# ORSS Newsletter – August 2006

**(for members only)**

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## From the President's Desk

**by Lai Kah Wah**

Greetings to all ORSS Members, Associates, Friends and Well-wishers!

I guess many of you already know me. Nonetheless, allow me to summarise my past whereabouts…

I 'grew-up' in the MINDEF OA/IT groups, and then moved on to PSA Corp and part-timing in the Land Transport Authority. After some time in Malaysia and China, I returned to Singapore to work on infrastructures assessments. I thank my former bosses in MINDEF and PSA for their unstinting guidance. Also, I salute them for their conviction that OR, properly applied, is invaluable to an organisation's operations and management decision-making.

We had emailed you a quick survey in late Apr 06, to seek your thoughts on your needs/interests, what ORSS can do for you (& vice versa). To those who replied, many thanks. You indicated that ORSS should continue its activities of talks/seminars, newsletters and industrial visits. We shall do so.

To the others, perhaps the excitement of GE2006 in May/Jun 06 had overshadowed our little survey then? May we request that you take a few minutes to reply us via email?


I rather like this 'OR Inside' icon, by the OR Society of UK (www.orsoc.org.uk). It hints that OR can be inside much of our daily activities, without fanfare or fuss.

Likewise, we want to make ORSS your silent, supportive partner in your 'the Science of Better' quest.

Sincerely,
Kah Wah

## News Flash

- The 31st Annual General Meeting was held on Saturday, 8th April 2006 at the NUS Staff Club. The 31st ORSS Management Committee was elected.

- The Management Committee extends its thanks to Mr Nathaniel B. Noriel, Assoc. Prof. Lee Loo Hay and Assoc. Prof. Ong Hoon Liong for their dedicated past service to ORSS.

## Summary of Some Recent Technical Talks

### Optimization-based What-if Analysis & Scenario Comparison makes Powerful Planning Applications Available for Business Managers

**Date: 3 July 2006**

**Speaker: Mr. Jeff Kilbreth,**

**Director, Product Management & Product Marketing Optimization Product Line, ILOG, Inc**

The talk was co-organized with Department of Industrial & Systems Engineering, National University of Singapore. It was held at the National University of Singapore. More than twenty people attended the talk.

The presenter began the talk by introducing ILOG and its company profile to the audience. The two key ILOG optimization technologies are Mathematical programming (MP) & Constraint programming (CP). Although many problems can benefit from blending MP and CP technologies, there are few attempts. Based on an impromptu survey by the speaker, most audiences are familiar with the MP technology, rather than the CP technology.

He went on to share some practical experience on translating the result of an OR study to non-technical business managers. Throughout the talk, he stressed the need to explain the technical solutions in layman language. It is critical that the OR consultants interact with the users to get feedback on the models. Equipped with rich experience and business intuition, the business managers are the best candidates to assess whether the model captures the problem correctly. To illustrate this, he cited two successful industry examples: Coors Golden Brewery and Samsung. The talk ended with a demonstration on the latest ILOG software, the *Optimization Decision Manager*.

On the whole, the talk was interesting as it present a different perspective of OR. It emphasizes the importance of **making mathematical models accessible to business leaders**. It generated much interest among the audience, based on the many probing questions raised during the talk. However, it would be better-rounded if the speaker presented more industry examples.

### The Missing 10 Lines of Code in Your Beloved LP Solver

**Date: 17 July 2006**

**Speaker: Professor Moshe Sniedovich, University of Melbourne, Australia**

The talk was co-organized with Department of Industrial & Systems Engineering, National University of Singapore. In this seminar, Prof. Moshe explained why these lines of code are missing and what they could do to enhance the capabilities of the Linear Programming (LP) Solver.

He started the talk, by introducing a class of optimization problem, known as **Composite Concave Linear Programming problem (CCLP)**. For more information on this topic, the

readers can request a copy of the presentation slides from ORSS or are referred to:

www.ms.unimelb.edu.au/~ moshe/cclp/

To solve a CCLP problem, one option is to re-formulate it as a **Parametric Linear Programming** problem. The speaker raised the issue that the subject of Parametric Linear Programming is not widely discussed in most OR textbooks. To make matters worse, it is also not supported by most LP solvers.

He next revealed the 10 lines of code that will enable the LP Solver to solve this class of optimization problems.

