Master Engineering ELITE Programme **Sabatino Costanzo & Loren Trigo**
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PORTFOLIO MANAGEMENT PRAXIS UNDER REAL MARKET CONSTRAINTS (AP1051)

--COURSE DESCRIPTION—

After an introductory review of the techniques most commonly used to evaluate investment portfolios and investment managers, this course will, through a combination of lectures, readings, short case studies and exercises, try to enable students: to understand the trading techniques of few important portfolio managers; to test, when applicable, simplified versions of these techniques on basic portfolios under real market constraints; to manage basic portfolios of Stocks & ETFs as well as basic derivatives portfolios of Credit & Debit Spreads using time-tested value, momentum and covered options algorithms; to manage the risk of an investment portfolio using market breadth-based algorithms; to learn the main techniques used to evaluate the historical performance of trading systems, and to create a general portfolio management strategy adapted to the risk and return requirements of the user by incorporating the principles learned in the course, which will be back-tested against historical data to objectively evaluate its performance. Ideally the participant will have some exposure to basic equity valuation methods, basic portfolio optimization methods and basic bond and derivative pricing methods (like the ones discussed in "Financial Engineering I & II"), even though we'll cover these topics if required by the participants in order to make our course as self-contained as possible.

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COURSE PREREQUISITES

Ideally the participant in this course has had some previous exposure to basic equity valuation methods, basic portfolio optimization methods, basic bond and derivative pricing methods (as they are offered in the courses "Financial Engineering I & II") and to basic coding (Python or Mat Lab; helpful but not necessary), even though the coverage of these topics will be provided by the instructors to all those participants requesting it, in an effort to make this course as self-contained as possible.

COURSE OBJECTIVES

This course intends:

- To review and to hone through practice the student's ability to apply the techniques most commonly used to evaluate investment portfolios and their managers (Sharpe, Treynor, "The Alphas", performance attribution analysis, etc…).
- To expose students to the quantitative trading and investing philosophy and techniques of some of the most relevant portfolio managers of our time (including the LTCM hedge fund!); to make students understand the quantitative bases of these management techniques through the guided

analysis of selected literature, and to enable them to implement and apply working versions of these techniques to the management of simple portfolios subject to real market constraints.

- To teach students through practice (hands-on) how to manage basic stocks and ETF portfolios subject to real market constraints, by using a simplified (working) version of the set of value-based and momentum-based algorithms designed by the course instructors to manage similar portfolios in their own practice
- To teach students through practice (hands-on) how to manage basic derivatives portfolios of credit & debit spreads subject to real market constraints, by using a simplified (working) version of the set of algorithms designed by the course instructors to manage similar portfolios in their own practice
- To teach students through practice (hands-on approach) how to apply a simplified (working) versions of the set of market breadth-based algorithms used by the course instructors to manage portfolio risk in their own practice
- To expose students to techniques used to evaluate trading systems performance (Timmerman & Pessaran, Anatolyev & Gerko, etc.) and to show (through the 'hands-on approach') how to apply these performance evaluation tools (using code developed by the instructors of the course) to the historical testing of trading and portfolio management algorithms.
- To show students (through the 'hands-on approach') how to assemble an "upgradeable" portfolio management strategy based on the value, momentum and risk management algorithms shared by the instructors; how to test the protocol against historical data and to show why its structure and performance is compatible with the relevant literature.

COURSE STRUCTURE AND CONTENT

This course consists of four themes, each one discussed in several weekly sessions:

- **First Theme:** review of the relation between risk and return and its applications to basic portfolio and manager evaluation
- **Second Theme:** cases about the philosophy and the techniques of some of the great traders and investors of our time
- **Third Theme:** design and implementation of [arbitrage-based] trading algorithms, [value and momentum-based] trading algorithms, [market breadth-based] risk management algorithms and advanced [algorithm-performance] evaluation methods
- **Fourth Theme:** design, back-testing and progressive upgrading of a robust [portfolio management strategy] adapted to the risk & return requirements of the user

COURSE EVALUATION

The components of the final course grade will be weighted as follows:

Due on Session 3: Quiz on [basic Portfolio and Manager Evaluation (and other basic quantitative) methods ...……***10%***

