WORLDQUANT

# An Introduction to WebSim™
# A Briefing Guide

2013.08.30

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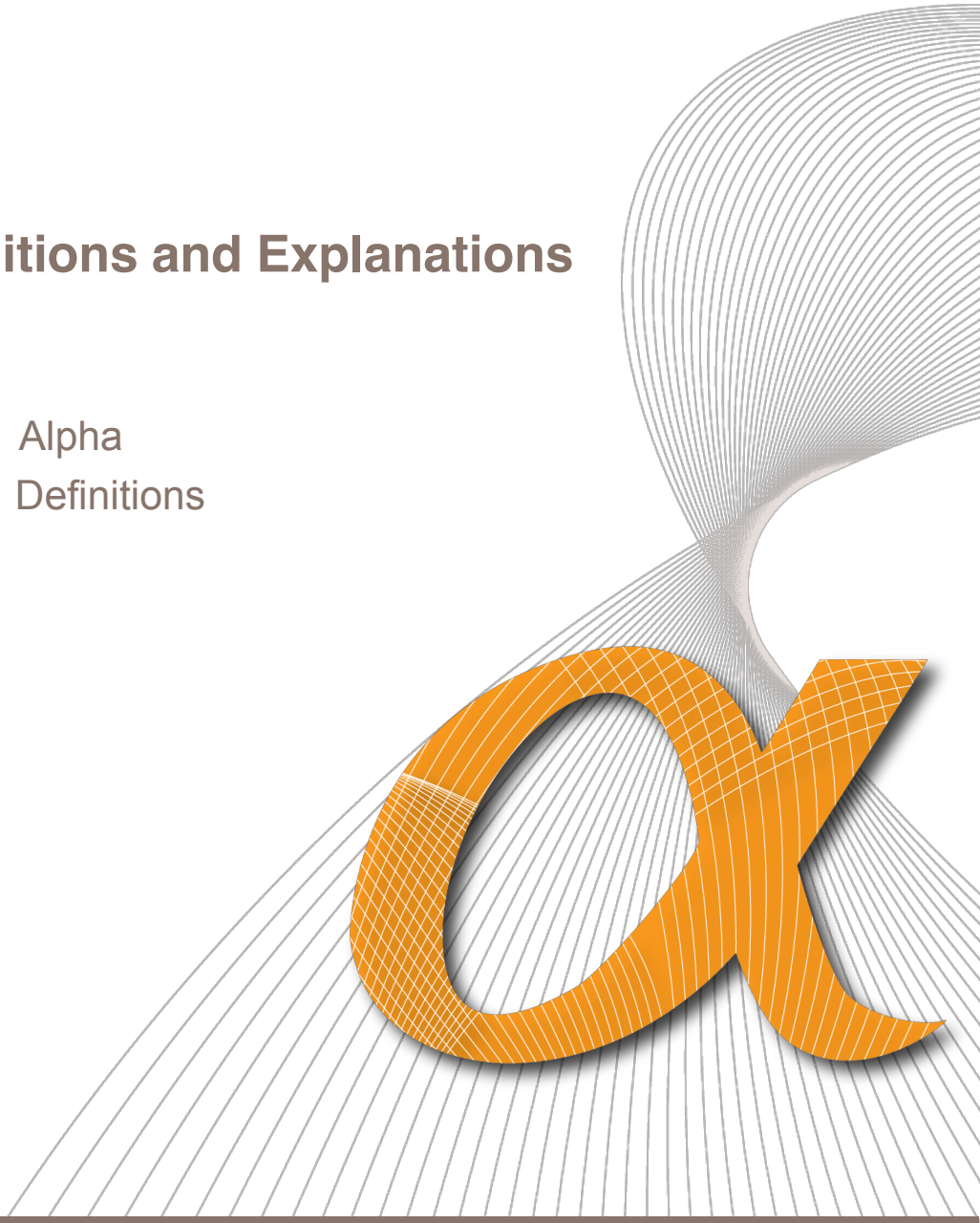


