1. COURSE SYNOPSIS

Do machines make better decisions than humans? This is the question with which the course begins. It considers the raison d’etre for the emergence of “Robo Advisors” in the marketplace and how they might evolve as alternatives to traditional investment alternatives. The meat of the course addresses how in this age of “big data” we can design machines to make investment decisions systematically in an automated manner.

The course covers the basis, evaluation and execution of trading strategies that are commonly used by professionals in financial markets. Systematic strategies and execution are of particular interest because of their consistency in decision making, transparency, and scalability. The central objective of this course is to understand the essence of systematic trading, key elements of which are the basis for generation of “alpha” or “exotic beta” and how to think about and control the various types of risks associated with systematic trading systems. The strategies are grounded in data of various forms including prices, fundamentals, as well as unstructured data from news sources. The second part of the course creeps into Artificial Intelligence and its exploration in modern decision making systems.

The course is grounded in data and takes the following perspective: “in God (and theory) we trust, everyone else please bring data.” We will explore strategies with data in Excel, but you will also be given templates in Python in case you want to stray in that direction. Programming experience is not required, but if you have it, you are encouraged to use it for your project.

Many students who have taken this course over the last 10 years have gone onto fulfilling careers in finance and elsewhere. I’ll be happy to put you in touch with them depending on your interests.
2. LEARNING GOALS

There are two main learning goals and a secondary one associated with this course:

I. Critical and Integrative Thinking: specifically, how do you transform a trading idea into a concrete description that can be described and modeling using a spreadsheet. The spreadsheets from the various assignments are usable as “templates” for developing more advanced strategies. In addition to translating an idea into a model, students will learn how to draw and assess conclusions from the model and data provided. You are free to use other software for testing more sophisticated strategies, especially for your project.

II. Effective Oral Communication: Each student shall be able to communicate verbally in an organized, clear, and persuasive manner, and be a responsive listener.

III. Interpersonal Awareness and Working in Teams: Students will submit a project which may entail working in a small group (two people) and must apportion tasks appropriately and submit a quality product in a timely manner.

The course strikes a balance between theory and practice by grounding the discussion in the current state of financial markets. The course requires students to do several hands-on exercises with real market data. The exercises start with a review of simple concepts of risk and return and progress to realistic trading strategies that students build and evaluate. The objective is to help you understand how to assess markets in an orderly and scientific way so as to be able to draw sound inferences from the analysis.

The course should be of interest to students across the financial services industry. It will not transform you into a trading expert, which takes considerable effort, time, and pain. It will, however, bring the concepts of risk and return alive by working with real data and exercises, and through industry experts describing their approach to fund management and administration. More generally, the course should give you a clearer appreciation on the fact that understanding markets is a theory building exercise, where professionals spend a lot of time in understanding emerging market phenomena with the objective of translating their insights into profitable strategies. These concepts are useful regardless of your specific interest in the financial industry, i.e. whether you intend to be a trader, risk manager, controller, salesperson, or analyst.

Self-learning is a particularly important part of this course. You will get the best value from this course if you experiment actively with ideas and actively construct and test trading strategies instead of just coming to class and expecting to be told what works and what doesn’t. There’s nothing like learning by doing. Accordingly, 50% of the grade is assigned to your project. So, start early. Exploratory work always takes longer than you think. Indeed, your very first assignment is to write a 1-2 page summary of what you
might do as your project. Even if you end up changing topics, the exercise will help you get started in thinking about it seriously, before you get into the nitty-gritty of the quantitative exercises.

3. COURSE MATERIALS

Software
All required exercises are done in Excel. Other software may be brought in on occasion, including Python scripts. The course will also provide access to “Kensho,” – a new tool in the “Fintech” space designed to facilitate flexible data access and analysis. Some of the assignments will offer you the opportunity to extend your analysis by importing new data from Kensho.

Please note that there is very limited support for Kensho, available through the TA for the course.

Books
There is no required book for this course since none of the available books in this area are aligned with the objectives of this course. But there are several books worth consulting, depending on your interests. There’s a wonderful book by Lasse Pedersen called “Efficiently Inefficient” that is wonderful from a finance and markets perspective:

http://www.lhpedersen.com/efficiently-inefficient

The following book describes at a high level the basis for quantitative trading strategies used by portfolio managers but doesn’t go into details or hands-on examples for how to build and evaluate strategies scientifically:

Inside the Glass Box: The Simple Truth About Quantitative Trading, Rishi Narang, 2009

For those students wanting details on the thinking behind various kinds of market indicators and measurement, a useful textbook is:

New Trading Systems and Methods, Perry Kaufman, Wiley 2014

Readings
A set of current readings for each session will be posted on Blackboard that you must read prior to each class. In addition to these readings, the course will provide datasets that will be used for the assignments. The assignments are simple, and intended to serve as a foundation for thinking about more sophisticated trading strategies you might build going forward. In order to keep the material accessible, all examples are illustrated in Excel.
Since one of the main objectives of the course is to provide you with hands-on skills in developing and understanding trading strategies, several datasets are provided including the following:

2. Daily data for selected currency, fixed income, equity futures, and commodity futures
3. Intraday (minute level bars) for select futures contracts
4. Fundamentals (Trade Balance) data for currencies (aligned with the dollar index)
5. Fundamentals-based aggregated equities data
6. Equities data for spread-based (pairs) trading
7. News-based sentiment data for equities
8. High frequency data on select futures contracts including equity, bond, currency, and commodity indices

All materials (except for late breaking articles and non-electronic information) are posted on the class website. Students are also encouraged to explore the Internet for materials relevant to the course.