Due along the next 7 course sessions: Team homeworks (all the needed software will be provided to students)……...***50%***

Due on sessions 11 & 12: team presentations. Each team will present one of the following projects, or a project proposed by the team that has been approved by the instructors……...……***20%***

Some project suggestions:

Project 1: *Several possible Book Reviews proposed by the instructors.*

Project 2: *Exploring the 'ecosystem' of today's crowd-financed, open trading platforms and developing a user-friendly guide to the Quantopian platform focused on 2 examples on how to port two specific Python programs to Quantopian-Python and vice-versa.*

Project 3: *Integrate Value, Momentum and Statistical Arbitrage in a single, universal trading program using as input the corresponding programs shared by the instructors*

Project 4: *Improve the Neural Network trading program shared by the instructors: implement (on its output) (i) an optimal equity-curve identifier (i.e., optimal equity curves could be, for example, those whose 2d degree polynomial approximation has a minimal adjustment coefficient) and (ii) implement a "bagging/normalizing" procedure that makes the NN output "consistent" across different initial weight assignments.*

Project 5: *Any relevant project proposed by the team and approved by the instructors.*

Due by the end of the Reading Period: An Individual final paper on the aspect of the team presentation developed by each student…...…..……..……***20%***

(**Important Note:** topics and deadlines are all tentative and subject to changes)

LEARNING OUTCOMES

The students will:

- Review and master through practice the techniques most commonly used to evaluate investment portfolios and investment managers
- Understand the trading and investing techniques of some of the most important portfolio managers and will be able to apply simplified (working) versions of these techniques to basic portfolios in real time and subject to real market constraints
- Be able to manage basic equities market portfolios (Stocks & ETFs) in real time using the value and momentum algorithms designed by the course instructors for that purpose
- Be able to manage basic derivatives portfolios (of credit & debit spreads and some of their combinations) using the algorithms designed by the course instructors for that purpose
- Be able to manage the risk of a basic portfolio using the market breadth-based algorithms designed by the course instructors for that purpose
- Learn through practice how to apply some useful techniques to the evaluation of the historical performance of a trading or a portfolio management system.

- Be able to create an upgradeable portfolio management strategy based on the techniques learned in the course, to test the protocol against historical data and to understand the theoretical reasons supporting its structure and performance

COURSE GENERAL LAYOUT

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1A REVIEWING THE BASICS OF PORTFOLIO AND MANAGER EVALUATION

Revisiting Basic Portfolio and Manager Evaluation

- The Treynor, Sharpe, Sortino and other ratios reflecting investment's risk v.s. return
- How to use the ratios
- The Jensen, Fama & French, and other "versions" of Alpha
- More basic ways of evaluating portfolios and managers
- When and how to use each of these evaluation tools
- How these tools can be used to complement each other
- Worked Examples
- Applications

CASES:

- "Benjamin Graham: Value Investing"
- "Warren Buffet: Improving on Graham through Common Sense"

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1B BASIC METHODS OF PORTFOLIO AND MANAGER EVALUATION

Performance Attribution Analysis

- Going beyond Alpha
- Ways to determine a Portfolio Manager's abilities to pick Securities V.S. selecting Sectors based on the comparison of his performance with the performance of a Benchmark
- Defining and Calculating the Allocation and the Selection Effect
- The True Meaning of Performance Attribution Analysis
- Using the Automatized Performance Attribution Analysis as a subtle Portfolio Rebalancing Tool
- Worked Examples
- Applications

CASE:

- "Phil Fischer And T. Rowe Price: Distinguishing Growth From Value"

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2A REVIEWING MODERN PORTFOLIO THEORY: THE BASICS

Revisiting risk, return, the market line and the CAPM model

- The Concepts of Risk, Return and the Market Line (Review),
- The CAPM Model (Review)
- Introduction to Fama, French and the Momentum Anomaly
- Worked Examples
- Applications

CASE:

- "Harry Markowitz: a Ph.D. dissertation and Modern Portfolio Theory"

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2B REVIEWING MODERN PORTFOLIO THEORY: LOOKING AT MARKOWITZ FROM A DIFFERENT PERSPECTIVE

Markowitz Theory as seen by Wouter, Butler and Kipnis, authors of the prize winning paper "Markowitz and Momentum, a Golden Combination"

