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Ongoing Deliverable D1.2

Description of Research Seminar:
Online delay management in

passenger transport

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Participants: UGOE
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Research Seminar

offered by Christiane Zeck (ES-UNIKL-5)

in February 2011,

in Auckland, New Zealand

Subject: Online delay management in passenger transport

Problem: Given delayed feeder trains, the task of delay management is to decide whether connecting trains should wait for delayed feeder trains or not. We consider delay management for the case of one train line and assume that all passenger paths, i.e., the numbers of passengers with a certain origin and destination, are known in advance. However, it only becomes known over time, i.e., in an online manner, how many passengers of each path are delayed by δ minutes. We assume that, once delayed, trains cannot catch up on their delay.

We develop online algorithms that are suitable to manage the occurring delays with respect to certain objectives and analyze their performance by means of competitive analysis. That is, we look for strategies such that their output compared to the output of an optimal offline algorithm (which has all the information about the delays in advance) is best possible. In other words, the aim is to close the gap between lower and upper bound on the best possible competitive ratio.

Main Results: For the case of a single train and the objective of minimizing the total delay of all passengers, we develop an offline algorithm based on enumerating the different possibilities for waiting at the single stations. Making use of the special structure of the objective function, it can be implemented such that its running time is linear in the number of passenger paths. Viewing the corresponding online problem in a game theoretic context, we develop an approach that is suitable to develop new lower bounds and is based on game tree evaluations.

We study the same model for the objective of maximizing the profit assuming that passengers who reach their destination with a delay of at least Δ get part of their ticket price refunded. We show that there cannot be a competitive deterministic online algorithm for this setting, but we develop a randomized online algorithm with bounded competitiveness.

We discuss possible modifications of the basic model taking into account the possibility of the train to catch up on delay and show that without any further restrictions, there cannot be a competitive algorithm for such a setting.

Participants: students and researchers from UOA.

Publication: Krumke, S. O., Thielen C., Zeck, C., Extensions to Online Delay Management on a Single Train Line: New Bounds for Delay Minimization and Profit Maximization, *Mathematical Methods of Operations Research*, vol. 74(1), pages 53-75. (2011)