Mat-2.177
Seminar on Case Studies in Operation Research

Project plan
20.2.2005

Project:	Bidding Optimisation in Electricity Exchanges
Client:	Process Vision Ltd.
Project manager:	Sami Niemelä, sniemela@cc.hut.fi
Project group:	Antti Malava, antti.malava@hut.fi
	Lauri Sommarberg, lauri.sommarberg@hut.fi
	Kimmo Lehikoinen, kimmo.lehikoinen@hut.fi
	Jaakko Lehtinen, jklehtin@cc.hut.fi

INTRODUCTION

Bidding optimisation is a problem that concerns every energy company that participates in the electricity exchanges (Nordpool, EEX). There is a need to optimise the company's bids to the exchange in order to gain maximum profit with minimum risk. The BIDOPT project aims at building a pilot version of a decision support system's bidding optimisation application. This document includes a project plan for BIDOPT.

Many different approaches have been made to tackle this problem. Game theoretic approaches have been studied recently in order to understand the behaviour of market players. Classical optimisation techniques are often applied in situations, where the actions of other players can be neglected. Thus, the role and size of the market player plays a significant role in bidding optimisation. These attributes decide, which assumptions are valid for the bidding optimisation model and define the properties of the model that can be used.

The project is a part of a course (Mat-2.177) in the Helsinki University of Technology (HUT), which the project group members are attending. Therefore all the material that is produced within this project is published on the course website.

PROJECT OBJECTIVES

The aim of this project is to achieve the following:

- Gain thorough understanding of the underlying problem
- Build a realistic mathematical model of the problem
- Build a pilot application using the defined model

There are several possible ways of modelling the bidding optimisation problem. A literature survey on the existing methods is needed in order to understand the current solutions and their problems. The literature survey allows the identification of the essential parts of the problem structure.

With a good understanding about the problem and its variations, it is possible to build a mathematical model about the bidding optimisation procedure. It is possible that several different models need to be built for different situations.

The model itself has no value without an application. Therefore, a pilot version of a tool that uses the developed model is built and tested. This is required for validating the model.

PROJECT RESTRICTIONS

The following are excluded from the scope of this project:

- Local modifications
- Integration to GENERIS™ product family

In addition to the normal conditions, there could be case specific detail information that should / must be used in the decision-making. These detail considerations are not of interest in this project as the objective is to find a general solution.

Before the bidding optimisation tool can be delivered to PV's customers it must be implemented within the GENERIS™ framework. The project group does not have sufficient knowledge about the GENERIS™ products, and therefore the integration is not defined, as it clearly is outside of the scope of this project. Some GENERIS™ features may be used in the solution, though. GENERIS™ has ready-made time series handling, for example, which supports importing/exporting from/to MS Excel.

SUGGESTED APPROACH

There are basically two main approaches to the bidding optimisation problem that are studied in literature. One way is to treat the problem with game theory; another way is to formulate the problem as a classical optimisation problem. The first approach requires knowledge (or assumptions) about the competitors' processes. If such information was available, it should be accounted for, but this kind of information is often highly classified. Therefore, a classical approach is suggested, where market data, which is public, is the only source of information that is required.

PROJECT DELIVERABLES

The following deliverables will be delivered during the project:

- Status report
- End report
- Pilot application

The status report is delivered to the course personnel on Tuesday, March 15th. The idea of this report is to report deviations from the original project plan and to specify the needed measures that are required to fulfil the project objectives.

The end report is delivered to the course personnel on Friday, April 22nd. This report is in form of a research paper and it includes the theoretical considerations and definitions that were made during the project.

The pilot application is delivered with the end report. It is an MS Excel spreadsheet application using the model that is defined in the end report.

PROJECT PHASES

Planning phase aims at producing the project plan. The focus will be on the project management issues including project definition, scheduling, resource management and risk management. Background research phase familiarizes the project group with the problem and the previous solution techniques that are described in the literature.

In model definition phase, the group uses the knowledge gained in background research phase in order to produce a model of the bidding optimisation problem. This phase is crucial for the project, because the defined model must correspond to the real-life situation well or the implemented solution will have less value – or none at all.