- The CAPM Model and the Market Momentum Anomaly
- In depth analysis of the hybrid model presented in the paper: "Markowitz and Momentum, a Golden Combination"
- Building a robust equities portfolio based on combining Minimum Variance and Market Momentum
- Worked Examples
- Applications

CASE:

"John Bogle: Vanguard and the Invention of the Index Fund"

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3 USING FUNDAMENTAL ANALYSIS TO BUILD AND MANAGE EQUITY PORTFOLIOS

Implementing a robust Equity Portfolio Management Strategy by using the Altman, Piotrovski and Beneish scores, the regression channel and a sound risk-management strategy

- How to use the Fundamental Analysis Principles integrated in the Piotroski, Altman and Beneish scores to manage a Stock Portfolio
- How to implement the strategy with resources freely available in the net
- Trading the portfolio assets using multiple time frame statistical arbitrage

- Managing the portfolio's risk using a regime-based strategy
- Hedging the portfolio's risk by selling options on the SPY

CASE:

- "Peter Lynch: Fidelity and the Saga of the Magellan Fund"
- Graham

PRAXIS:

- Implementing an Effective Value-Based Trading System For Stocks

Students implement in the trading platform screener a "stocks portfolio [value optimization function]" based on the 3 scores built on financial ratios discussed in class. Note: by this moment students should have pre-programmed the Altman, the Piotroski and the Beneish scores required to build the function to be used in this activity.

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4 DESCRIBING BASIC (MARKET BREADTH) RISK SAFEGUARDS FOR STOCK PORTFOLIO PROTECTION: INTRODUCING OPTIONS ON INDEXES FOR STOCK PORTFOLIO HEDGING

Building a robust [Market-Breadth Based] Risk Management System and hedging a stock portfolio with index derivatives

- Creating a basic [Double-Filter], [Regime-Based] Risk-Management Exclusion Criterion
- Defining the First Filter: (acceptance dependent on exceeding an optimal S.M.A.)
- Defining the Second Filter: (acceptance dependent on exceeding the Treasury Bill yearly return)
- Creating an Advanced [Regime-Based] "Flotation Line" Filter to upgrade the Double Filter.
- Worked Example
- Applications

CASE:

- "Jesse Livermore And James Chanos: the profitable art of predicting Market Crashes"

PRAXIS:

Managing and mitigating the risk of an Investment Portfolio:

- Students set up the trading platform as a data-feed provider, programming into the platform screener their own version of the "regime-based portfolio [risk minimization function]" discussed in class; select the "safe" assets to be included in the portfolio, according to the "regime-based portfolio risk minimization function" programmed in the screener to finally back-test (on the provided historical data) the performance of each asset filtered with the "risk minimization function", and compare the volatility of each one with the volatility of its unfiltered version to decide if investing is pertinent or not.

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5 USING MARKET MOMENTUM TO BUILD ETF PORTFOLIOS AND MANAGING THEIR RISK WITH A REGIME-BASED CASH FILTER

Robust ETF Portfolio Management Strategies based on Relative (Rotational) Momentum

- What is Absolute Momentum?
- How is it used by traders?
- What is Relative (Rotational) Momentum?
- How is it used by traders?
- How to use "Relative Rotational Momentum" to build and manage an ETF portfolio?
- How to implement the strategy with resources freely available in the net?

CASE:

- "James Simmons: Math, Cryptography and the legendary Renaissance Fund"

PRAXIS:

Implementing an effective Rotational Momentum Trading System for ETFs:

- Students implement in the trading platform screener the "ETFs effective portfolio [momentum optimization function]". Note: by this moment students should have pre-programmed the rotational momentum algorithm required for this activity.

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6 USING STATISTICAL ARBITRAGE TO BUILD AND MANAGE CURRENCY PAIRS, FIAT CURRENCY AND CRYPTOCURRENCY PORTFOLIOS MANAGING ITS RISK THROUGH A MARKET BREADTH "FLOTATION LINE" FILTER.

Implementing a mechanical Portfolio Management Strategy based on Statistical Arbitrage programmable in Python.

