Magister en Analitica de Negocios

Data-Driven Decision Making

Prof: Marcelo Olivares

July 2025

Course Summary

#	Session	Topics	Required Readings
1	Sat July 5, 8:30-13:00	Introduction Decision under uncertainty -The Newsvendor model -Forecasting and measuring uncertainty	**Case: Club De Vin** Optional Book chapter: "Betting on Uncertain Demand"
2	Thu July 17, 17:30 – 21:30	Price Optimization and Revenue Management	**Case: Nomis**
3	Fri July 18, 17:30 – 21:30	Managing Response Time in Services and Platforms	**Case: Saintmarie Hospital** **Case: Uber** Optional Book chapter: "Variability and its Impact on Process Performance: Waiting Time Problems"
4	Sat July 19 8:30-13:00	Matching in Two-Sided Markets	**Case: Pandora**

Data-Driven Decision Making

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Course Overview

"Data-Driven Decision Making", delves into the intersection of data analysis, decision models, and practical applications across various business sectors, providing a variety of quantitative methods and modeling approaches to make evidence-based decisions in different functional areas of an organization.

Key topics include:
1. **Decisions Under Uncertainty:** Understanding and applying the newsvendor model to evaluate decisions that require pre-commitment in settings where demand uncertainty is relevant and unavoidable. Developing robust forecasting techniques to reduce uncertainty and accounting for the implications of inherent uncertainties in decision-making.
2. **Pricing Decisions:** Techniques to estimate price elasticities using regression models and optimizing pricing strategies. It also includes insights into revenue management to control capacity to segment customers.
3. **Capacity Management:** Strategies for managing response times in service industries. Covers different modeling approaches to quantify the impact of capacity utilization on response time, including queuing models, simulation and matching algorithms.
4. **Matching of Marketplace Platforms:** Exploring two-sided markets, including the development of recommendation systems and matching preferences in centralized mechanisms.

Each topic integrates theoretical modeling and data analysis with real-world case studies, providing a holistic view of data-driven strategies in modern business practices.

Methods and Materials
The course uses a variety of teaching methods and materials, including lectures, case discussions, analytical tools and experiential activities (e.g. games). Some of these activities will require working in groups. This syllabus provides a detailed description of the material to be covered on each class.

Text and Readings
Required readings must be completed before coming to class. The syllabus describes case preparation questions for each case (and also for the lectures); students should come prepared to class to discuss these questions.

Groups
Some assignments and class activities will require working in groups. Please work with your pre-assigned group on these.

Class Preparation
Class participation will be evaluated on each class.

Conduct
- No electronic devices will be permitted in class, unless otherwise established by the professor. In some sessions we will work with Excel during class.
- All class participants should arrive on time. If you plan on leaving early, please talk to the professor ahead and provide your justification.
- Do not walk in and out during class.
- All class participants should be respectful to the professor and classmates.

Grading
Your grade in the course will be based 20% on class participation, 40% on the group assignments and 40% on final exam.

Class Participation (20%)
We will judge class participation on the extent to which you appear prepared, the relevance and depth of your comments, the degree to which you listen carefully and respond to your peers, and your willingness to take chances in order to further the educational experiences of others. Please bring your name card to class. Please notify your instructor by email in advance if you have to miss a class, or if you will be late or leaving early from class.

Group Assignments (40%)
The course will have two group assignments which involve working with dataset to solve managerial problems. These assignments require using Excel or coding in Python or R (your preference).

We will also have some in-class group activities to get some hands-on experience on some of the concepts covered in class. This assignments will include questions related to these in-class activities.

Final Exam (40%)
The main evaluation of the course is the final exam. This is a take-home evaluation which includes several problems which will require working with data and modeling. The exam should be self contained, provide all the main discussion and answers in a single PDF document written in text processor (hand-writing scans not permitted). Computer code and spreadsheets can be provided as supplementary material. The exam can be written in English or Spanish.

<u>Class by Class Activities</u>

Session #1

Topics:
Decisions under uncertainty: The Newsvendor model.

Prepare:

Make a forecast for the iPhone world-wide sales (in units) during the fourth calendar quarter (Oct-Dec) for this year (this is the first fiscal quarter of Apple for the following fiscal year). Please provide your forecast in the following web survey before coming to class: http://www.surveymonkey.com/s/ZKKQHNZ .

Read "Club de Vin" case and answer the online quiz. We will discuss the following in class:
- What is the net loss of having one bottle not sold during the regular season, but sold at a discount in the La Cave catalogue? Do the numeric calculations for a white wine bottle sold at a list price of $10 euros.
- Take a look at the forecasts reported in Exhibit 1 (also shown in the Excel spreadsheet). What is your assessment of Le Club's forecasting performance?

