CSIT 513 Building Applications for Computational Finance

Description

This course introduces the tools and technologies widely used in industry for building applications in computational finance. From analysis and design to development and implementation, this course covers:

- Financial arithmetic fundamentals, including the core concepts of discounting, net present value and cashflow analysis.
- Pricing interest rate market instruments, including money markets and futures, interest rate swaps, bonds and options.
- Basic skills on translating financial mathematics into spreadsheets using Microsoft Excel and VBA.
- Advance techniques for developing financial library using Excel C++ add-in.
- Modeling financial data and designing financial application using UML.
- Design pattern in financial application.

About 30% of the course will cover financial concepts and the other 70% will cover tools and technical techniques. Depending on the background of the class, we will develop a simplified version of a financial add-in.

Background Recommended

C/C++ programming experience.

Outline and Content (Tentative)

Financial Concepts

Financial Arithmetic

- Simple and compound interest
- Nominal and effective Rates
- Future value / present Value
- Discount factors

Money Market

- Money market basics
- Coupon securities
- Discount instruments

- Money market calculations

FRA/IRF

- Forward-forward, forward rate agreements, futures
- Pricing FRAs
- OTC vs exchange traded
- Hedging

Interest Rate Swaps

- Basic concepts and applications
- Valuing swaps

Yield Curve

- Zero curve basics
- Bootstrapping from first principles

Bond

- Capital market instruments
- Bond pricing
- Modified duration
- Bond futures

Options

- Statistics and probabilities preliminary
- Option pricing
- Black-Scholes model
- Monte Carlo Simulation

Tools and Technologies

Excel

- Basic Excel
  Excel Data Organization, Cells and Ranges, Data Types, Formulas, Range Names, Formatting, Navigating, Creating Charts, Data Tables
- Excel Functions
  Logical, Text, Lookup, Date & Time, Mathematical, Statistical, Financial
- Advanced Excel
  Regression, Formula Auditing, Pivot Tables, Solver

VBA

- Basic VBA
  Object-Oriented Concepts, Macros, Variables and Data Types, Arrays, Control Structures, Sub and Function Procedures
- Advanced Excel
  Programming Charts, Import Data, Forms, Control Toolbox, Debugging

Excel Add-in

- Dynamic Linked Library
- XLL Interface
- How Excel exchanges Worksheet Data with XLL
- Memory Management

Object-Oriented Modeling

- UML Overview
- Object Modeling and its Application to Financial Data

Design Patterns

- Introduction to Design Patterns
- Patterns in Financial Application