17th CEMS Workshop on Logistics and Supply Chain Management

Louvain School of Management
Université catholique de Louvain
December 3, 2014

Université Saint-Louis, Brussels

PROGRAM

Address: room P61 (119, rue du Marais), Université Saint-Louis, Brussels

12:15 – 13:00  Sandwich lunch
13:00 – 13:40  The NODUS Multimodal Freight Network Model
               Bart JOURQUIN,
               Louvain School of Management, UCL Mons
13:40 – 14:20  Alternative Incentives in Inventory Management - How do Performance Metrics Affect Inventory Decisions?
               Michael BECKER-PETH,
               University of Cologne
14:20 – 15:00  Vessel Capacity Restrictions in the Fleet Deployment Problem. An Application to Panama Canal.
               Manuel HERRERA RODRÍGUEZ
               Altagracia Consultores, S.L.P.
15:00 – 15:20  Coffee break
15:20 – 16:00  A Resolution of an Express Shipment Service Network Design with Branch and Price
               Pierre Yves MISTIAEN,
               Louvain School of Management, Université catholique de Louvain
16:00 – 16:40  Modeling Load Retrievals in Puzzle-based Storage Systems
               Masoud MIRZAEI,
               Rotterdam School of Management, Erasmus University
ABSTRACTS

The NODUS Multimodal Freight Network Model

Prof. Bart JOURQUIN,
Louvain School of Management, Université catholique de Louvains (Mons)

For almost 25 years, the members of the Group Transport & Mobility (GTM) at UCL Mons (formerly FUCaM) have conducted a number of projects (transportation plans, cost-benefit analysis, internalization of external costs, estimations of elasticity’s, optimal locations for container terminals, …) that involve the modeling of freight transport networks at a strategic level, considering the multimodal and intermodal contexts for road, railroad and inland waterways transports.

Many of these studies are based on a particular representation of transport networks, i.e. “virtual networks”, embedded in a dedicated software called Nodus. Both the methodology and the software are continuously improved. Nowadays, very large problems can be solved using parallelized algorithms and Nodus is compatible with most GIS industry standards.

During this presentation, the basics of “Virtual Networks” will be explained and a broad range of different applications presented. The goal is to disseminate this particular methodology and software tool among the CESCM community, opening the way to further collaborations.

Alternative Incentives in Inventory Management - How do Performance Metrics Affect Inventory Decisions?

Michael BECKER-PETH,
University of Cologne

Firms have numerous (accounting) reasons to optimize performance (e.g., inventory levels) for the annual financials statement. By lowering inventories they can optimize the annual cash flow and signal efficiency to analysts and shareholders. In the past decades, many firms have realized the strong impact of incentives on the performance of different functions. Based on their incentives, sales increases discounts and sales effort at the year end to achieve annual revenue targets, manufacturing increases lot sizes to reduce production cost and sourcing selects overseas suppliers to minimize unit costs. Supply chain managers are often squeezed in the middle while having their own objectives: to minimize inventory levels for a given service level. In our paper we analyze the impact of different incentive schemes on supply chain managers inventory decision and the link to the company objective and performance. We analyze three commonly used incentive systems: (1) focusing on Cash Flow, (2) focusing on Accounting Profit, and (3) focusing on Return-on-Asset. We derive normative benchmarks for multi-period models for all three incentive systems. Furthermore, we test these incentive schemes in lab experiments and find significant differences between incentive systems which are theoretically similar. Analyzing different behavioral theories, including loss aversion, bounded rationality or time-discounting, we can explain the observed differences. Using these insights, we derive the optimal incentive system based on the relevant firm parameters and objectives.
Vessel Capacity Restrictions in the Fleet Deployment Problem. An Application to Panama Canal.
Manuel HERRERA RODRIGUEZ
Altagracia Consultores, S.L.P.