*P.S. Here's a challenge: can you reduce that to just 5 lines of code?*

## Summary of A Recent Industrial Visit

### Visit to Pulau Seraya Power Station

**Date: 27 July 2006**

The ORSS organized a visit to Pulau Seraya Power Station. It was first built in 1986 as Singapore's first offshore power plant. Currently, it has six units of 250MW steam plants running on Heavy Fuel Oil, two units of 370MW Combined Cycle Power Plants, three units of 250MW steam plants running on Orimulsion Heavy Fuel Oil. It supplies approximately 30 per cent of Singapore's energy needs.

During the visit, the staff explained the facilities and key processes in the Plant. Based on the brief exchange, we understood that the power plant has to plan how best to meet the varying demand for electricity via the Singapore energy market, which has a daily and weekly cycle.

The short-term optimisation problem is probably scheduling electricity generation to minimise the variable operating costs over the said period whilst satisfying the appropriate operations constraints. The longer-term optimisation objective can be to 'maximise 'profit', defined as the total revenue from electricity sales minus costs (fuel, other variable costs, and amortized fixed costs).

Considerations and constraints may include:

- Cost characteristics of generating units (fixed cost and incremental operating costs, start-up cost or a number of warmth-dependent start-up costs);
- Capacity and fuel requirements;
- Total output of all the generating units equal to the "committed" supply at each time-point.
- Total spinning-reserve from all the generating units must be greater than or equal to the spinning-reserve requirement;
- Synchronising or balancing the outputs of identical generating units;
- Transmission capacity, emission control constraints;
- Scheduling and dispatching constraints on individual generating units etc

Possible OR techniques that can be explored to represent (and solve) the above short-term problem include Constraint Programming, and for the longer-term problem include Mixed Integer Linear Programming (MILP) method, perhaps multi-stage.

On the whole, it was an enriching visit. It provided us a rare chance to take a glimpse at the inner working of electricity generation.

We would like to express our appreciation to Power Seraya Ltd / Seraya Energy Pte Ltd for hosting ORSS' visit to the power station. We were also provided with an information pack and a CD giving an overview of the power generation.

# Feature Profile

In each issue, we will invite a notable O.R. practitioner to share his / her view on the field of O.R.. In this and next issue, we are pleased to have **Mr Loy Hein Thuan, Operations Planning Manager, PSA Corp** to kick off this column. Here, he pens his thoughts…

***Can you provide a brief biographical statement about yourself?***

Physics was the subject of major for my first university degree because I have always marvelled at its elegant beauty in attempting to explain physical phenomena by constructing mathematical models of the physical world.

There are the Newtonian model of our everyday mechanical world, the quantum mechanical model of the subatomic world, and the Maxwell's concise mathematical representation of the electromagnetic world. After graduating from NUS with a first class honours in Physics on a government scholarship in 1990, there were a few options for me to continue to be in a job that is related to what I had been trained in. The meteorological service was one and I nearly became a weatherman, studying the weather with sophisticated models using a supercomputer.

However, as it turned out, an opportunity turned up at MINDEF for me to join as an Ops Analyst. I was involved in policy modelling such as manpower and capital budget modelling. That was my first step towards an OR career, and it was comforting to know that many of the pioneers of OR during the WWII were mostly physicists. I went on to do an M.BA. and joined a start-up company in the business of OR consulting. Much hard work was involved as I learned how OR and quantitative methods could be effectively applied to real businesses to improve their bottom-line.

Subsequently, I joined PSA Corp and then went on to become "formally accredited" with a M.Sc. in Management Science at Stanford.

***Can you briefly describe your job?***

I presently manage a team of OR/MS specialists to improve productivity at the container terminal operations. It is, in a way, an open-ended job where we have to identify, understand and define the problem, and then propose solutions to our bosses for a project go-ahead.

A colleague once said that the port is a playground for OR/MS practitioners where opportunities for application of OR lie in wait to be discovered. We just have to look for them and exploit them.

***How is OR being applied in PSA?***

My diverse team consists of mathematicians, computer scientists, and engineers and we work closely with the frontline operations colleagues to define and understand the problems, and perform reality-checks on our assumptions. We build the models or the tools which often have to be incorporated into the IT systems with the close collaboration of our IT colleagues.

We have often been likened to the defence engineers of MINDEF who conceptualise and design better weapons (i.e. tools or processes) for the soldiers in the trenches (i.e. operations colleagues handling the day-to-day container terminal operation processes).

OR has been applied in many areas of port planning and operations. For example, simulation and queuing theory have been applied in such areas as container terminal layout design, and the capacity planning of berths, yard space and gate. Graph partitioning models have been applied to allocate the vessels that interconnect among themselves to the 4 geographically separate container terminals to minimize cost of transfers between the terminals. We also have a comprehensive simulation model put together by a competent

simulation team. The model is used to project PSA terminals' handling capacity, and to study proofs of concept for new initiatives such as new equipment, new processes, new deployment strategies, and new system algorithms.

