

# SUPER COMPUTER CONSULTING INC.

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## ADVANCED MODELLING TECHNIQUES FOR PRICING AND HEDGING DERIVATIVES (Model Building Bootcamp)

### Warm-up session on pricing and valuing derivatives

- The price of any instrument is the present value of the expected value of its cash flows
- The risk neutrality assumption
- Normal and log normal distributions
- The stochastic model for the underlying instrument
- Special cases: commodities, interest rates, weather and catastrophe derivatives
- The time value of money
  - Net present value of cash flows
  - Converting between yield curves:
    - the par bond curve
    - the zero coupon curve
    - the forward curve
    - discount factors
  - When should each curve be used?

**Workshop 1:** building a spreadsheet to convert from the par bond yield curve to the spot curve and vice versa using boot strapping and other methods.

### Mastering the theory and practice behind option pricing models

- Discovering where you can find the underlying data for your calculations
  - Reuters, Bloomberg, and other data feeds
- Learning how to price European options using:
  - closed form formulas
  - tree building

- numerical quadrature
- Monte Carlo techniques
- finite difference methods
- A comparison between different types of trees:
  - equal probability trees and other trees
  - when should each one be used?
- Explaining what the assumptions behind the different models are
- Fully understanding the differences that arise between the various models
- Sanity check: “is it the price reasonable?”

**Workshop 2:** building a spreadsheet to price European options using the methods described above.

### **Understanding the importance of the Greeks**

- The meaning of Delta, Gamma, Vega, Rho and Theta
  - Examining what the implications are when their value changes
  - What do traders look for?

**Workshop 3:** modifying your spreadsheet to compute Delta, Gamma and the other Greeks.

### **Getting to grips with the pricing and valuing of exotic options**

- Learn how to price exotic options using:
  - a tree to handle American and Shout options
  - Monte Carlo to handle Asian options and Barrier options
  - quadrature to handle Compound options and Chooser options
  - techniques to improve and speed up the Monte Carlo algorithm

**Workshop 4:** creating the model to price the exotic option of your choice

### **Options on interest rates: applying them in practice**

- Examining how yield curves are modelled
- Applying the different interest rates models:
  - Cox Ingersoll Ross,
  - Black, Derman and Toy
  - Ho and Lee
  - Vasicek, Hull and White
  - Longstaff and Schwartz

- Black-Karasinski
- Brace and Musiela
- Explaining the advantages and disadvantages of each model
- How to choose the right model for your particular needs
- How to successfully overcome the problem of calibrating your model to current market conditions
- Using binomial and trinomial interest rate trees
- Incorporating volatility into your tree calculations
- Learning how to deal with the different length of time in interest rates when building your tree

**Workshop 5:** building a binomial tree and pricing a callable bond

#### **Understanding duration and convexity**

- Describing the concepts of duration, convexity and option adjusted spread (OAS)
- Learning what their uses are:
  - adjusted duration and MacAulay duration
  - the case of the “century” bond
  - using duration as a hedge ratio
- How to use OAS as a measure of relative value

**Workshop 6:** modifying your spreadsheet to compute duration, convexity and OAS