

## Who Should Attend?

This workshop series is specially designed to provide insight into the discipline of optimisation for a wide range of individuals such as OR professionals & financial quantitative analysts, risk analysts, consultants, DSS application developers, and academics. Everyone can benefit from a clear presentation of optimisation and how it is applied to solve business problems.

**OR Professionals:** This workshop series will help you to get up-to-date on the latest methodologies and receive exposure to the wide range of technologies and software now available in the field of optimisation.

**Quantitative Analysts / Risk Analysts:** This workshop series gives you an overview of the wide range of the technologies available allowing you to define and conceptualise your business problem in terms of an optimisation problem.

**Software Developers/IT:** This workshop series provides instruction on how to embed optimisation models into software applications. It will also give you all the necessary information and techniques in order to understand optimisation modelling and data modelling integration.

**Academics and Students:** Take advantage of our application focused examples to view optimisation from a business perspective, as well as receive hands-on experience with leading optimisation software.

# CARISMA - IIM Calcutta Workshop Optimisation Methods, Risk Analysis & News Analytics: Applications in Finance

Date: 14 – 17 March, 2012

## Workshops:

**Part I: Linear & Integer Programming: Modelling Systems and embedded DSS**  
14 March - 15 March 2012

**Part II: Stochastic Optimisation Models and Solution Methods**  
16 March - 17 March 2012

**Part III: News Analytics**  
17 March 2012

## Venue:

Financial Research and Trading Lab, IIM Calcutta

[www.carisma.brunel.ac.uk](http://www.carisma.brunel.ac.uk)

## CARISMA Speakers:

- Gautam Mitra
- Cormac Lucas
- Christian Valente
- Neha Murarka

## IIMC Speakers:

- Ashok Banerjee
- Preetam Basu
- Sumanta Basu

## Benefits

At the end of the workshop, the participants will be able to develop their own optimisation models, link them to data sources and solve the models using state-of-the-art commercial solvers.

Participants will also acquire a good knowledge on how to embed optimisation models into applications.

By attending this workshop you will be able to:

**Build your own optimisation applications.**

**Identify the best use of optimisation techniques and how to deploy them for your purposes.**

**Gain an insightful and realistic view on the use of optimisation for business applications.**

**Prepare and consolidate data from disparate sources for optimisation applications.**

**Identify solving and fine-tuning requirements in your optimisation applications.**

## Software Used

The workshop is designed to give the participants hands-on experience with industrial optimisation tools, including

- AMPL (modelling language)
- AMPLDEV (modelling environment)
- AMPLNET (callable library)
- FortMP (solver)
- CPLEX (solver, from ILOG)
- LPOPT (open source solver)
- Microsoft Excel and Access

# Part I: Linear and Integer Programming & Embedded DSS

■ 14 March - 15 March 2012

## Background

Optimisation technologies have become key tools in making important business decisions that increase competitive advantage. Optimisation, through the use of advanced mathematics and computer science techniques, is used to assist organisations with solving their complex business problems in areas such as manufacturing, distribution, finance and scheduling. The success of optimisation projects depends on many different factors such as which modelling tools are used, integration with corporate data and the selection of the most efficient solution algorithms available for the problem. The purpose of this optimisation workshop is to provide participants with an insightful overview and give step-by-step instructions for successfully building optimisation applications.

In this workshop, our instructors, who all have years of experience in this field, will take you through all the steps of an optimisation project using powerful optimisation tools such as CPLEX, FortMP, FortSP and AMPL Studio. The purpose of the workshop is to show how optimisation models, relational data and optimisation algorithms can be brought together in one cohesive business application.

This workshop is an advanced course designed to benefit individuals with various levels of optimisation knowledge. Some previous exposure to optimisation is helpful.

## Overview

We introduce optimisation modelling using an algebraic modelling system and help delegates develop an understanding of how to formulate real-world optimisation models.

Furthermore, we cover advanced modelling concepts such as highly sparse large-scale models and how to formulate models with integer variables and logical constraints. We also guide participants to learn the tools and methods used for embedding optimisation into business applications including Excel and Access from Microsoft Office.