- Statistical concepts review
- Mean reversion and statistical arbitrage
- Description of the strategy
- Manual implementation of the strategy
- Brief introduction to Python tools
- Programming basic trading indicators in Python
- Automatizing the strategy
- Programming the Statistical Arbitrage Strategy in Python
- Implementing it with freely accessible resources

- Applications of the strategy to different families of pairs
- Back-testing the system against historical data
- Worked Examples
- Applications

CASE:

- "Bill Gross and Jeffrey Gundlag: the Bond Masters"
- Simmons

PRAXIS:

Trading High-Cap U.S. stocks with the Regression Channel in multiple time frames:

- Students set up the trading platform screener to select large capitalization stocks that have shown steady increase in their "cash flow from operations" during the last 5 years. Students will paper-trade these stocks using the multiple time frame regression channel which has been pre-programmed by them as needed to be used in this exercise.

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7 USING NEURAL NETWORKS IN TRADING

Demystifying neural networks.

- Understanding the intuitive ideas behind them
- Understanding their underlying math structure
- Learning about their evolution from regression to the perceptron
- Mistakes commonly seen in the use of NN's in Finance/Trading
- Understanding how to use these tools for basic forecasting and basic classification tasks in finance.
- "Machine learning based" stock price forecasting: watching a NN predicting Stock Prices
- Preview of the courses:

  "A.I.: from the perceptron to deep learning in Finance: Foundations"

  "A.I.: from the perceptron to deep learning in Finance: Applications"

PRAXIS:

Homework discussion.

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8 SOME USEFUL METHODS OF MODEL EVALUATION AND IMPROVEMENT.

Smart ideas underlying the "Horse race-type" tests:

- White's Reality Check Test for Data Snooping (Examples)

- Timmerman & Pessaran Test (Examples)
- Anatolyev & Gerko Test (Examples)

PRAXIS:

- Homework Review

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9A LESSONS FROM "LONG TERM CAPITAL MANAGEMENT"; DISCUSSION OF THE NOVA PROGRAM AND REVIEWING THE FUTURES ARBITRAGE TRADING TECHNIQUE USED BY THE LTCM TEAM.

How to use arbitrage convergence to build Futures Portfolios

- Review/intro to Futures Contracts
- Review/intro to the principles of Futures Arbitrage
- Analysis of the main F.A. "Market Neutral" techniques used by LTCM to manage the Fund's portfolio
- Applying the LTCM Futures Arbitrage techniques to the construction of a simple portfolio
- Understanding the risks of the portfolio
- Historical testing of the portfolio
- Worked Examples
- Applications

CASES:

- "Long Term Capital Management: The (Nobel Laureates) Trillion Dollar Bet".
- "Paul Tudor Jones: futures trader extraordinaire"

PRAXIS:

- Cont. of previous week assignment.

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9B LESSONS FROM LONG TERM CAPITAL MANAGEMENT: EXPLAINING THE IMPORTANCE OF MANAGING RISK.

Assessing the need for risk management

- Antecedents of the LTCM fund
- Methodology of operation
- Chronology of market events
- Effects of events on LTCM

- Rescue operation
- Final results
- Lessons to be learned in risk management

CASE:

- "Nick Leeson: Baring's wunderkind".

PRAXIS:

Cont. of previous week assignment.

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10 INTRODUCING AND SHOWING HOW TO TRADE BULISH CREDIT SPREADS, BEARISH CREDIT SPREADS AND IRON CONDORS, AND POINTING OUT THEIR ADVANTAGES AND DISADVANTAGES

Setting up and using a Trading Platform options screener to select and trade simple derivative structures: (i) 10% "in the money" Covered Calls and Covered Puts on [the SPX and other selected indexes] as well as [Large Cap stocks]. (ii) Bull and Bear Credit and Debit Spreads satisfying [the corresponding time-decay requirements discussed in class], by using the [Multiple Time Frame Regression Channel] to determine an optimal entry according to the estimated [movement potential] of the underlying asset.

