Chansiri Singhtaun 2007: Efficient Algorithms for Capacitated Multi-facility Location Problems. Doctor of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Associate Professor Peerayuth Charnsethikul, Ph.D. 107 pages.

This research is created to find the solutions to squared- Euclidean distance capacitated multi-facility location problems where the costs are directly proportional to distances and the amount shipped. The algorithms for both specific and general cases of this problem are developed.

For the specific case, the problem with balanced transportation constraints is shown to be equivalent to a minimizing concave quadratic integer programming problem subject to transportation constraints. The extreme point ranking based method, which utilizes a special structure of constraints, is developed. It can be ensured to provide the optimal solution by comparing with a linearization method.

For the general case, the problem with unbalanced transportation constraints is shown to be a sum-of- ratio problem, which if each denominator functions is fixed at a certain value; the problem will be equivalent to the specific problem. The proposed extreme point ranking based method can be combined with explicit branching on the denominator functions as an empirical exact algorithm. Owing to the large computational time, a branch-and-bound based heuristics algorithm is created. Each branch uses a rectangular partition with lower bound and upper bound computed by utilizing the extreme point ranking based method and the proposed multistart trust-region method sequentially. The results show that with much less time the proposed heuristic algorithm can provide the solution within $0.62 \pm 0.42\%$ of absolute error with 99% confidence comparing with the empirical exact algorithm.

_____ _____ ___ / ___ / ___

Student's signature Thesis Advisor's signature