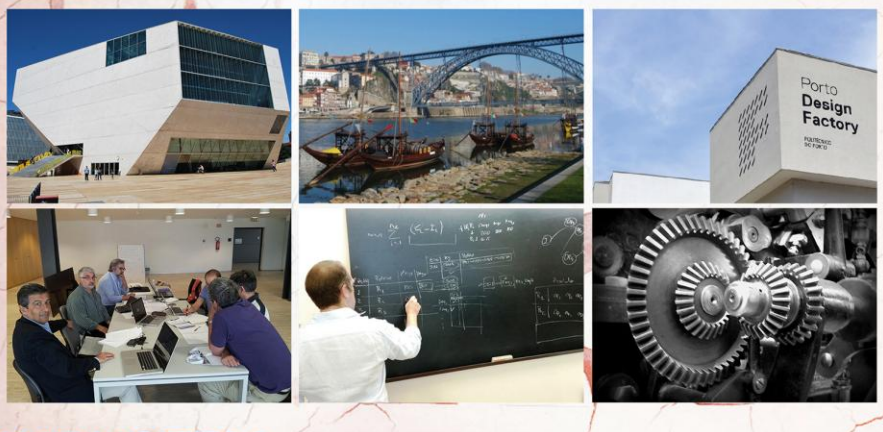
# EUROPEAN STUDY GROUP WITH INDUSTRY

# ESGI 119

## June 27th - July 1st 2016




## INDUSTRY MEETS MATHEMATICS.

PORTO PORTUGAL

ESCOLA SUPERIOR DE TECNOLOGIA E GESTÃO DE FELGUEIRAS

ESCOLA SUPERIOR DE ESTUDOS INDUSTRIAIS E DE GESTÃO

THIS INITIATIVE IS SUPPORTED BY COST ACTION TD1409, MATHEMATICS FOR INDUSTRY NETWORK (MI-NET). COST IS SUPPORTED BY THE EU FRAMEWORK PROGRAMME HORIZON 2020.

PT MATHS IN rede portuguesa de matemática para a indústria e inovação

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ESGI119 PORTO PORTUGAL

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# Program

| | Monday June 27th | Tuesday June 28th | Wednesday June 29th | Thursday June 30th | Friday July 1st |
|---|---|---|---|---|---|
| 9:00 - 10:00 | Opening Session | Working on Problems | Working on Problems | Working on Problems | Working on Problems |
| 10:00 - 11:00 | Problems Presentation | Working on Problems | Working on Problems | Working on Problems | Final Presentations |
| 11:00 - 11:30 | Coffee break | Coffee break | Coffee break | Coffee break | Coffee break |
| 11:30 - 13:00 | Problems Presentation | Working on Problems | Working on Problems | Working on Problems | Final Presentations |
| 13:00 - 14:00 | Lunch | Lunch | Lunch | Lunch | Lunch |
| 14:00 -16:00 | Working on Problems | Working on Problems | Working on Problems | Working on Problems | |
| 16:00 -16:30 | Coffee break | Coffee break | Coffee break | Coffee break | |
| 16:30 -17:30 | Working on Problems | Working on Problems | Working on Problems | Working on Problems | |
| 17:30 -18:30 | Working on Problems | Progress Report | Progress Report | Working on Problems | |
| 18:30 - 20:00 | Welcome Reception | | | | |
| 20:00 -22:00 | | | Dinner | | |

## Organizing Committee


Eliana Costa e Silva, CIICESI/ESTGF-IPP
Aldina Correia, CIICESI/ESTGF-IPP
Isabel Cristina Lopes, LEMA/ESEIG-IPP
Manuel Cruz, LEMA/ISEP-IPP
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# PROBLEM 1: Time Reduction of the Packaging Process

Savana (http://www.savanashoes.com/) is a company in the footwear sector which has more than 27 years old and has more than 150 employees. This company specializes in children's footwear and sells shoes from size 18 to 40. Each pair of shoes is individually packaged in a cardboard box customized for each client. The ideal size of each box size depends on the shoe model and the position in which is placed within the box. These boxes are ordered from an external supplier that has only a few available measures, so it will have to use the same size boxes for various sizes and models.



Due to the constant introduction of new models in production, the size of the boxes is initially set manually in an experimental procedure (testing), often time consuming. Savana challenges ESGI's participants to study their packaging process, in order to reduce the variety of box sizes, the empty waste of space inside the boxes and to eliminate the need to perform testing, thereby reducing the time and increasing the efficiency of the packaging process.

Furthermore, the orders of each customer are packed in larger cardboard box. Within one of these big boxes various designs and sizes to be delivered to a single client can be included. These larger boxes have dimensions, weight and forms of inner organization subject to customer specifications. In this context, Savana intents to determine automatically the size of the big boxes to send to each customer and how to dispose the individual boxes for each clients' order.

