Proceedings of the 2015 International Conference on Operations Excellence and Service Engineering
Orlando, Florida, USA, September 10-11, 2015

A Case Study Job-Shop Project Planning and Scheduling Problem

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Abstract

This paper, based on a real-life case study, looks at the job shop scheduling problem from a project planning and scheduling perspective. In the job-shop in question, every client customer order is considered as a project with a batch of parts. We propose a hierarchical production planning approach to scheduling production. First, a planning model produce a long-term plan for the production considering promised due-dates. Then, the result from the planning model is used in the scheduling model to provide a short-term schedule for the production, whose objective is to minimize total weighted tardiness. The optimization model is coded in Pulp, a linear/integer programming modeler written in Python, which can call standard LP/MIP packages. There are multiple resource constraints (operators and machines) with generalized precedence relations. Also, alternative resources may be used for jobs within a project. However, there is a requirement that the entire batch be completed consecutively and the same resources be used for all jobs in a batch. Once a machine resource is assigned to a job, no other jobs can be allocated to the resource during the job processing time. However, with operator usage, some batches may not require the resource's full capacity. Hence, operators may be assigned to more than one job during a specific period, to the extent of their full capacity. Some numerical results are presented as well as how the model can be used flexibly to either promise orders or reschedule batches in case of unforeseen delays due to machine breakdown or operator unavailability.