Multi-commodity inventory-location problem with two different review inventory control policies and modular stochastic capacity constraints

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In this article, we introduce two novel multi-commodity inventory-location models considering continuous and periodic review inventory control policies and modular stochastic capacity constraints. The models address a logistic problem in which a single plant supplies a set of commodities to warehouses where they serve a set of customers or retailers. The problem consists of determining which warehouses should be opened, which commodities are assigned, and which customers should be served by the located warehouses; as well as their reorder points and order sizes in order to minimize costs of the system while satisfying service level requirements. This problem can be formulated as a mixed-integer nonlinear programming model, which is non-convex in terms of modular stochastic capacity constraints and the objective function. A Lagrangian relaxation and the subgradient method solution approach is proposed. We consider the relaxation of three sets of constraints, including customer assignment, warehouse demand, and variance constraints. Thus, we develop a Lagrangian heuristic to determine a feasible integer solution at each iteration of the subgradient method. An experimental study shows that the proposed algorithm provides good quality gaps and near-optimal solutions in a short time. It also evinces significant impacts of the selected inventory control policy into total costs and network design, including risk pooling effects, when it is compared with different review period values and continuous review. © 2020 Elsevier Ltd

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