# 1. INTRODUCTION TO ALPHA

## Alpha Definitions and Explanations Relative to WebSim

**- Alpha**

*An alpha is a mathematical, predictive model of the performance of financial instruments*

**- Statistical Arbitrage**

*Alphas and strategies are called "statistical arbitrage", or "quantitative trading", or "systematic trading", or "relative value". A good StatArb model usually involves a large number of securities and has very short holding periods, with positive returns expected in the long run.*

**- Long/Short Strategy: Market Neutral**

*Hold long/short positions and maintain neutral exposure to the market*

# 1. INTRODUCTION TO ALPHA

## Alpha Definitions and Explanations Relative to WebSim

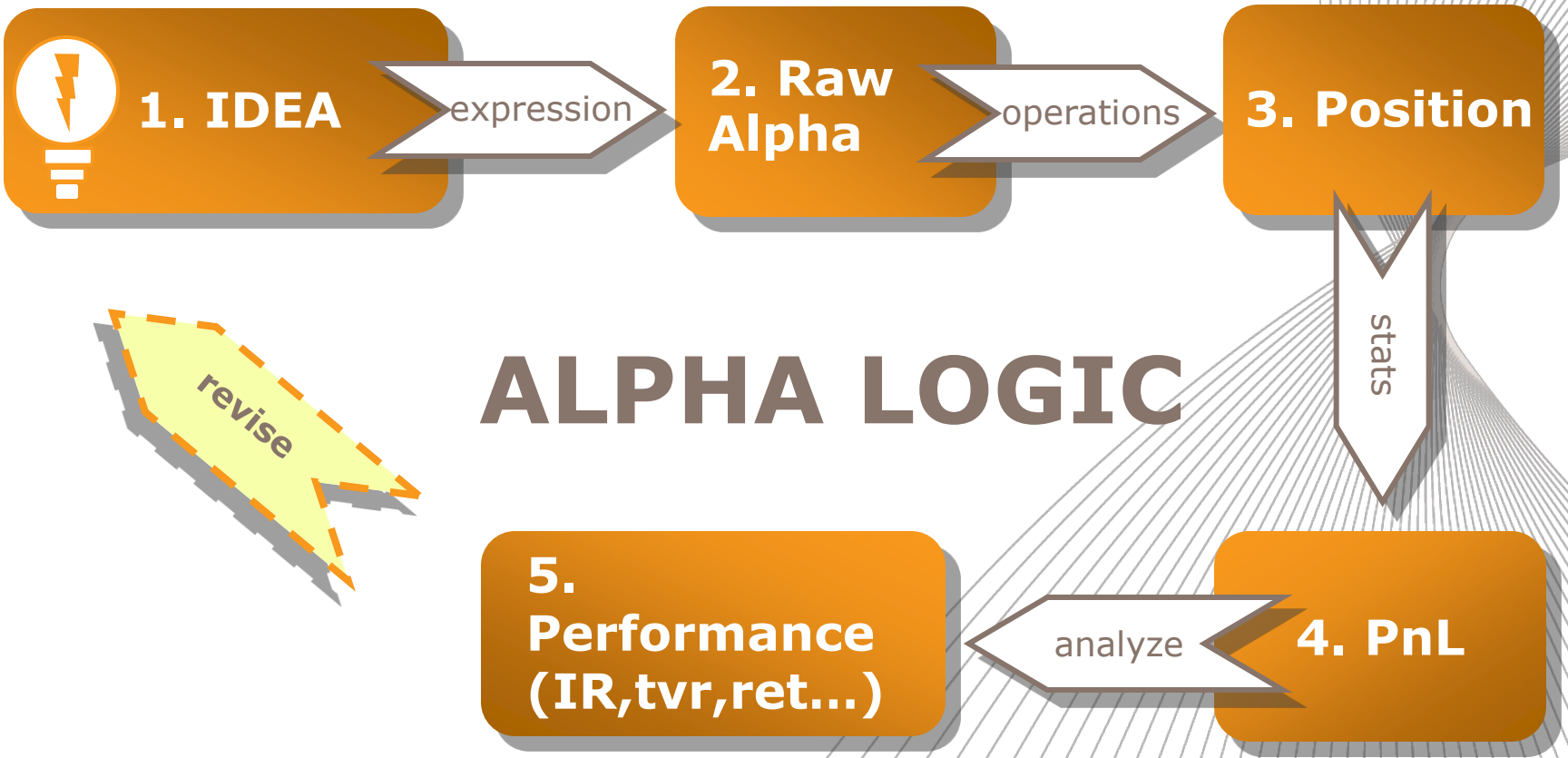
**- Universe**

*A set of instruments that an investor is interested in trading*

**- Weight**

*A risk-adjusted measure of the so-called active return on an investment. These weights are not constants, they change over time - based on the current information and the history of the changes of some variables (such as prices, volumes, etc.)*

# 1.1 ALPHA LOGIC CHART



# 1.2 INTRODUCTION TO ALPHA

## Alpha Types

**Type:**

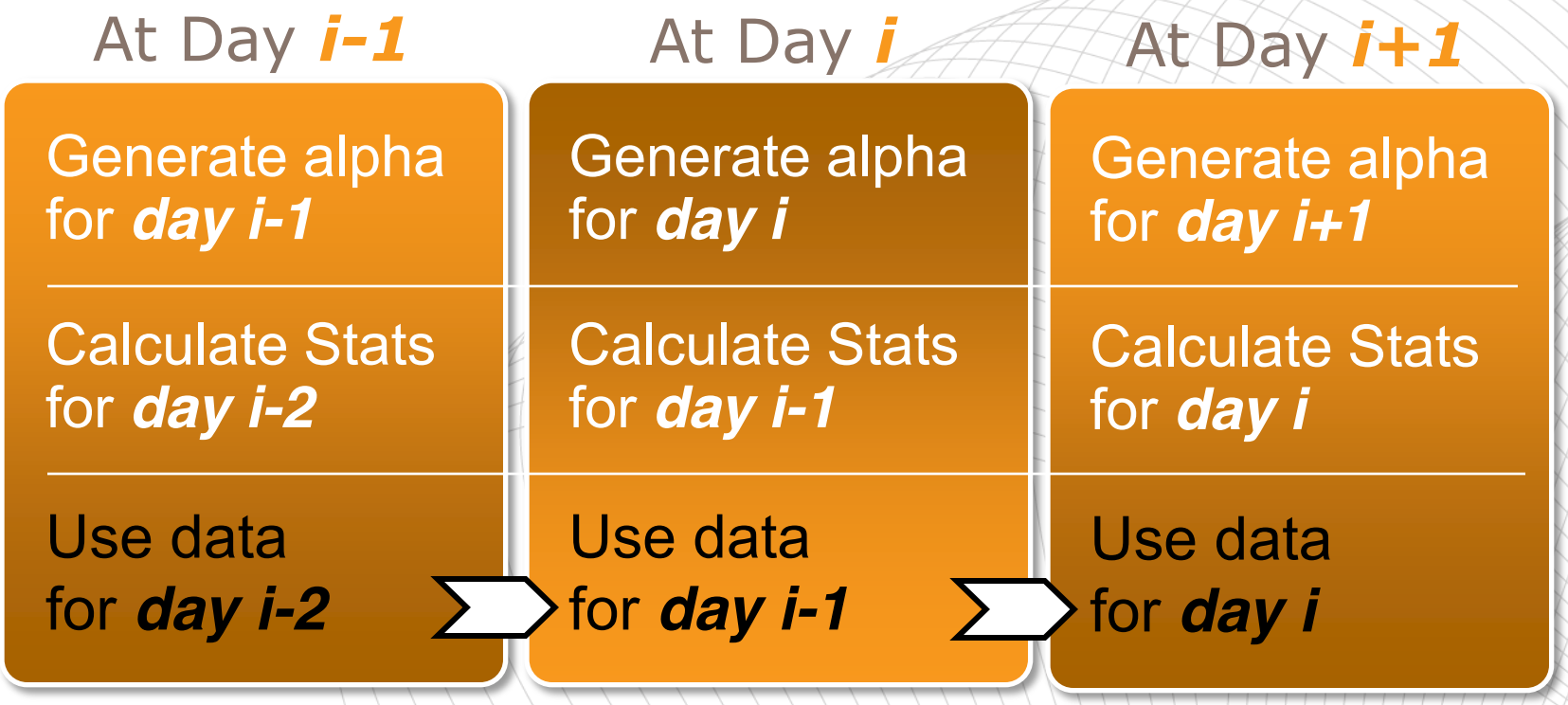
- Delay (delay-1, delay-0, intraday)