***In your opinion, what aptitude should an OR practitioner have?***

Think long-term enough to want to share the limelight & credit of the success of a project with your client, especially the project sponsor and the end-users. This will ensure sustainability of the successful project long after you leave the scene, and this will also increase the chance of repeat business from your clients.

I like a writeup in the June 2000 issue of the "OR-MS Today" magazine (I think) that described the desirable qualities of an OR practitioner that our education system should produce. I excerpted below the parts of the article that put it so well.

**Problem oriented.** We will always need technique-oriented OR people, but we want people to be as good at defining problems as they are at solving them. We need people with a knack for delineating the problem setting and prototype solutions.

**Scientific curiosity.** Scientists wonder about the entire phenomenon they are observing; they like to ask, Why? The scientific method is their road map for addressing the world. They are proficient at inductive as well as deductive thinking. They are good at formulating assumptions and testing them.

**Engineering drive.** Engineers like to set up and solve problems. But they also like to get things working, to cut through the formalities and to tinker with what is at hand. They understand the value of trial and error. Good engineers also understand, as part of this approach, the inherent risk of reaching invalid conclusions.

**Resource oriented.** We need people that frequently ask questions like, Has this problem been solved before? If so, where? What approach has been found to work elsewhere? Our urge to be creative can result in ignorance of a wealth of existing solutions.

**Holistic outlook.** We need people who can see the big picture, who are part visionary and part pragmatist. We need people who care about how the pieces fit together even beyond the scope of the defined problem, and who care how all stakeholders will be affected. Such traits are often ascribed to great leaders, but we should not fail to see them in ordinary workers who are hungering to make a contribution.

## OR Brain Twister

A standard Sudoku puzzle is a 9X9 grid. A particular puzzle will have some of its 9X9 grid squares pre-filled with digits between 1 and 9. The player is required to complete the puzzle by filling the grid so that every row, every column, and every 3X3 box contains the digits 1 through 9. An example is given below.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 3 | 7 | |
| 9 | | | | 8 | 6 | | | |
| | 4 | | 7 | | | 2 | | |
| 3 | | | | 6 | | 4 | | 2 |
| | | | 1 | | 9 | | | |
| 2 | | 5 | | 3 | | | | 7 |
| | | 4 | | | 5 | | 8 | |
| | | | 8 | 4 | | | | 1 |
| | 3 | 9 | | | | | | |

Can we formulate this as a MIP problem? Alternatively, can we think of a heuristic that can solve this problem?

To all readers, if you have the answers, please feel free to email us (orss@pacific.net.sg) your answer. We will publish the answer in the next issue of the ORSS newsletter.

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# Abstract of interesting articles published in APJOR

Asia-Pacific Journal of Operational Research (APJOR) is published by World Scientific Publishing Co.

**Title: FINANCIAL RATIO ANALYSIS OF THE ELECTRIC POWER INDUSTRY**
**Source: APJOR, Vol. 22, No. 3 (2005) 349-376**
**Author(s): TOSHIYUKI SUEYOSHI**
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Abstract: Financial Ratio Analysis is newly proposed to examine the financial performance of the American power/energy industry. The new approach compares the financial performances of 147 non-default firms with those of 24 default firms in the US power/energy market. The proposed approach is a new type of nonparametric discriminant analysis that provides a set of weights of a linear discriminant function, consequently yielding an evaluation score for group membership. Such weight estimates, along with an evaluation score, of the discriminant function provide a total financial evaluation measure, based upon which we can determine the financial performance of the power/energy firms. This empirical study informs that both leverage (debt) and profitability (returns on equity) are important financial factors in terms of avoiding corporate distress or bankruptcy. The empirical results obtained from the American power/energy industry are further extended to the international comparison of other major industrial nations including Japan and the European nations. The international comparison concludes that Japanese electric power firms have enough managerial and financial capabilities even if the American financial standard is hypothetically introduced into the evaluation of their financial performances. However, the empirical results also indicate that the Japanese power industry performs barely above the American standard. Thus, corporate leaders in the Japanese power industry need to pay more serious attention to their corporate finances and financial strategies. Such financial perspective will be increasingly important along with the current deregulation policy of the Japanese government.

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*We welcome comments, contributions, critiques from all, concerning this newsletter. Please feel free to email to: orss@pacific.net.sg*