You can use the spreadsheet Le Club.xls to answer the questions, which have Exhibit 1 and 2 from the case.

Be prepared to discuss the questions during the class.

Optional reading: Cachon and Terwiesch, "Matching supply with demand", Chapter "Betting on Uncertain Demand: The Newsvendor Model".

Class Activities:
- Course introduction
- Learn the Newsvendor model to understand the implications of production pre-commitment, forecasting and risk in supply chain management. Use the concepts of the model in the Club de Vin case.
- Learn and implement time-series forecasting models. We will apply these models to predict customer traffic in retail stores and plan staffing capacity.

Software requirements:
- Excel to analyze forecast data and estimate demand distributions.
- Python to implement time-series forecasting models (Available in Google Colab).

Recommended Reading:
Cachon & Terwiesch, Matching Supply with Demand, Chap 11 "Betting on Uncertain Demand: The Newsvendor Model"

Session #2

Topics:
Price optimization and Revenue Management

Prepare
Read the case "Nomis Solutions (B)" and be prepared to answer the following questions.
- In optimizing the loan rates: what objective should e-Car seek to maximize?
- The attached spreadsheet includes a sample of the loans offered to customers and for each of them whether they were accepted or rejected. Think on how these data could be used to optimize loan rates.
- From the data: do you identify any opportunities to improve e-Car's pricing strategy?

Class Activities
In the first part of the session, we will discuss the Nomis (B) case and analyze how to estimate price elasticities and optimize customized prices.

In the second part of the session, we will play an experiential activity with your groups in which each group will be in charge of managing the sales of tour packages. We will use this game to learn about pricing models, tools and managerial practices that are used in revenue management.

Software requirements:
- R Studio to implement logistic regression models to estimate price elasticities.
- Excel spreadsheet to analyze demand curves and optimal prices.

Session #3

Topics:
Managing response time in services operations.

Prepare:
Read "Emergency Department Congestion at Saintemarie University Hospital" and be prepared to answer the following questions:
1. What operational problems is Saintemarie Emergency Department facing? What is your assessment of the current performance and what do you think is driving these problems?
2. What are some possible alternatives for improving Saintemarie ED's performance?

Read "Uber Search Pricing case"

Answer the online quiz related to these readings.

Class Activities:
- Cover some basic concepts to model processes and analyze the impact of resource utilization on waiting times.
- Apply these concepts to the Saintemarie ED case.
- Analyze how to reduce response times in a service platform (such as Uber) through efficient pricing and matching the two sides of the market.
- Learn tools based on simulation to conduct process analysis and impact on waiting time.

Software requirements:
- Excel and Python to implement queuing models and discrete-event simulation (Available in Google Colab).

Recommended Reading:
Cachon & Terwiesch, Matching Supply with Demand, Chap 7 "Variability and Its Impact on Process Performance"

Session #4

Topics:
Platform design for two-sided markets

Topics:
Centralized Matching Platforms
Recommendation Systems (Pandora Internet Radio)

Prepare:

Fill the survey on movies' rating. For each movie that appears, fill-in with a number between 1 and 5, where: 1 = Totally dislike it, 2 = Dislike it, 3 = Just ok, 4 = Like it, 5 = Totally Like it. If you have not watched a movie, please skip the question. Survey link: https://forms.gle/dEWy9Z6Apt4c6Mb67

Read "Pandora Internet Radio" case. We will discuss the following in class:
- In retrospective, how does the streaming market evolve during the decade from 2010 to 2020? In your opinion, how does this market seem to be doing in the following years to come?
- What is the trade-off, that is, the benefits and costs, in increasing the pool of songs analyzed? How did small bands react to the emergence of these business models?
- How can an internet radio station broadcast songs in a personalized way to its audience? What would you do to recommend a song to a user? In other words, what elements would you take into consideration, and what would you do with these.
- What other applications might also benefit from a recommendation system? For one of these industries/applications, what attributes would you use to define some metric of "closeness" between two different items?

Be prepared to discuss the questions during the class.

Software requirements:
- Excel or Python.

Class Activities:
We will first look into the supervised machine learning technique of k-Nearest Neighbour (k-NN), see the logic behind the method and how to apply for regression and categorical prediction cases. We apply this modelling techniques to the case study on recommendation systems of media content to users.

In the second half, we study matching algorithms used in centralized platforms using school choice and job search as examples.