- A brief introduction to Options And Derivatives: demystifying Derivative Products
- Derivatives Trading Technique I: buying covered Puts and Calls 10% "In The Money", entering the trade according to the [directional movement potential] of the Underlying Asset
- Defining and demystifying Bullish and Bearish Credit Spreads
- Derivatives Trading Technique II: selecting Bullish or Bearish Credit Spreads according to the [Directional Movement Potential] of the Underlying Asset and the [Potential Time-Decay] implicit in the length of the derivatives contract.
- Defining and demystifying Bullish and Bearish Debit Spreads
- Derivatives Trading Technique III: Selecting Bullish or Bearish Debit Spreads according to the [Directional Movement Potential] of the Underlying Asset and the [Potential Time-Decay] implicit in the length of the derivatives contract
- Defining, demystifying, explaining the advantages and the risks of trading the "Iron Condor"
- Worked Examples
- Applications

CASE:

- "Bankers Trust versus Procter & Gamble: who is lying now?"

PRAXIS:

Trading weekly option spreads (Covered Calls, Covered Puts, Bear Calls, Bull Puts, Iron Condors) on the SPX and on some volatile Large Cap stocks:

- Students set up the trading platform options screener to paper-trade simple derivative structures, looking for: (i) 10% "in the money" Covered Calls and Covered Puts on [the SPX and other selected indexes and Large Cap Stocks] (ii) Bull and Bear Debit and Credit Spreads that satisfy [the time-decay requirements discussed in class], using the multiple time frame regression channel to determine the right moment of entry according to the expected movement of the underlying assets.

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11 GUIDELINES TO BUILD AN "ALL-INCLUSIVE" PORTFOLIO MANAGEMENT STRATEGY THAT COULD SERVE THE PARTICIPANT'S NEEDS.

How to build a portfolio management strategy that: (i) Incorporates the general portfolio management principles learnt in the course (ii) It is adapted to the user's risk and return requirements and (iii) Can evolve in time through the upgrading of its basic components.

- Historical review of the development of the portfolio management techniques taught in the course
- Conceiving the Portfolio Management Strategy as a scalable, upgradeable and adaptable structure based on value, momentum, sound diversification and sound risk management methodologies learned in the course.
- Progressively upgrading the Value aspect of the Portfolio Management Strategy
- Progressively upgrading the Momentum aspect of the Portfolio Management Strategy
- Progressively upgrading the Risk-Management aspect of the Portfolio Management Strategy
- Worked Example
- Applications

CASE:

- "A. W. Jones: the first Hedge Fund"

PRAXIS:

- Cont. of previous week assignment.

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SOME RELEVANT LITERATURE

Short Case Studies:

- "Benjamin Graham and Joel Greenblatt: Value Investing and The Magic Formula"
- "Warren Buffet: Improving on Graham through Common Sense"
- "Phil Fischer And T. Rowe Price: Distinguishing Growth From Value"
- "Harry Markowitz: Modern Portfolio Theory"
- "John Bogle: Vanguard and the Invention of the Index Fund"
- "Peter Lynch: Fidelity and the Saga of the Magellan Fund"

- "Bill Gross and Jeffrey Gundlag: The Bond Masters"
- "A. W. Jones: The First Hedge Fund"
- "Jesse Livermore And James Chanos: The profitable art of predicting Market Crashes"
- "Paul Tudor Jones: Futures Trader extraordinaire"
- "James Simmons: Math, Cryptography and the legendary Renaissance Fund"
- "Robert Merton and Miron Scholes: LTCM, The Nobel Laureates Trillion Dollar Bet"

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- IOSR Journal of Business and Management (IOSR JBM) ISSN: 2278 487X, p ISSN: 2319 7668. PP 72 80 www.iosrjournals.org 8th International Business Research Conference 72 | Page IES Management College and Research Centre, Mumbai, India A Study on back testing of Bull Call Debit spread strategy on Nifty Index Options. Chirag Babulal Shah PhD (Pursuing), M.M.S., B.B.A., D.B.M., P.G.D.F.T., D.M.T.T. Assistant Professor at Indian Education Society's Management College and Research Centre
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COURSE INSTRUCTORS

