A Branch-and-Price Algorithm for Facility Location with General Facility Cost Functions

by

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Date: 28 April 2020 (Tuesday)
Time: 2:30pm - 3:30pm
Online Session in Blackboard*: Research Seminar by Dr Miao SONG

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(Conducted in English)

Abstract:
Most existing facility location models assume that the facility cost is either a fixed setup cost or comprised of a fixed setup and a problem-specific concave or submodular cost term. This structural property plays a critical role in developing fast branch-and-price, Lagrangian relaxation, constant ratio approximation, and conic IP reformulation approaches for these NP-hard problems. Many practical considerations and complicating factors, however, can make the facility cost no longer concave or submodular. By removing this restrictive assumption, we study a new location model that considers general nonlinear costs to operate facilities in the facility location framework. The general model does not even admit any approximation algorithms unless P=NP because it takes the unsplitable hard-capacitated metric facility location problem as a special case. We first reformulate this general model as a set-partitioning model and then propose a branch-and-price approach. Although the corresponding pricing problem is NP-hard, we effectively analyze its structural properties and design an algorithm to solve it efficiently. The numerical results obtained from two implementation examples of the general model demonstrate the effectiveness of the solution approach, reveal the managerial implications, and validate the importance to study the general framework.

Bio:
Dr. Miao Song got her PhD degree from MIT in 2010. She then joined the Department of Industrial and Manufacturing Systems Engineering at the University of Hong Kong as an assistant professor. She has been an associate professor in the Department of Logistics and Maritime Studies at the Hong Kong Polytechnic University since 2015. Her research focuses on applications of optimization methods in operations management, particularly inventory and pricing problems. Her research works have been published in top journals such as Operations Research, Management Science, and Production and Operations Management.

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All PolyU staff and students are welcome!