Application development phase will be needed to produce the pilot version of the decision-making tool handling bidding optimisation. The developed application will be a lightweight application, but it should incorporate all the properties that are defined in the developed market model. Reporting phase is ongoing throughout the whole project. It includes all the actions that

PROJECT SCHEDULE

The project includes the following phases and activities:

Phase I: Planning

Activity	Start	Finish
P1A1: Project kick-off	28.1.	28.1.
P1A2: Project plan	1.2.	22.2.
P1A3: Project plan delivery	22.2.	22.2.

Phase II: Background research

Activity	Start	Finish
P2A1: Influence of market role on the problem	31.1.	15.2.
P2A2: Influence of optimisation method on the problem	31.1.	15.2.
P2A3: Problem restriction definitions	15.2.	20.2.

Phase III: Model definition

Activity	Start	Finish
P3A1: ER-definition	25.2.	15.3.
P3A2: Definition of mathematical form	25.2.	15.3.
P3A3: Model validation	15.3.	18.3.

Phase IV: Application development

Activity	Start	Finish
P4A1: Spreadsheet model	18.3.	20.4.
P4A2: Definition of needed procedures	18.3.	20.4.
P4A3: Implementation of needed procedures	18.3.	20.4.
P4A4: Procedure integration	18.3.	20.4.

Phase V: Reporting

Activity	Start	Finish
P5A1: Status report	25.2.	15.3.
P5A2: Status report delivery	15.3.	15.3.
P5A3: End report	25.2.	22.4.
P5A4: End report delivery	22.4.	22.4.

PROJECT WORK AMOUNT ESTIMATE

The following table lists all the project tasks, their estimated work amounts and division between project group members.

Activity	Duration (h)	Contribution				
		Niemelä	Malava	Sommarberg	Lehikoinen	Lehtinen
P1A1	4	25%	25%		25%	25%
P1A2	20	80%	5%	5%	5%	5%
P1A3	0	100%				
P2A1	20		50%		50%	
P2A2	20			50%		50%
P2A3	30	20%	20%	20%	20%	20%
P3A1	30	20%	20%	20%	20%	20%

P3A2	30	20%	20%	20%	20%	20%
P3A3	20	80%	5%	5%	5%	5%
P4A1	60	10%	22.5%	22.5%	22.5%	22.5%
P4A2	30	20%	20%	20%	20%	20%
P4A3	60	10%	22.5%	22.5%	22.5%	22.5%
P4A4	30	10%	22.5%	22.5%	22.5%	22.5%
P5A1	20	60%	10%	10%	10%	10%
P5A2	0	100%				
P5A3	150	20%	20%	20%	20%	20%
P5A4	0	100%				
Total	**524**	**114**	**102.75**	**101.75**	**102.75**	**102.75**

PROJECT RISK MANAGEMENT

The following are identified as risks in this project:

Risk	Impact	Likelihood	Preventive actions
Computer defects	High	<1%	All information is stored in network drives at either HUT or PV. Only copies are handled with group members' home PCs
Lack of communication within project group	High	5%	Meetings are scheduled so that at least four (preferably all) project group members will attend them. E-mail and telephone are used frequently for communication.
Lack of communication between PV and project group	Medium	10%	Project manager has established connections with PV personnel involved in the project. Busy schedules of these persons form the major part of this risk factor.
Lack of communication between end user and project group	Low	>99%	There are no clients at the moment. PV has a good understanding about the requirements, so they represent the end customer in this project.
Missing a project deadline	High	10%	The project group has weekly meetings, in which all reports and report deadlines are checked.
Bad work amount estimates	Medium	20%	The work needed to complete some project tasks is hard to estimate. If the estimates are poor, there could be difficulties in holding the time schedule. All activities are begun ASAP to avoid schedule problems at the end of the project.
Insufficient know-how	Medium	20%	There is a possibility that some programming tasks are more complicated than anticipated. Starting all project phases ASAP helps to prevent schedule problems.
Failure to identify key tasks	Medium	10%	Some tasks could prove as bottlenecks. Starting all project phases ASAP helps to prevent schedule problems.