Sabatino Costanzo-Alvarez

Sabatino Costanzo-Alvarez holds a Masters in Economics and Finance from Brandeis University as well as a Magister Scientiarum, a Magister Philosopharum and a Ph.D. in Mathematics from Yale University, where in 1990 achieved a significant breakthrough by solving a mathematical conjecture which had remained unsolved for more than 3 decades. Taught Mathematics of Finance at Boston University as an Associated Professor for 5 years and later co-founded the Boston Trading Group LLC, designed the trading systems used in the firm's daily Futures Trading Operations and acted as head trader of the team. Holds the licenses "Registered Representative NYSE/NASDAQ" (Series 7), "Registered Financial Advisor", "Registered Uniform State Law Securities Agent", "Registered Managed Futures Fund Representative" in the U.S. and "Canadian Securities Course" & "Conduct and Practices" in Canada, as well as products training at Morgan Stanley in Boston, and later at Merrill Lynch in New York. Chaired the Advanced Management Program for Senior Executives (PAG), an Executive MBA at the US Accredited IESA Institute in Caracas, where he taught Financial Engineering and Investment Management as an Associate Professor, and tutored over 70 MBA dissertations. Acted as Head of Research at Econo Invest C.A., the largest Investment Firm in Venezuela, leading the Investment Strategy Team in charge of generating and executing the U.S. & E.U. investment strategies for Commodities, Fixed Income Instruments and Equities for the firm (published weekly in Bloomberg), as well as generating and maintaining the Sovereign Fixed Income Indexes of Brazil, Colombia, Mexico, Peru, Chile, Uruguay and Venezuela to be used in the design of international financial products. Acted as an Investment Advisor for the International Wealth Management Groups at Morgan Stanley (Boston), Merrill Lynch (NY) and the Royal Bank of Canada(Toronto), and is now a Senior Partner at the Toronto boutique Investment Firm Inter Alea, where he provides state-of-the-art mathematical modeling solutions to portfolio and risk management problems for a select group of corporate and high net worth private clients, designing and managing their investment portfolios based on their specific risk & return requirements. He teaches Portfolio Management, Statistics & Mathematical Modelling and Business Mathematics Courses at the Pilon School of Business, and is the founder and advisor of the Sheridan Students Trading and Investment Association. He is a Lecturer at the U of T Graduate School, where he is teaching Portfolio Management, Blockchain Technology, Cryptocurrencies and Artificial Intelligence applied to Finance.

Rosario Lorenza Trigo-Ferre

Holder of a B. A. in Philosophy (Magna Cum Laude) from Yale University -where she also received training in Math & Physics-, a Ph.D. in Generative Linguistics from Massachusetts Institute of Technology (MIT) and a M. Sc. in Management of Information Systems from Boston University ("Beta Gamma Sigma Honors" award), she was a Professor at Boston University for 8 years. While a Programmer Analyst at Boston University, she designed and developed an application for the management of accounts trading stock and currency futures and co-designed financial applications under the direction of Professor Zvie Bodie at B.U.

Co-founder and Trader at the Boston Trading Group and Certified Programmer Analyst in e-commerce by the University Computer Careers Program, she generated the trading signals for currencies and metals futures used in the BTG's market operations; developed an application maximizing the efficiency of trading system for currency and metal futures, and designed a client-server application for the management and operation of trading accounts. Has designed and developed many multi- tiered e-commerce applications dynamically generated from databases. Project leader and senior programmer analyst at IngeDigit, designed and developed internet applications for banking accounts management & operation, and for international transactions between banking accounts and credit cards. She was a Professor at the Department of Production and Technical Innovation of the IESA Institute, the top -only US accredited- Venezuelan Business School, where taught courses in Information Systems, Simulation in Finance, Operations and Database Marketing. She is the author of many scientific papers in refereed journals and a Permanent Consultant for an international development bank (C.A.F, The Andean Region Development Bank), where she has designed the financial models used to evaluate the profitability, coverage and socio-economic impact of projects like the inclusion of fiber-optic cable in highways in Colombia and Peru. These models led to the enactment of new laws making such inclusion mandatory in the Andean region. Also designed the financial models used to evaluate the profitability of projects in satellite technology in Argentina (specifically the ARSAT program) by estimating the future regional demand for transponders and the impact of the project in the input-output matrix of the country, and is now a Partner at the boutique Investment Firm InterAlea, where she designs, develops, tests and implements trading and risk management strategies based on the entropy analysis of price signals, executed on stock quote-data processed through SQL-Server. She is a Lecturer at the U of T Graduate School, where she is teaching Portfolio Management, Blockchain Technology, Cryptocurrencies and Artificial Intelligence applied to Finance.