# PROBLEM 2: Revenue Management Pricing in Douro Hotels



In Hospitality and Tourism, Mathematical tools are already widely used with regard to data analysis. Revenue Management has taken advantage of some of these tools. Using Mathematics, it is possible to create models that help decision making and carry out actions based on facts and not merely on intuition.

The volume of data available in most hotel and tourism units allows, through the application of various Statistical techniques, for example, to identify patterns of guests that did not repeat stays; booking cancellations; bookings in advance; expenditure patterns of "loyal" customers; consumption of food and beverages due to the segmentation of the guests.

In addition, it is also possible to identify the relationship between revenues and costs versus occupation / guest segmentation; to make forecasts of demand / occupancy and revenue of other departments depending on guests' segmentation.

The company intends to find an algorithm that generates the ideal price to practice for a given date, based on the Hotel records of previous years and in the occupation and prices of the competition. Reservations already confirmed for future dates, the existence of events in the guests town or in the hotel area, bank holidays, popularity ratings on hotel search engines, among others, may also be considered.

Ideally, the algorithm should react whenever significant changes occur in the competition prices. The final goal is to move towards price management automation in these Hotel units.

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# PROBLEM 3: Improving the grape reception process - Harvest

AVELEDA

Preserving until today its family-oriented, Aveleda has evolved over time combining dedication, tradition and technology and ensuring careful management, allowing it to follow, in the best way, the prompts and growth of markets and improve the quality of its products and services.

Aveleda is a world leader in the production of green wine, annually exporting more than half of its production to over 70 countries worldwide.

In all harvest periods and especially at certain hours of the day, Aveleda faces extensive waiting lines of its suppliers for discharging the grapes.

Most worrying is the fact that the processing capacity of the grape deliveries is far from the maximum processing capacity of the wine house, since the grape flow is not regular throughout the day.

There are many aspects to consider when trying to minimize the waiting queues and manage the unused capacity of the wine house in less "crowded" hours. The aim is to mathematically model this problem and point out improvements of the existing process.

# PROBLEM 4: PRIMAVERA Manufacturing Software - Optimization of Production Planning


For nearly 10 years, PRIMAVERA BSS has had in its product portfolio a standard industrial production management solution for which covered key features across various industries (see http://pt.primaverabss.com/pt/catalogo/solucoes-setoriais/industria/manufacturing/#solucao for a description of this solution). It is a very competitive solution in regards to logistics, product engineering, budgeting, MRP and MES.

However, although it offers a good user experience and it is an agile tool in a graphical environment, it is also somewhat limited in the manufacturing planning aspect, both in terms of the optimization criteria and in setting production priorities.

After investing a few years in these areas, PRIMAVERA BSS considers it is time to give its customers other innovative solutions in the field of management planning by applying production optimization and prioritization algorithms.

The aim is to meet the industry's needs in an increasingly global and competitive environment, where it is necessary to apply new concepts based on efficient methods, in order to increase production capacity and performance.

Given a set of jobs, operation times and costs, delivery dates, available resources, work centers, time schedules and calendars, the objective is create the algorithms and heuristic data that can provide the best response to a combination of optimization criteria, such as minimizing the lateness in deliveries, the makespan, and the setup times, or maximizing the load level of the work centers, and the throughput rate, also by considering one or more sorting rules (earliest due dates, shortest processing times,…).

PRIMAVERA BSS wants to find an effective scheduling algorithm that can add new features to their software, with a good performance (being able to run in less than 10 minutes), and that can be sufficiently generic and adaptable to be used by different industries (metal, furniture, wood, textile, and food industry).

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# PROBLEM 5: Pattern simulation


EDP – Energias de Portugal (www.edp.pt), with nearly 14 000 MW (2012 update and excluding wind power) of installed capacity in the MIBEL (Iberian Electricity Market), is the only company in the Iberian Peninsula with generation, distribution and supply (both electricity and gas) activities in Portugal and Spain. EDP is present in Portugal, Spain, France, Belgium, Poland, Romania, Italy, United Kingdom, United States and Brazil being the third largest wind operator worldwide with a strong presence in the USA, as well as in Europe.

We integrate the Dow Jones Sustainability Indexes World for the eighth consecutive year, the world's most demanding ranking, that distinguishes the best performing companies on issues related to transparency, sustainability and excellence in economic management and social environment.

Being active in the electricity market we are interested in simulating electricity prices not only for risk measures purposes but also for scenario analysis in terms of pricing and strategy. The daily market electricity prices, $Y_t = [y_{1t}\ y_{2t} \dots y_{nt}]'$, $t = 1,2, \dots$, is a strip of prices (one for each hour of the day), all simultaneously observed once at a given time of each day. Therefore the daily market prices can be interpreted as a time dependent multivariate random variable. For simplification, we may suppose that $Y_t, t = 1,2, \dots$, is multivariate normal random variable with an inner variance-covariance matrix (constant in time) and with an auto-regressive structure for time dependence. Although simulating multivariate normal distributions is a straightforward exercise we need (and purpose) to simulate it subject to restrictions on the sum of $Y_t, t = 1,2, \dots,$. We also welcome some insights on the estimation side when this conditioning on the sum of $Y_t, t = 1,2, \dots$, is made.