- Universe (Top3000,Top 2000,Top1000, Top500)

***Please start with US delay-1, Top 2000***

# 1.3 INTRODUCTION TO ALPHA

## Simulation Logic for delay-1 alpha



# 1.4 INTRODUCTION TO ALPHA

## Performance Measurements: Definitions

- **PnL**

  *daily_pnl = sum of (position * daily_return)*

  *(the daily return is per instrument (today's close / yesterday's close) – 1.0)*

- **Information Ratio (IR)**

  *Prediction ability of a model: mean(daily_pnl)/std(daily_pnl).*
  *Sharpe ratio is the annual IR: IR * sqrt(252)*

  *(the 252 represents the estimated number of trading days in a year)*

- **Turnover (tvr)**

  *Value traded / value held*

- **Drawdown**

  *Percentage of the largest loss*

# 1.5 RESOURCES

## Books

**Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk** by Richard Grinold and Ronald Kahn

## Wiki

*Market efficiency; Technical indicators; Stat-arb*

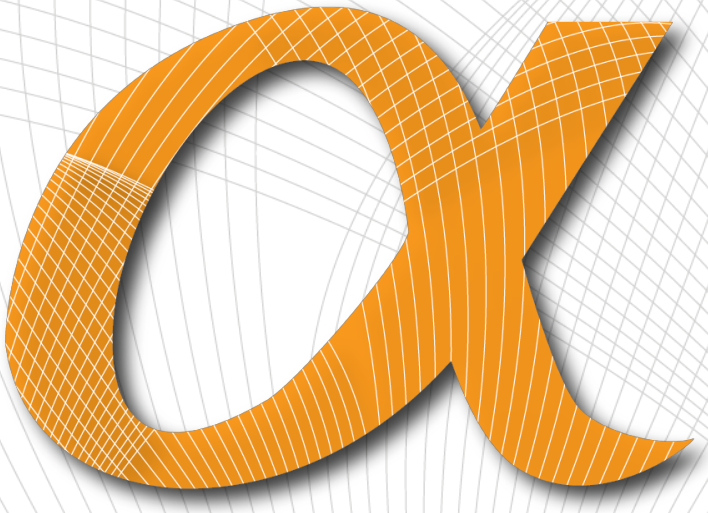
## Paper

Fama, G. and French, K. (1992) 'The cross-section of expected stock return', *Journal of Finance,* 47, June, pp. 427-65

# AGENDA

1 Introduction to Alpha

2 Introduction to WebSim



# 2.1 INTRODUCTION TO WEBSIM

## Definitions: WebSim

**- What is WebSim**

*WebSim is a web-based tool for back-testing trading ideas. An alpha in WebSim is defined by an expression.*

# 2.1 INTRODUCTION TO WEBSIM

## Definitions: WebSim

**- How is an alpha simulated?**

*After user enters an alpha expression that consists of data & operators (refer to 'Alpha definition'), and constants. The input code is evaluated for each instrument to construct a portfolio.*

*Then WebSim simulates an investment in each stock for a one-day period in proportion to the values of the expression. The process repeats each day. If the user specifies Neutralization, the "raw" values (i.e., the values of the expression) are not used directly, and that operation is applied to calculate the final values.*

*With the final values, negative numbers would result in short positions, and positive numbers long positions. Based on those daily positions, **PnL** is then calculated and displayed to user. **NaN** means no positions and thus no PnL.*

# 2.1 INTRODUCTION TO WEBSIM

## Definitions: Alpha Expression

**- Expression**

*An alpha expression consists of data, operators, and constants. The following tables list the data and operators available for use. Concrete example alpha expressions will be generated by clicking button 'Example' on the main page.*

# 2.1 INTRODUCTION TO WEBSIM

## Definitions: Simulation

### Simulation Settings:

Simulation environment can be set by clicking the gear icon on the top right of web page after logged in.

