

**Principal Components Analysis (PCA)** is a very important mathematical technique used in almost all areas of Quantitative Finance. Institutional portfolio managers use this to allocate funds amongst assets and asset classes, interest rate structurers and quants use this technique to model the yield curve and analyze its shape and many rate quants use this technique to implement the famous HJM Model. Many rates and fixed income traders use this methodology to hedge their portfolios, quantitative equity traders use this to develop algorithms to buy and sell stocks and FX algorithmic traders use this to generate price signals.

Even outside of Quantitative Finance, PCA is everywhere in our lives, from biology, physics, engineering, economics to software development and internet search engines. The most famous and powerful internet search engine, Google, uses PCA algorithm. It can be safely said that without PCA there would be no Google Search.

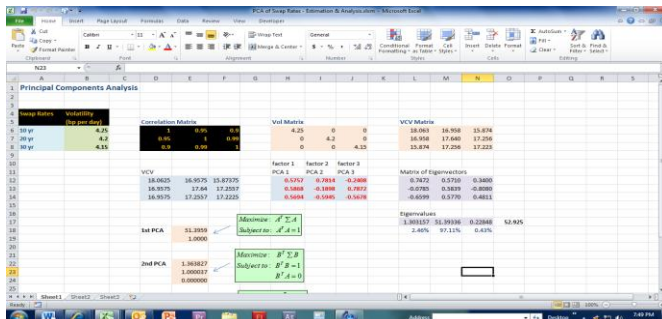
$$MW = \lambda W$$

$$MW - \lambda W = 0$$

$$\Rightarrow (M - \lambda I)W = 0 \Rightarrow |M - \lambda I| = 0$$

$$W \Lambda W^T = M$$

$$M = \begin{pmatrix} \rho_{11} & \dots & \rho_{1N} \\ \vdots & \ddots & \vdots \\ \rho_{n1} & \dots & \rho_{nn} \end{pmatrix} \quad \Lambda = \begin{pmatrix} \lambda_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & \lambda_n \end{pmatrix}$$



# Principal Components Analysis (PCA) & Equity Trading Algorithms

## Quantitative Finance Seminar

14<sup>th</sup> April 2012

Trident Hotel, Bandra-Kurla\*

$$M = \begin{pmatrix} 1 & -0.990 & 0.860 & 0.005 \\ -0.990 & 1 & -0.670 & 0.047 \\ 0.860 & -0.670 & 1 & 0.128 \\ -0.005 & 0.047 & 0.128 & 1 \end{pmatrix}$$

$$W = \begin{pmatrix} 0.613 & 0.777 & -0.132 & -0.050 \\ -0.574 & 0.560 & 0.585 & 0.117 \\ 0.542 & -0.286 & 0.777 & 0.139 \\ 0.023 & 0.014 & -0.187 & 0.981 \end{pmatrix}$$

## Principal Components Analysis (PCA) & Equity Trading Algorithms

### Quantitative Finance Seminar, Mumbai

14<sup>th</sup> April, 2012

CFE School, the Learning and Education division of Risk Latte Company, is organizing a **Quantitative Finance Seminar** in **Mumbai** the area of **Statistical Arbitrage and Equity Trading**. The seminar is aimed at quantitative equity traders, institutional portfolio managers and analysts, algorithmic traders and other equity and market risk professionals. It is even suitable for all those who are keen to understand the PCA technique and how it is applied and implemented within an important area of finance.

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Seminar Title: **Principal Components Analysis (PCA) & Equity Trading Algorithms**

Date: 14<sup>th</sup> April, 2012

Time: 4:30 pm to 7:30 pm

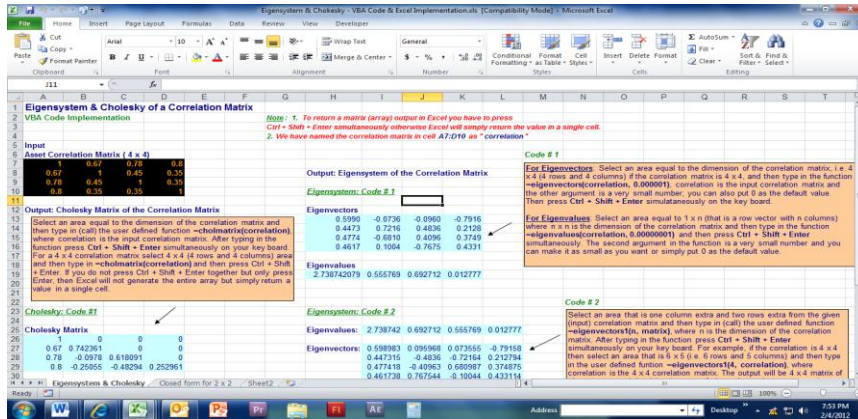
Venue: Trident Hotel, Bandra-Kurla Complex

Duration: 4 hours (with a break)

Methodology: **Excel™ spreadsheet** Implementation

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- What are Eigenvalues and Eigenvectors of a correlation matrix? Intuitive understanding of eigenvectors and eigenvalues and how they relate to concepts in finance and economics.
- What is the PCA methodology and how is it relevant in equity analysis (asset allocation and trading);
- Estimating Principal Components (PCs) of equity price data from Correlation matrix
- Optimization Technique for estimating PCs (Matrix Math and Excel™ Solver optimization);
- Eigen decomposition of symmetric matrices (correlation matrix of asset returns, variance-covariance matrix of asset returns) for estimating PCs (Matrix Math for estimating Eigenvalues & Eigenvectors );
- A simple Stock Trading PCA tutorial using Excel spreadsheet;
- Using PCs to analyze market signals, structure and trading strategies – relevance in analyzing market crashes;
- Estimation of “Eigen-portfolio” and asset allocation algorithm: “market portfolio”, “noise eigenvectors” and pairs trading (live example from HSI / SP500, etc.);
- Relative Value Model for generating price signals: Ornstein-Uhlenbeck (OU) process for stock price dynamics and estimating technique for the parameters; OU modeling for “pairs trading” of stocks
- Trading algorithms for pure mean reversion and mean reversion with drift;



**Fees:**

- US\$50 (USD Fifty) for all CFE graduates
- US\$50 (USD Fifty) for all CFE Level 2 registrants
- US\$75 (USD Seventy Five) for all CFE Level 1 registrants
- US\$200 (USD Two Hundred) for all others

**Registration:**

If you are interested in attending this seminar on either of the above dates then please write to us at [cfeschool@risklatte.com](mailto:cfeschool@risklatte.com) with your contact details together with the details of the fee payment.

**Note:** Seats are extremely limited due to restriction of space, so book your seat early.

The fee can be paid by direct transfer / wire transfer to our bank account. The bank account details are:

**HSBC**

Exchange Square Branch  
Hong Kong

Account Number: **083 384404 838**  
Account Name: **Risk Latte Company Limited**

SWIFT CODE: **HSBCHKHHHKH**

*\*Dates and Venue subject to change.*