Optimizing workforce scheduling and routing problem with electric vehicles

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Abstract

Motivated by a real-life technician routing and scheduling problem that a company in energy distribution sector faces on a daily basis, in this study, we work on a workforce scheduling and routing problem (WSRP) that involve dispatching of a number of multi-skilled personnel to a set of geographically distributed tasks having multi-skill requirements, different priority levels, and precedence relationships. These days, electric vehicles are preferred by such service companies instead of conventional vehicles due to environmental considerations and cost reductions. The WSRP addressed in this study differs from the traditional problems in this domain by use of electric vehicles to perform tasks and consideration of the charging needs of these vehicles. The objective is to minimize total weighted completion time of all tasks, where the tasks that cannot be performed in the current planning horizon (shift) are assumed to be completed during the upcoming shift. We develop a mathematical formulation to address the problem. As the computational effort grows for realistic size instances, we propose a metaheuristic based on a variable neighborhood search. We analyze the performance of the proposed solution approach through computational analysis on instances derived from literature.

Keywords: Service operations, Electric VRPs, Workforce scheduling and routing, Metaheuristics

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