### Introduction to Optimisation Modelling and Solving

- Fundamental modelling techniques and model development
- Formulating models with a Modelling System
- Solving models with MATLAB, CPLEX, FortMP
- Discrete Optimization Models and Methodologies
- Fine tuning of optimisation applications for performance
- Model validations and sensitivity analysis
- Common modelling mistakes and how to avoid them.

### Advanced Optimisation Modelling

- Special model formulations
- Integer/binary variables
- Logical constraints
- Advanced indexing techniques for sparse data
- Data instantiation techniques
- Scalability for large optimisation models
- Developing solution heuristics using a script language
- Hints and tips for managing your data
- Common data problems and how to avoid them

# Part II: Stochastic Optimisation Models & Solution Methods.

■ 16 March - 17 March 2012

## Background

In real world decision problems, time and uncertainty play important roles and stochastic programming models are designed to capture both these aspects, thus optimally allocating resources, while taking into consideration the alternative scenarios of how the future unfolds. The result is an optimal, or near optimal, plan of action that is hedged against the vagaries of the future.

Stochastic programming is at the forefront of making decisions for the uncertain world of tomorrow. After three decades of research into the theory and application of stochastic programming, today, it is the first choice for analysts in portfolio selection, asset allocation, supply chain planning, energy systems planning, and agricultural planning, among others. We also introduce robust optimisation and illustrate how risk can be modelled and constraints used to control Conditional Value At Risk (CVAR).

This workshop is designed for those who wish to deploy stochastic programming successfully, but have little or no experience in the development of stochastic programming applications. Our course is most comprehensive and covers the latest developments in the field, with plenty of hands-on examples which help you develop stochastic programming applications for your sector, be it financial, supply chain, agriculture or energy systems planning. If you want to make optimal plans for an uncertain future, this is definitely the course for you. The course also introduces the delegates to the state of the art software **AMPLDev SP Edition**, for developing and investigating stochastic programming applications.

## Topics Covered

- **Introduction to stochastic programming**
- **Scenario generation**
- **Use of simulation as model validation**
- **Application of stochastic programming in Asset Liability Management**
- **Robust Optimization**
- **Portfolio optimisation with conditional VaR**
- **News Analytics**

## Overview

*The aims of this workshop are to explain to the attendees:*

- The implications of time and uncertainty in optimum decision making
- The alternative models for capturing uncertainty and optimum resource allocation
- The role of scenarios as a pragmatic way of representing future uncertainties
- The requirements for modelling and solving stochastic programming (SP) problems
- The use of simulation as model validation
- How to make risk decisions

*Alternative paradigms for optimum decision making under uncertainty will be presented, namely:*

- Two stage stochastic programming (TSSP)
- Multi stage stochastic programming (MSSP)
- Chance constrained programming (CCP)
- Integrated chance constrained programming (ICCP)
- Robust Optimisation (RO)

*Moreover, the attendees will be able to*

- Understand the interplay between algebraic formulation of optimisation models and the imposed (decision) trees of SP representation.
- Gain insight into available software tools in respect of capturing and solving these classes of SP problems.
- Be able to incorporate risk measures in SP in order to make optimal risk decisions
- Understand models of randomness, scenario generation and the decision evaluation techniques

## LINEAR PROGRAMMING MODELLING

Wednesday 14 March 2012

TIME	TOPIC	Presenter
9.00	<b>REGISTRATION AND COFFEE</b>	
9.15	<b>Ice breaking session</b>	
9.30	<b>Introduction and Overview</b>	
9.40	<b>Introduction to LP Terminology, model representation and mathematical models</b>	<i>Gautam Mitra</i>
10.30	<b>COFFEE BREAK</b>	
11.00	<b>An Introduction to Modelling using AMPLDev</b> Participants will learn how to use various functionalities of AMPL Dev	<i>Cormac Lucas</i>
11.30	<b>An Introduction to AMPL Syntax</b> A formal presentation of basic AMPL modelling constructs	<i>Christian Valente</i>
12.00	<b>Efficient/Structured Modelling</b> A process to create an efficient model starting from the problem is presented	<i>Cormac Lucas</i>
12.30	<b>Goal programming/Elastic Constraints</b> Presentation of an introductory financial model that includes goal programming	<i>Gautam Mitra</i>
13.15	<b>LUNCH</b>	
14.15	<b>Using EXCEL as data source for AMPL</b> How to connect an AMPL model to Excel	<i>Neha Murarka</i>
14.45	<b>Workshop (I) Financial Model</b> Participants investigate, formulate and solve an introductory financial model using AMPL	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
15.15	<b>TEA BREAK</b>	
15.30	<b>Hands-on models partial description: bond stripping, portfolio, ALM, supply chain</b> The models for the hands-on sessions will be described and hints for their implementation will be given	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
16.00	<b>Hands-On Session</b> The attendees should form groups and implement one of the models presented in the previous session	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
17.00	<b>Discussion and Feedback</b>	