- **Region and Universe**

  *The number of most-liquid stocks to trade*

- **Delay**

  *The timing data used to generate positions: delay-1 uses yesterday's prices while delay-0 uses today's prices*

- **Decay**

  *Combine today's value with previous days' decayed value*

- **Neutralization**

  *Apply market normalization to the results*

- **Max stock fraction**

  *Limit each stock's exposure to a portion of the overall portfolio*

- **Unit check**

  *Make sure the units (dollars, etc.) match in the expression*

- **Simulation timeframe**

  *How much history to back-check*

# 2.1 INTRODUCTION TO WEBSIM

## Definitions: Simulation

**Summary of Results:**
A tabular representation of results

- **Booksize**: *Amount of capital used, long and short*
- ***PnL***: Profit or loss
- **Annual return***: Return on capital used*
- ***Sharpe:*** *Average return divided by standard deviation of returns*
- **Max drawdown: A***bsolute value of maximum peak to trough return*
- **% profitable days:** positive pnl days divided by number of days
- **Daily turnover:** *Dollars traded divided by half of booksize*
- **Profit per $ traded:** *PnL divided by dollars traded*

# 2.2 INTRODUCTION TO WEBSIM

## Results Analysis (for illustrative purposes only)

# 2.3 INTRODUCTION TO WEBSIM

## Getting Started

WebSim is a web-based simulator of global financial markets that was created to explore Alpha. Go to:

***https://websim.worldquant.com***

- **After agreeing with the terms and logging in:**
  - Type **expressions** in the box
  - Set the **Alpha Type**: Region, Universe, Delay
  - Set the **Alpha Operation**: decay, neutralization
  - Click **SUBMIT**

# 2.3 INTRODUCTION TO WEBSIM

## Getting Started: Available Market Data

| DATA NAME | DESCRIPTION |
|---|---|
| open | Daily open price |
| close | Daily close price |
| high | Daily high price |
| low | Daily low price |
| vwap | Daily volume weighted price |
| volume | Daily volume |
| returns | Daily returns |
| adv20 | Average daily volume in the past 20 days |
| sharesout | Daily outstanding shares |

# 2.3 INTRODUCTION TO WEBSIM

## Getting Started: Operators/Functions

| OPERATOR | DESCRIPTION |
|---|---|
| +, -, *, /, ^ | Add, Subtract, Multiply, Divide, Power |
| <, <=, >, >=, ==, != | Logic comparison operators |
| \|\|, &&, ! | Logical OR, AND, Negation |
| cond ? expr1 : expr2 | If cond is true, expr1; else expr2. For example, close < open ? close : open |
| Rank(x) | Rank the values in vector x and the return values are between 0.0 and 1.0 |
| Min (x, y) | Parallel minimum of vectors x and y (similar to the pmin function in R) |
| Max(x, y) | Parallel maximum of vectors x and y (similar to the pmax function in R) |
| StdDev(x, n) | Standard deviation of the values in vector x for the past n days. Note that n must be less than *256 |
| Correlation(x, y, n) | Correlation of the values in vectors x and y for the past n days. Note that n must be less than 256 |
| Sum(x, n) | Sum of the values in vector x for the past n days. Note that n must be less than 256 |
| Covariance(x, y, n) | Covariance of the values in vectors x and y for the past n days. Note that n must be less than 256 |

