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An effective teaching-learning-based optimization algorithm for the multi-skill resource-constrained project scheduling problem

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Abstract

Purpose – The purpose of this paper is to consider one of the recent and practical extensions of the resource-constrained project scheduling problem (RCPSP) termed as the multi-skill resource-constrained project scheduling problem (MSRCPSP) for investigation. The objective is the minimization of the makespan or total project duration.

Design/methodology/approach – To solve this complex problem, the authors propose a teaching–learning-based optimization (TLBO) algorithm in which self-study and examination have been used as additional features to enhance its exploration and exploitation capabilities. An activity list-based encoding scheme has been modified to include the resource assignment information because of the multi-skill nature of the algorithm. In addition, a genetic algorithm (GA) is also developed in this work for the purpose of comparisons. The computational experiments are performed on 216 test instances with varying complexity and characteristics generated for the purpose.

Findings – The results obtained after computations show that the TLBO has performed significantly better than GA in terms of average percentage deviation from the critical path-based lower bound for different combinations of three parameters, namely, skill factor, network complexity and modified resource strength.

Research limitations/implications – The modified TLBO proposed in this paper can be conveniently applied to any product or service organization wherein human resources are involved in executing project activities.

Practical implications – The developed model can suitably handle resource allocation problems faced in real-life large-sized projects usually administered in software development companies, consultancy firms, R&D-based organizations, maintenance firms, big construction houses, etc. wherein human resources are involved.

Originality/value – The current work aims to propose an effective metaheuristic for a more realistic version of MSRCPSP, in which resource requirements of activities may be more than one. Moreover, to enhance the exploration and exploitation capabilities of the original TLBO, the authors use two additional concepts, namely, self-study and examination in the search process.

Keywords Project management, Algorithms, Scheduling, Heuristics, Optimization

Paper type Research paper

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