## Part I: Linear and Integer Programming & Embedded DSS

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### ADVANCED MP MODELLING

Thursday 15 March 2012

TIME	TOPIC	Presenter
<b>9.00</b>	<b>COFFEE</b>	
<b>9.30</b>	<p style="text-align: center;"><b>Mixed Integer Programming Problems</b></p> <p>Integer problems involving binary variables, semi-continuous variables and special ordered set variables are introduced. A few discrete programming problems are explained</p>	<i>Gautam Mitra</i>
<b>10.30</b>	<b>COFFEE BREAK</b>	
<b>11.00</b>	<p style="text-align: center;"><b>Case study: IP with buying threshold</b></p> <p>An IP model with semi-continuous variables is introduced</p>	<i>Cormac Lucas</i>
<b>11.45</b>	<p style="text-align: center;"><b>An Introduction to AMPL scripting functionalities</b></p> <p>Introduction to AMPL's powerful scripting functionalities</p>	<i>Christian Valente</i>
<b>12.15</b>	<p style="text-align: center;"><b>Continuation of Hands-On Session</b></p> <p>The groups should continue the implementation of the chosen models and prepare brief presentations of their results</p>	<i>Cormac Lucas, Christian Valente</i>
<b>13.15</b>	<b>LUNCH</b>	
<b>14.15</b>	<p style="text-align: center;"><b>Introducing AMPL-COM</b></p> <p>How to embed optimisation models in applications</p>	<i>Christian Valente</i>
<b>15.00</b>	<b>TEA BREAK</b>	
<b>15.30</b>	<p style="text-align: center;"><b>Part I: Heuristic for solving Integer Programs using AMPL Script</b></p> <p>Different kind of heuristics to speed up solution of problems are here proposed and prototyped using AMPL scripting functionalities</p>	<i>Cormac Lucas</i>
<b>16.00</b>	<p style="text-align: center;"><b>Part II: AMPL-COM implementation of AMPL script procedures</b></p> <p>Examples of integration of models and scripts into applications</p>	<i>Christian Valente</i>
<b>16.30</b>	<p style="text-align: center;"><b>Attendees' Presentations and feedback</b></p> <p>The groups have ten minutes each to present the model they implemented and their results</p>	
<b>17.00</b>	<b>Discussion and Feedback</b>	

## INTRODUCTION TO SP

Friday 16 March 2012

TIME	TOPIC	Presenter
9.00	<b>COFFEE</b>	
9.30	<p><b>Stochastic Programming: optimum decision making under uncertainty: an overview</b></p> <p>A theoretical background to decision making under uncertainty will be given, with a particular focus on Stochastic Programming</p>	<i>Gautam Mitra</i>
10.30	<b>Stochastic Programming and Risk Measures</b>	<i>Gautam Mitra</i>
11.00	<b>COFFEE BREAK</b>	
11.30	<p><b>Stochastic measures and formulations</b></p> <p>Using AMPL the Expected Value, Wait and See and the Here and Now formulations are introduced, together with the stochastic measures that arise.</p>	<i>Neha Murarka, Christian Valente</i>
12.30	<b>LUNCH</b>	
13.30	<b>Pension Fund Management in India: A Stochastic Programming Approach</b>	<i>Sumanta Basu, Preetam Basu</i>
15.00	<b>TEA BREAK</b>	
15.15	<p><b>Stochastic Extensions to AMPL: SAMPL</b></p> <p>AMPL Language extensions to represent SP, Chance Constrained, Integrated Chance Constrained and Robust Optimisation problems are presented</p>	<i>Christian Valente</i>
16.15	<p><b>SAMPL Example: an ALM model</b></p> <p>An ALM model will be refined by the introduction of uncertainty and expressed using SAMPL syntax</p>	<i>Christian Valente</i>
16.45	<p><b>Hands-on: Expected Value, Wait and See and Here and Now Formulations</b></p> <p>The attendees will be helped in the implementation of the mentined model classes in AMPL</p>	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
17.45	<b>Discussion and Feedback</b>	