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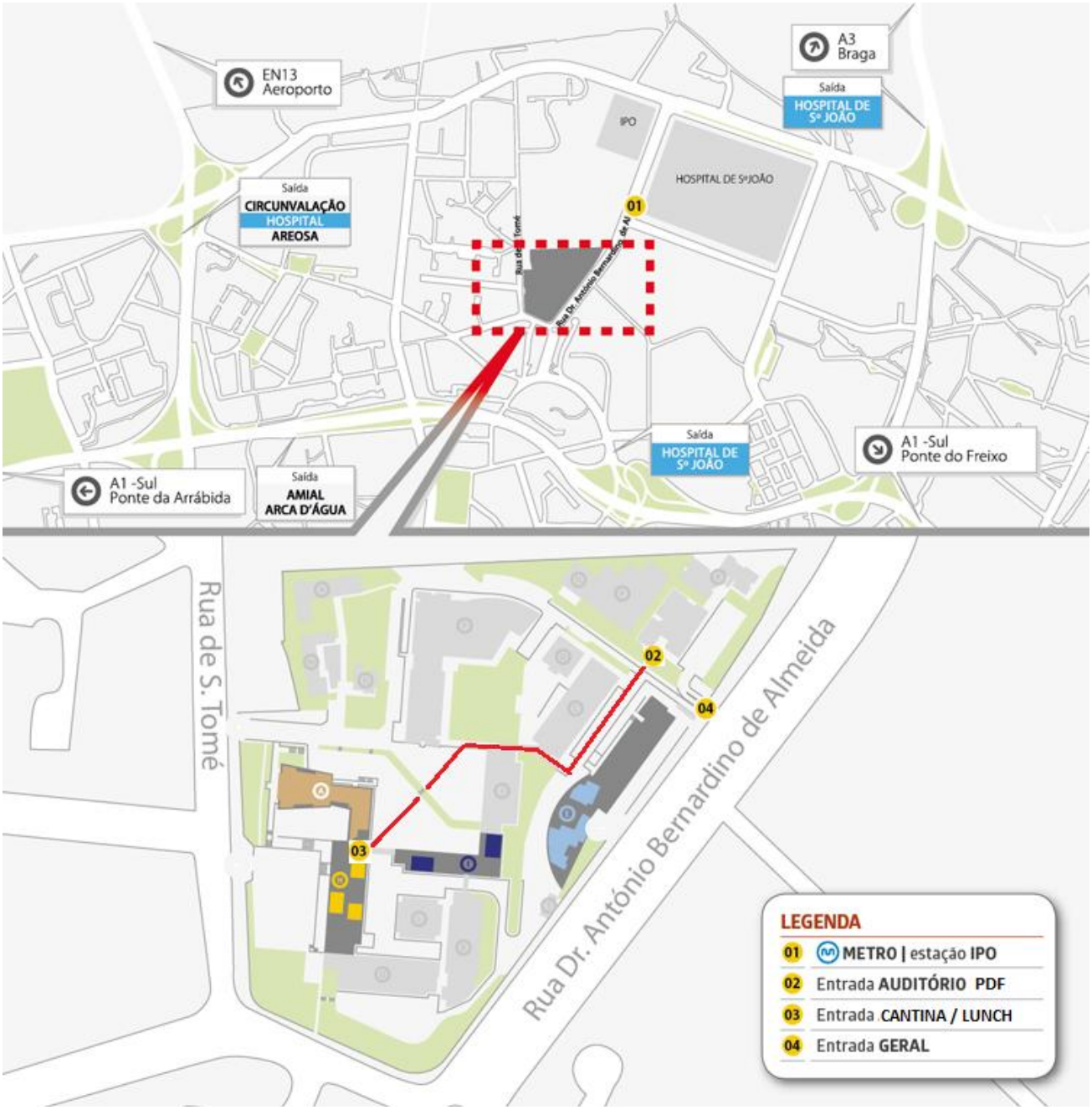


**Venue** **Porto Design Factory**

R. Dr. António Bernardino de Almeida 537, 4200-072 Porto (near Hospital S.João)
Metro Station - *IPO* - yellow line

**Lunch** **Cantina ITAU – ISEP**

Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto

**Conference Dinner** **Restaurante Ar de Rio**

Av. de Diogo Leite 5, 4400-111 Vila Nova de Gaia (Cais de Gaia)
Metro Station - *Jardim do Morro* - yellow line

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