4. EVALUATION

Since this is a hands-on course, there are several small assignments involving data analysis. You must have reasonable Excel skills to do these assignments. There are up to six such assignments. You must also participate in class discussion and come prepared to present your analyses to the class. Each class where an assignment is due will begin with several students at random being chosen to present their results. All assignments due on a particular date must be submitted prior to the beginning of class since solutions are discussed in class. Late submissions will not be accepted.

In addition, you must hand in a term project describing a complete trading strategy. It is preferable if this strategy is demonstrated using data and analysis, but conceptual analyses are also acceptable. Examples of things you could explore are:

- Is there any evidence of predictive information in the newer source of data such as social media?
- Is there any relationship between current volatility and future returns in equity or currency markets in the US or other markets?
- Which macroeconomic indicators have exhibited a consistent influence on which markets and what could explain this?
- (How) and when does spread-based trading work and why?
- Which fundamentals or technicals spread-based or directional trading strategy works on indices, individual/pairs, ETFs, etc.?
• Engineer a system where you can describe the market conditions under which it would make and lose money. How would you position such a system for investors?
• Why and when does mispricing occur in ETFs? Is it exploitable?
• How could one design a news-driven sentiment analysis system for trading individual equities or equity/currency/commodity indices?
• Is high frequency trading worthwhile? In which markets? Under what conditions would you expect to engineer a profitable system for high frequency trading?

In the past, students have turned in interesting projects in a number of areas that typically “expand” on an assignment, such as testing pairs trading “on scale” across all equities in a sector or market index or commodities (such as related energy futures contracts), extending pairs trading to “baskets,” exploring and integrating currency strategies across multiple timeframes, behavior of markets around options expiration, and so on. Creativity and exploration is highly encouraged.

Start early on your project. The assignments are “front loaded” and largely done midway through the course which should give you time to focus on your term project.

There is no final exam. The grade breakdown is as follows.

i. Assignments: 50 points
ii. Term paper on a trading strategy: 40 points
iii. Class participation and attendance: 10 points

5. ATTENDANCE AND PUNCTUALITY
Every session covers a specific type of trading strategy and each session builds on the previous ones. Sessions also discuss “tips and tricks” you will not find in readings or books. Complete attendance is therefore critical. Class participation is an equally important part of the learning process. Absence is only appropriate in cases of extreme personal illness, injury, or close family bereavement. Voluntary activities such as job interviews, business school competitions, travel plans, joyous family occasions, etc. are never valid reasons for missing any class. Students who miss two or more sessions without notice will get a zero on attendance.

Late arrival is disruptive to the learning environment; so please arrive before the scheduled time.

6. PRE-REQUISITES
There are no pre-requisites for this course, except reasonable Excel skills and an enthusiasm to work with data. However, knowledge about financial markets and financial instruments never hurts!
7. TIMETABLE (subject to slight revision):

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading/Preparation (posted on BB)</th>
<th>Submission/Handout</th>
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</thead>
<tbody>
<tr>
<td>Feb 6</td>
<td>Introduction and Course Objectives</td>
<td>Should You Trust Your Money to a Robot? (See link on website)</td>
<td>Assignment 0 handed out</td>
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<td></td>
<td></td>
<td>Bring laptops to class</td>
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<tr>
<td>Feb 13</td>
<td>Smart beta and Robo advisors</td>
<td>Reading on Robo Advisors (website)</td>
<td>Assignment 0 due</td>
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<td>Signal, noise, randomness</td>
<td>Life at Sharpe’s End</td>
<td>Assignment 1 handed out</td>
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<tr>
<td></td>
<td>Markets and basic measurements of performance, direction and volatility</td>
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<td>Bring laptops to class</td>
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<td>How do you compare strategies</td>
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<td>Feb 20</td>
<td>Systematic Trading: Trend Following Systems &amp; Futures Markets</td>
<td>Reading: Kauffman</td>
<td>Assignment 1 due</td>
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<td>Assignment 2 handed out</td>
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<td>Feb 27</td>
<td>Systematic trading: Trend and Counter-trend systems</td>
<td>Reading: website link</td>
<td>Assignment 2 due</td>
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<td>Assignment 3 handed out</td>
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<td>Mar 6</td>
<td>Technical trading: Spreads and pairs trading in Equities Markets</td>
<td>Kauffman Chap13: Spreads and Arbitrage; Dickey-Fuller test handout</td>
<td>Assignment 3 due</td>
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<td>Trading “neutral” portfolios</td>
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<td>Assignment 4 handed out</td>
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<td>Mar 20</td>
<td>Pairs trading review; Fundamentals and currency trading strategies</td>
<td>Readings: FX Guide</td>
<td>Assignment 5 handed out</td>
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<td>Mar 27</td>
<td>Currencies: Flow-based strategies and carry trades; Cointegration and</td>
<td>FX Guide (cont.)</td>
<td>Assignment 4 due</td>
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<td>basket trading</td>
<td>Battle of the Dollar</td>
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<td>Apr 3</td>
<td>Machine Learning and Artificial Intelligence in Financial Prediction</td>
<td>TBD</td>
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<td>Apr 10</td>
<td>News-based Trading Systems: interpreting “big” unstructured data</td>
<td>Chapter 15 from High Frequency and Algorithmic Trading</td>
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<td>Late breaking articles on BB</td>
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<td>Apr 17</td>
<td>High frequency trading: Interpreting “big” structured data</td>
<td>High Frequency Trading reading</td>
<td>Assignment 5 due</td>
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<td>Apr 24</td>
<td>Recap and Summary Student Projects</td>
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<tr>
<td>May 1</td>
<td>Recap and Summary Student Projects</td>
<td>None</td>
<td>Final projects are due within one week of this session</td>
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