## SCENARIO GENERATION AND APPLICATIONS

Saturday 17 March 2012

TIME	TOPIC	Presenter
9.00	<b>Stochastic Programming and Scenario Generation: A Modelling perspective</b> The role of scenario generation in SP will be illustrated	<i>Gautam Mitra</i>
9.45	<b>Scenario Generation: overview and desirable properties</b>	<i>Gautam Mitra</i>
10.15	<b>COFFEE BREAK</b>	
10.30	<b>Hands-on: formulation of SP models in SAMPL</b> Chance Constraint and Integrated Chance Constraint formulation of some models in SAMPL	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
11.00	<b>Hands-on: formulation of SP models in SAMPL</b> Various SP models will be described and attendees will be helped in their implementation in SAMPL	<i>Christian Valente, Cormac Lucas</i>
11.30	<b>Hands-on: formulation of CCP and ICCP models in SAMPL</b> Chance Constraint and Integrated Chance Constraint formulation of some models in SAMPL	<i>Cormac Lucas, Neha Murarka, Christian Valente</i>
12.30	<b>LUNCH</b>	
	<b>Part III: News Analytics</b>	
13.30	<b>News Analytics: An Introduction</b>	<i>Ashok Banerjee Gautam Mitra</i>
15.00	<b>TEA BREAK</b>	
15.15	<b>News Sentiments and Stock Market</b>	<i>Ashok Banerjee</i>
16.45	<b>Discussion and Feedback</b>	

## Presenters

**Professor Gautam Mitra** is an internationally renowned research scientist in the field of Operational Research in general and computational optimisation and modelling in particular. He has developed a world class research group in his area of specialisation with researchers from Europe, UK & USA. He has published three books and over hundred refereed research articles. He was Head of the Department of Mathematical Sciences, Brunel University between 1990 and 2001. In 2001 he has established CARISMA: The Centre for the Analysis of Risk and Optimisation Modelling Applications. CARISMA specialises in the research of Risk and Optimisation and their combined paradigm in decision modelling. Professor Mitra is a Director of OptiRisk Systems UK and OptiRisk India. Many of the research results of CARISMA are exploited through these companies.

**Dr. Cormac Lucas** has extensive knowledge of Mathematical programming modelling, Pre-analysis and reduction techniques in linear programs and representation of logical expressions as MIPs. Dr Lucas has a PhD and BSc degree from Brunel University. He has held academic positions at CARISMA, Brunel University, London. Dr Lucas has published extensively in the area of optimisation modelling. He has led a number of industry projects on scheduling and decision support.

**Dr. Christian Valente** joined OptiRisk in 2005 as software engineer, coming from the field of Artificial Intelligence. He has participated in the development and maintenance of many of the company's products. Along with Dr Lucas he is main responsible in holding workshops and training sessions, and he is the main technological advisor for external projects. He is the main designer and developer of SPInE, the OptiRisk modeling system for Stochastic Programming. He has completed his PhD in Mathematics at Brunel University, and his main research interests are Stochastic Programming and parallel computing. He has a first class degree in Computer Science from Politecnico di Milano, Milan, Italy and an MSc equivalent in Artificial Intelligence from the same institution. He holds a ISEB Foundation certificate in software Testing. Dr Valente speaks fluent Italian and English and has a good knowledge of German.

**Professor Ashok Banerjee** is a Professor of Finance at Indian Institute of Management Calcutta. He holds an M.Com degree from Calcutta University and a Ph.D. At IIM Calcutta, he is a senior Professor in the Finance and Control group. He is also the faculty in-charge of the Financial Research and Trading Lab at IIM-C. His primary research interests are in areas of Financial Time Series, News Analytics and Mergers & Acquisitions.

