

A mixed integer programming approach to multi-skilled workforce scheduling

Cuevas, R., Ferrer, J. C., Klapp, M., & Muñoz, J. C. (2016). A mixed integer programming approach to multi-skilled workforce scheduling. *Journal of Scheduling*, 19(1), 91-106. <10.1007/s1095> Accessed 18 Dec 2020.

Abstract

The potential benefits of using human resources efficiently in the service sector constitute an incentive for decision makers in this industry to intelligently manage the work shifts of their employees, especially those dealing directly with customers. In the long term, they should attempt to find the right balance between employing as few labor resources as possible and keeping a high level of service. In the short run (e.g., 1 week), however, contracted staff levels cannot be adjusted, and management efforts thus focus on the efficient assignment of shifts and activities to each employee. This article proposes a mixed integer program model that solves the short-term multi-skilled workforce tour scheduling problem, enabling decision makers to simultaneously design workers' shifts and days off, assign activities to shifts and assign those to employees so as to maximize and balance coverage of a firm's demand for on-duty staff across multiple activities. Our model is simple enough to be solved with a commercial MIP solver calibrated by default without recurring to complex methodologies, such as extended reformulations and exact and/or heuristic column generation subroutines. A wide computational testing over 1000 randomly generated instances suggests that the model's solution times are compatible with daily use and that multi-skilling is a significant source of labor flexibility to improve coverage of labor requirements, in particular when such requirements are negatively correlated and part-time workers are a scarce resource..

Keywords

Workforce management, Labor productivity, Shift scheduling problem, Tour scheduling problem, Multi-skilling.