

## UNIVERSITY OF BRESCIA

## DEPARTMENT OF ECONOMICS AND MANAGEMENT



## SEMINAR

## Crowdshipping in Dynamic Pickup-and-Delivery Problems

**Prof. Demetrio Laganà** Università della Calabria

Chair: Prof. Luca Bertazzi University of Brescia

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The recent acceleration of technology has influenced distribution logistics and many other sectors. In a competitive global marketplace, customers consider the time factor to be a significant issue in their supplier selection. As customer demands rise, last-mile logistics companies must optimize their delivery capacity. They must also consider how to manage the growing volume of packages according to the concept of sustainability and the principles of the sharing economy, which are key issues in logistics. In this context, we study a particular class of vehicle routing problem identified as the pickup-and-delivery problem (PDP), in which each customer is characterized by a request pickup location and a delivery location in a context of same-day delivery. Based on the attributes of a customer request, a dispatcher dynamically schedules the delivery service on either a dedicated vehicle or a crowdshipper, both of whom experience time-dependent travel times. While dedicated vehicles are available throughout the day, the availability of crowdshippers is unknown a priori and they appear randomly for only portions of the day. With an objective of minimizing the sum of routing costs, piece-rate crowdshipper payments, and lateness charges, we model the uncertainty in request arrivals and crowdshipper appearances as a Markov decision process. To determine an action at each decision epoch, we employ a heuristic that partially destroys the existing routes and repairs them under the guidance of a parameterized cost function approximation that accounts for the remaining temporal capacity of delivery vehicles. We benchmark our real-time heuristic with an adaptive large neighborhood search and demonstrate the effectiveness of our method with several performance metrics.

> Via S. Faustino 74/B, 25122 Brescia (BS), Italy Tel +39 030 2988896 <u>commissionericerca.dem@unibs.it</u>