**Professor Sumanta Basu** is an Assistant Professor of Operations Management at Indian Institute of Management Calcutta. He holds a FPM degree in Production and Quantitative Methods, Indian Institute of Management Ahmedabad and a B.Tech (Hons.) in Chemical Engineering from Vidyasagar University. His primary research interests are in Heuristics and meta-heuristics, Algorithms and computational aspects of operational research, Travelling salesman problem and its applications.

**Professor Preetam Basu** is an Assistant Professor of Operations Management at Indian Institute of Management Calcutta. He holds an MS degree in Applied Mathematics from University of Minnesota and a Ph.D degree from University of Connecticut. His primary research interests are in Operations Management, Supply Chain Management, Working Capital Management etc.

**Neha Murarka** completed her MSc degree from UCL in 2009 with a distinction in Machine Learning. She has a BA in Computer Science from the College of Wooster, Ohio, USA. Her position at OptiRisk Systems commenced in April. She creates and manages the Graphical User Interfaces (GUIs) for the DSS applications and works on the AMPLDev project which provides Eclipse with AMPL support. Her programming languages are C++, C# and Matlab.



# CARISMA - IIM Calcutta Workshop

## Optimisation Methods and its Financial Applications.

14 — 17 March 2012

VENUE: Financial Research and Trading Lab, IIM Calcutta  
You can use this form to book your seat  
*The last date of registration is 07 March 2012*

Please book me on the event(s) ticked opposite

- Please send further information on the related event ticked in the list Opposite
- I cannot attend but wish to purchase the event documentation ticked in the list opposite
- I am interested in an in-house course

Events - Please tick as appropriate

- Part I: Linear and Integer Programming & Embedded DSS **14 — 15 March 2012**
- Part II & III: Stochastic Optimisation Models and Solution Methods, News Analytics **16 — 17 March 2012**

Four easy ways to book

1. Fax this page: 033-24677851
2. Post to: Asst. Manager-Financial Research and Trading Lab, Indian Institute of Management, D.H. Road, Joka, Kolkata 700104, INDIA
3. Email: [asstmgr\\_finlab@iimcal.ac.in](mailto:asstmgr_finlab@iimcal.ac.in)
4. Telephone: +91-98305 16165

### Delegate

Dr/Mr/Ms/Mrs.....First Name.....

Surname.....

Position.....

Head of Department.....

### Contact Details

Organisation.....

Address.....

.....

.....

Tel.....

Fax.....

### Status:

- PhD Student
- Academic or Researcher
- Industry

### Fee

Place and date.....

Signature.....

Tel.....

### Registration Fees (in INR)

Students	4000
Academic & Researchers	7000
Industry	10000

For sponsorship and group booking contact:

[asstmgr\\_finlab@iimcal.ac.in](mailto:asstmgr_finlab@iimcal.ac.in)

### Registration Details

The registration fee for the event covers the following: Attendance, copy of the documentation, lunches and light refreshments  
Accommodation is not included. Detailed delegate information will be sent to you approximately two weeks before the event. Payment is required in advance of the event or at the latest, paid at the event. Payment may be made by par cheque or demand draft drawn in favour of Indian Institute of Management Calcutta" payable at Kolkata .

### WHAT HAPPENS IF I HAVE TO CANCEL?

Confirm your CANCELLATION in writing up to 15 working days before the event and receive a refund less a 10% service charge. Regrettably, no refunds can be made for cancellations received less than 15 working days prior to the event.

SUBSTITUTIONS are welcome at any time.

The organisers reserve the right to amend the programme if necessary.

INDEMNITY: Should for any reason outside the control of Indian Institute of Management Calcutta/ OptiRisk Systems, the venue or the speakers change, or the event be cancelled due to industrial action, adverse weather conditions, or an act of terrorism, Indian Institute of Management Calcutta/ OptiRisk Systems will endeavour to reschedule, but the client hereby indemnifies and holds Indian Institute of Management Calcutta/ OptiRisk Systems harmless from and against any and all costs, damages and expenses, including attorneys fees, which are incurred by the client. The construction validity and performance of this Agreement shall be governed by all aspects by the laws of India to the exclusive jurisdiction of whose court the Parties hereby agree to submit.