This presentation analyses the operation of a container liner shipping fleet over a set of defined routes, some of them crossing the Panama Canal. Restrictions derived from the maximum beam of the canal locks are taken into account. Presently, the capacity of the vessels crossing the canal is restricted to 5000 teus. After the expansion process the canal is undertaking, it will reach 12000 teus. An application is carried out, using a mixed integer linear programming model in order to determine how changes in the Canal restrictions to vessels size, will affect vessels, cargo and ports. Maintaining the demand and using a modelled minimum cost objective function, the results indicate how the number and type of deployed vessels will change after the expansion, affecting the flow into and out of ports and the volume of transhipped containers. A new concept “cargo projection capacity (CPC)” is defined, providing insight into the cargo transfer capacity through the canal (per unit of time) of a fleet as a function of type of vessels and according to canal restrictions.

A Resolution of an Express Shipment Service Network Design with Branch and Price
Pierre Yves MISTIAEN,
Louvain School of Management, Université catholique de Louvain

In partnership with FedEx, we work on improving the express shipment service network. This network consists in the daily flights of light fret between some Europeans cities. All parcels must first be brought to the single sorting hub (“pick-up” phase), are sorted, and finally sent to their destination (“delivery” phase). Commodities can be split across several flights and/or merged on the same flight. Since the solution is repeated every day, the solution must also be cyclical with regards to planes. The goal is to minimize flight (i.e. leasing and operating) costs.

We use a strong covering-type formulation and branch-and-price. One variable corresponds to a set of commodities jointly served by a set of connected flights. Because the associated pricing problem is hard, we only solve it heuristically, turning the whole scheme into a heuristic as well.

We report on computational experiments testing different strategies to speed up pricing (at the cost of provable optimality) on instances up to 25 cities.

Modeling Load Retrievals in Puzzle-based Storage Systems
Masoud MIRZAEI,
Rotterdam School of Management, Erasmus University

As land becomes scarce in populated and industrial areas, space efficient storage and handling systems are being developed. Lack of space has urged companies to utilize land more efficiently. Warehouses consume much space, thus improving these facilities saves space and money. Puzzle-based storage systems are very compact storage systems which are fully automated. Unit-loads are stored dense, without aisles, yet each unit load can be retrieved independently. Although these systems, because of complete automation, might be considered
expensive in implementation, they are an innovative solution to this ever growing problem, by eliminate empty spaces in the warehouse. Application can be found in automated car parking as well as in industry.

The objective is to develop retrieval models for such systems. Gue and Kim (2007) develop the first unit-load retrieval time models for puzzle-based systems for systems which work with a single or multiple unit-load empty space (also called escort). Such systems have much in common with the well-known 15-tile sliding puzzle, where the objective is to solve the puzzle with the minimum number of moves. Zaerpour et al. (2013) study single-load retrieval in puzzle systems with multiple empty locations, sufficient to create a so-called virtual aisle. We extend these initial models in this paper, by proposing a method to retrieve multiple unit loads simultaneously in a minimum number of moves using a single escort. The goal is to reduce the total retrieval time, as compared with individual retrieval, by retrieving them jointly.

In practice, information is usually available of multiple loads needing retrieval. Hence, the question is in which sequence and how they should be retrieved in order to minimize total retrieval time. This question has not yet been addressed in literature. We develop an optimal method for this problem based on joint load retrieval. We show great saving can be achieved by joint retrieval compared with individual retrieval. We first present retrieval time models for two loads. Secondly, we extend these models for jointly retrieving three loads. Then we generalize it to retrieving multiple loads using approximate analysis.

In the case two loads need retrieval, the dual-load retrieval method uses a systematic joining procedure to bring two loads together efficiently, after which they are retrieved jointly. To determine the optimum joining location we enumerate all possible locations. Next, for every joining location, we find an expression for the two unit loads that determines the number of moves to the depot. The same method can be applied the same for the case of more loads. Programs are developed in MATLAB, in order to calculate steps and compare the results for each method.

Results show our methods provide up to 40% savings in travel time, compared to existing methods, in terms of number of steps that are required to retrieve loads.