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Central Europe Leuven Strategic Alliance

CELSA - Collaborative research project - Application form - COVER PAGE

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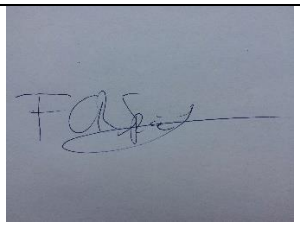
Signature[1]: 

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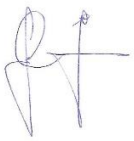
Signature[1]: 

3. Identification of third and fourth co-investigator(s) (if applicable) Expand table if more than four research units are involved.	
Third co-investigator	**Fourth co-investigator**
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Research unit within Faculty/Department:	Research unit within Faculty/Department:
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3. Non confidential and public friendly summary (max. 2000 characters)

Project title: Time Dependent Combinatorial Optimization

Summary: Over the last 60 years, Combinatorial Optimization (CO) has established itself as a highly significant field of applied mathematics with many, many practical applications alongside a number of astonishing success stories, both in theory as well as practice. This statement may be illustrated using two fundamental problems from the CO field: (i) the assignment problem (AP), and (ii) the traveling salesman problem (TSP). The ability to solve, to optimality, an instance of the TSP with 30.000 cities constitutes a huge success; and to take an even more extreme example, instances of the AP featuring over a million nodes can now be solved in seconds. These are remarkable computational achievements which may be interpreted as culminations of collective work in the field, beginning with seminal work of Dantzig et al. [1954] and Kuhn [1955]. Another example of the success of CO is the availability of an integer programming solver in a common software package like Excel. Given the almost ubiquitous proliferation of Excel, this means nearly every person with a second-level education is able to employ integer and linear optimization methods.

This research proposal seeks to extend the traditional framework of CO. The traditional format of a typical problem in the field of CO is as follows: first, all the parameters (or data) are specified, then a solution method (or algorithm) is employed which, using these parameters as input, executes and finds a feasible solution. Time-Dependent Combinatorial Optimization (TDCO) extends this format by considering problems where there exists a notion of time. Within TDCO problems, data is affected by the passage of time. More precise, we assume that an explicit expression (or function) is given that describes the value of a particular parameter as a function of time. For instance, instead of a scalar coefficient $c_{i,j}$ expressing the cost incurred when job j is executed by machine i, we now are given a function $c_{i,j}(t)$, denoting the cost incurred when job j is executed by machine i at time t. Next, a solution to the particular combinatorial optimization problem must be available at any moment in time. Thus, instead of presenting a one-shot solution which can be forgotten after its execution, in TDCO problems, a solution must be available at any moment in time. And preferably, the solution that is optimum at some moment in time should then be active.

4. List 5 key words

Combinatorial optimization, scheduling, exact methods, approximation