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Aims and Scope

Optimization has been expanding in all directions at an astonishing rate during the last few decades. New algorithmic and theoretical techniques have been developed, the diffusion into other disciplines has proceeded at a rapid pace, and our knowledge of all aspects of the field has grown even more profound. At the same time, one of the most striking trends in optimization is the constantly increasing emphasis on the interdisciplinary nature of the field. Optimization has been a basic tool in all areas of applied mathematics, engineering, medicine, economics, and other sciences.

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Just-in-Time Systems

 Springer

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Preface

Just-in-time (JIT) philosophy was introduced in the 1950s. Its aim was to reduce inventory and its associated costs. Nowadays, JIT is associated with efficiency, continuous improvement, quality, and optimal flow. JIT started in industries but it quickly attracted the interest of the researchers since its implementation involves difficult problems that have been, and will be, challenging the scientific community.

There is a large community dealing with JIT scheduling. As we show in the first part of this book, the scheduling models, their analysis, and their resolution methods are vast and are continuously expanding. Nevertheless, JIT is covering and integrating other parts of the supply chain as presented in the second part of the book. If we define a system as a set of interacting components forming an integrated whole, then the title of this book emerges: “JIT systems”. Indeed, not only one of the main objectives for us is to present state-of-the-art articles in JIT scheduling but also is to show that JIT includes lot-sizing, forecasting, game theory, mass production, and transfer lines.

The book is comprised of invitation-only articles written by experts in the JIT field. Each manuscript has been strictly peer-reviewed to ensure the quality of the work. The aim of the book is to present models, methods, algorithms, applications, or case studies of JIT systems. The target audience of this book will be professionals, researchers, and graduate students from diverse fields such as Operations Research, Management Science, Computer Science, and Discrete Mathematics.

Part I of the book deals with a surprising variety of JIT scheduling models. First, a survey of scheduling to maximizing the number of JIT jobs is presented by Shabtay and Steiner. It deals from the single machine case to the shop cases. Then, Tanaka contributed an article dealing with the exact resolution of the single machine earliness–tardiness scheduling. Indeed, earliness penalties can be considered as inventory costs while tardiness ones are related to the displeasure of the customer when a delay occurs. Yang and Yang present another field studied in scheduling that arises when the jobs or tasks have deteriorating and learning effects on a single machine.

In the scheduling literature, the single machine problem has received most of the attention. Nevertheless, the parallel machine case is interesting and closer to

the real problems industries have. Vallada and Ruiz present a genetic algorithm for the parallel machine earliness–tardiness problem with setup times. Moreover, Ronconi and Birgin deal with the exact resolution of the flowshop earliness–tardiness scheduling case. Soukhal and Hyunh Toung analyse the particular but challenging case of having jobs with equal processing times. Last article of Part I is by Oulamara and focus on scheduling problems where the jobs must be processed in batches as it often happens in the real world.

Part II of this book is intended to problems that include or integrate other parts of the production system. First, Jósefowska deals with the mass production environment where it is too costly to define and control due dates for individual items. Instead, the objective is to construct schedules with minimum deviation from an ideal product rate. Absi, Dautère-Pérez, and Kedad-Sidhoum show that JIT systems integrating the lot-sizing and the scheduling phases are actually interesting and challenging. Gourvès, Monnot, and Telelis examine an algorithmic game-theoretic approach to optimizing the performance of distributed systems utilized by autonomous self-interested users. They focus on scheduling with parallel machines with setup times.

For a JIT system to work properly, accurate forecasts are sought. In particular, neural networks can be extremely useful. This subject is treated by Cabrera-Ríos, Salazar-Aguilar, Villareal-Marroquín, and Anaya Salazar. The paper of Low and Jayawickrama present a real life building project that is managed with the JIT system. Finally, Gökçe, Dinçer, and Örnek study the throughput rates of transfer lines with pull systems.

Collectively, this book describes recent advances in JIT systems. We acknowledge that there are many topics that are not covered due to the limitations of space. Nevertheless, we trust that those that are included here will provide information and motivation to explore this research area.

We thank foremost the authors for their outstanding contributions and their cooperation for this project. Furthermore, we thank Professor Panos Pardalos, editor of the Springer Series on Optimization and Its Applications, for accepting and encouraging this project. We also thank Vaishali Damle and Meredith Rich from Springer for their support throughout the edition process of this book. We specially thank the anonymous reviewers who have greatly improved the quality of the chapters. We are also grateful to Omar Ibarra-Rojas and Mónica Elizondo-Amaya from UANL for their help during the edition of the book.

San Nicolás de los Garza, Mexico

Yasmín A. Ríos-Solís
Roger Z. Ríos-Mercado

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