup, delivery and relocation requests in a warehouse environment. In the other vehicle routing paper, "Vehicle routing: a review of benchmark datasets" (Gunawan et al. 2021), the authors review the benchmark datasets.

The final two papers study the assignment problem and project scheduling. Marzouk and Kamoun (2021) present "Nurse to patient assignment through an analogy with the bin packing problem: Case of a Tunisian hospital" where a binary linear integer programming problem is formulated for a task with the proposed
solution using the Max-Max assignment heuristic. Finally, Edwards et al. (2021) talk about "Symmetry breaking of identical projects in the high-multiplicity RCPSP/max" where they show symmetry breaking approaches, allowing solution methodologies to find solutions and prove their optimality for high-multiplicity resource-constrained project scheduling problem with generalized precedence constraints.

We would like to thank all those that carried out reviews for both the MISTA conference and for this special issue. We recognise the time and effort involved in providing high quality reviews, and we are extremely grateful for all their help. Without this support from the international scientific community, neither the conference, nor the special issue would have been possible.

We would also like to thank the local organisation team in Kuala Lumpur, with a special thank you to Debbie Pitchfork (University of Nottingham), for their help in organising the conference. Without their help, the job of organising the conference would be much more difficult.

## Note

MISTA 2017 saw 53 oral presentations. These consisted of both full papers and abstracts. Both abstracts and papers appeared in the conference proceedings and they are all available from the conference website (https://bit.ly/3ohP53O). The MISTA website (http://www.schedulingconference. org) provides access to all previous papers published from the series of MISTA conferences.

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