A Bi-Objective Model to Optimize the Total Time and Idle Probability for Facility Location Problem Behaving as M/M/1/K Queues

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Abstract : This article proposes a bi-objective model for the facility location problem subject to congestion (overcrowding). Motivated by implementations to locate servers in internet mirror sites, communication networks, one-server-systems, so on. This model consider for situations in which immobile (or fixed) service facilities are congested (or queued) by stochastic demand to behave as M/M/1/K queues. We consider for this problem two simultaneous perspectives; (1) Customers (desire to limit times of accessing and waiting for service) and (2) Service provider (desire to limit average facility idle-time). A bi-objective model is setup for facility location problem with two objective functions; (1) Minimizing sum of expected total traveling and waiting time (customers) and (2) Minimizing the average facility idle-time percentage (service provider). The proposed model belongs to the class of mixed-integer nonlinear programming models and the class of NP-hard problems. In addition, to solve the model, controlled elitist non-dominated sorting genetic algorithms (Controlled NSGA-II) and controlled elitist non-dominated ranking genetic algorithms (NRGA-I) are proposed. Furthermore, the two proposed metaheuristics algorithms are evaluated by establishing standard multiobjective metrics. Finally, the results are analyzed and some conclusions are given.