**** 256 is the maximum number of days prior to the first simulation day for which we have data***

# 2.3 INTRODUCTION TO WEBSIM

## Getting Started: Operators/Functions (continued)

| OPERATOR | DESCRIPTION |
|---|---|
| CountNans(x, n) | Number of NaN values in vector x for the past n days. Note that n must be less than 256 |
| Abs(x) | Absolute value |
| Delay(x, n) | Value of x at n days ago. Note that n must be less than 256 |
| Step(x) | For all stocks, current day is x, yesterday is x-1, and so on |
| Delta(x, n) | x[date] - x[date - n]. Note that n must be less than 256 |
| Decay_linear (x, n) | Linear decay over the last n days |
| Decay_exp(x, f, n) | Exponential decay. f is the smoothing factor, and the process starts from n days ago. For example, Decay_exp(close, 0.1, 20) |
| Product(x, n) | Product of the values in vector x for the past n days |
| Tail(x, lower, upper, Newval) | Set the values of x to newval if they are between lower and upper |
| Ts_Min(x, n) | Minimum value of x over the last n days. Note that this is different than Min. |

# 2.2 INTRODUCTION TO WEBSIM

## Getting Started: Operators/Functions (continued)

| OPERATOR | DESCRIPTION |
|---|---|
| Ts_Max(x, n) | Maximum value of x over the last n days. Note that this is different than Max. |
| Sum_i(expr, var, start, stop, step) | Loop over var (from start to stop with step) and calculate expr at every iteration (presumably expr would contain var), then sum over all the values. For example, Sum_i(Delay(close, i)*i, i, 2, 4, 1) would be equivalent to Delay(close, 2)*2 + Delay(close, 3)*3 + Delay(close, 4)*4 |
| Call_i(expr, var, subexpr) | Substitute subexpr for var in expr, and then evaluate expr. For example, Call_i(x + 4, x, 2 + 3) would be equivalent to (2 + 3) + 4 |
| Sign(x) | 1 if x > 0, -1 if x < 0, 0 if x == 0 |
| SignedPower(x, e) | Sign(x) * (Abs(x)^e) |
| Pasteurize(x) | Pasteurize the signals. Set to NaN if it is INF or if the underlying instrument is not in the universe |
| Log(x) | Natural logarithm |
| Ts_Rank(x, n) | Rank the values of x over the past n days, then return the rank of the current value. For example, if the current value is the max of the past n days, Ts_Rank is 1. If it's a min, Ts_Rank is 0. With all other values in between |

# 2.3 INTRODUCTION TO WEBSIM

## Getting Started: Operators/Functions(continued)

| OPERATOR | DESCRIPTION |
|---|---|
| Ts_Skewness(x, n) | Compute the skewness of x on the last n days |
| Ts_Kurtosis(x, n) | Compute the kurtosis of x on the last n days |
| Ts_Movement(x, k, n) | Compute the kth central moment of x on the last n days |
| IndNeutralize(x, y) | Neutralize alpha x against groupings specified by y. For example, IndNeutralize(x, industry). To neutralize against market, use IndNeutralize (x, 1) |
| Scale(x) | Scale alpha x so that its booksize is 1. To scale to a different book size, say 1000, use Scale(x) * 1000 |

# 2.4 INTRODUCTION TO WEBSIM

## Achieving Good Results: Tips for Maximizing Your Score

- **Think differently and dig deeper**
- **Think ideas in arbitrage view**
- **Try different operations**
- **Try new formulas instead of changing one formula**
- **Do not over-fit parameters**

# 2.4 INTRODUCTION TO WEBSIM

## Achieving Good Results: Find ideas

- **Price movement and technical indicator**
- **Volatility measures**
- **Volume interaction with price**
- **Short term and Long term trend**
- **Find ideas from the newspaper or online**

# 2.4 INTRODUCTION TO WEBSIM

## Achieving Good Results: Improve your ideas

- **Adjust cross-sectional distribution**
- **Think of factors to help signal**
- **Do not use much conditional operation**
- **Use more recent information**

# Thank You.
# We hope you enjoy using WebSim!

WORLDQUANT™

*With intellect, technology and effort,*
*WorldQuant is creating the future of trading*