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Modeling Operating Theater Scheduling and Configuration: An Integrated Model in Health-Care Logistics

Authors : Sina Keyhanian, Abbas Ahmadi, Behrooz Karimi

Abstract : We present a multi-objective binary programming model which considers surgical cases are scheduling among operating rooms and the configuration of surgical instruments in limited capacity hospital trays, simultaneously. Many mathematical models have been developed previously in the literature addressing different challenges in health-care logistics such as assigning operating rooms, leveling beds, etc. But what happens inside the operating rooms along with the inventory management of required instruments for various operations, and also their integration with surgical scheduling have been poorly discussed. Our model considers the minimization of movements between trays during a surgery which recalls the famous cell formation problem in group technology. This assumption can also provide a major potential contribution to robotic surgeries. The tray configuration problem which consumes surgical instruments requirement plan (SIRP) and sequence of surgical procedures based on required instruments (SIRO) is nested inside the bin packing problem. This modeling approach helps us understand that most of the same-output solutions will not be necessarily identical when it comes to the rearrangement of surgeries among rooms. A numerical example has been dealt with via a proposed nested simulated annealing (SA) optimization approach which provides insights about how various configurations inside a solution can alter the optimal condition.

Keywords : health-care logistics, hospital tray configuration, off-line bin packing, simulated annealing optimization, surgical case scheduling
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