

PURDUE QUANTITATIVE FINANCE CLUB

Presents

Cracking the Quant Finance Interview – Part I

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UNIV 117

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Recent Industry Background

Banking Experience

Risk Analyst (2010-2011)
Standard Chartered Bank
Group Model Validation
Singapore

Software R&D Experience

Data Analytics Engineer (2008-2010)
Vinta Systems, Incorporated
Makati City, Philippines

Cracking the Quant Finance Interview Series

- **Part 1**

Walk through Quant Finance Careers
Checklist of Concepts needs to be reviewed
Interview Preparation Advice

- **Part 2**

Theoretical reinforcement of concepts.

- **Part 3** (Spring semester, 2013)

Quant Finance Interview Questions and Answers
Frequently Asked Questions in Quant Finance

Some Key References for this Introduction

- **On Becoming a Quant** (by Mark Joshi, 2011)
- **Paul and Dominic's Guide to Getting a Quant Job** (by Dominic Connor and Paul Wilmott, 2007)
- **Interview Preparation: Quantitative Analysis** (Mark Page, 2012)

Why Prepare for Quant Interview?

Still remember the grueling rituals of preparing to grad school to get into a prestigious school like Purdue such as

Application Forms
Standardized Tests SAT / GRE
GRE / recommendations / essay
Cutting Edge GPAs
... other activities that make you **STAND OUT!**



It took months of Months of Preparation ...
YET, YOU ARE JUST STILL HALF WAY AROUND!

Why Prepare for Quant Interview?

What made you **HERE** in **PURDUE**?
BECAUSE YOU STOOD OUT OF THE REST!

This is no different of going to **WALL STREET**!
You will be competing with the **BEST OF THE BEST** from some of the graduates of prestigious institutions!

Thumb Rule Acceptance Rate:
Grad School (10% - 30%)
Quant Finance Interviews ($\leq 10\%$)



Why Prepare for Quant Interview?

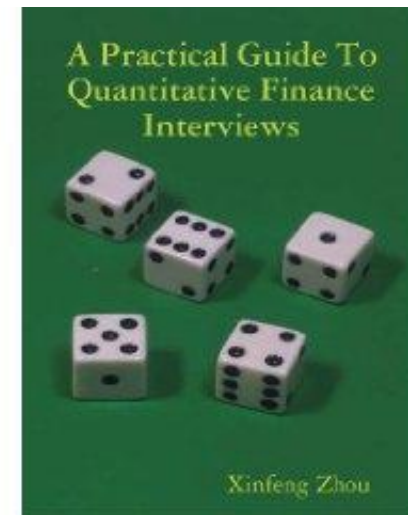
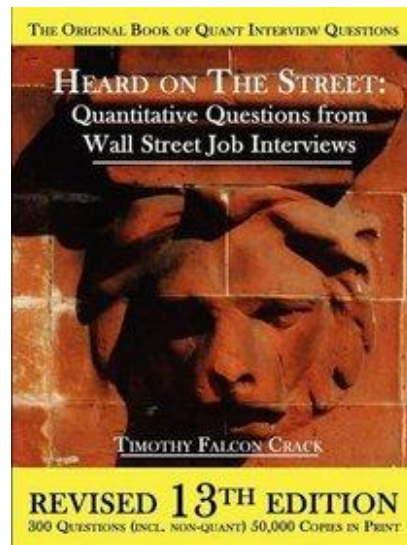
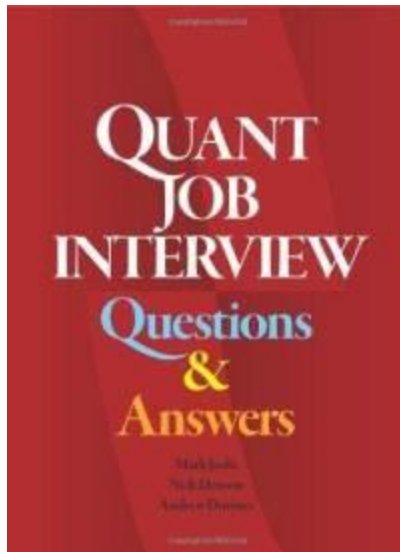
**THAT IS WHY WE ARE
CRACKING THE QUANT FINANCE
FOR YOU!**

"Chance favors the prepared mind!"

Louis Pasteur

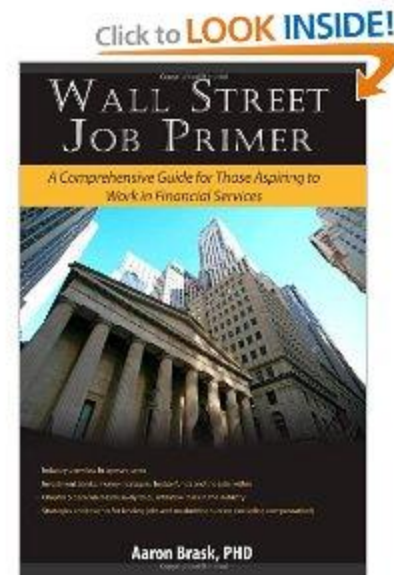
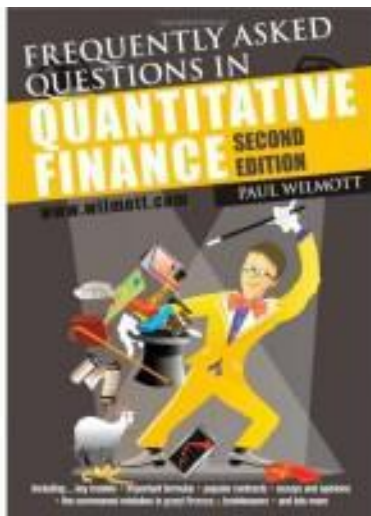
Quant Finance Interview Sources

- Mark Joshi, Quant Job Interview - Questions and Answers, 2008.
- Timothy Falcon Crack, Heard on the street: Quantitative Questions from Wall Street Job Interviews, 2009.
- Xinfeng Zhou, A Practical Guide to Quantitative Finance Interviews, 2008.



Quant Finance Interview Sources

- Paul Wilmott, Frequently Asked Questions in Quantitative Finance, 2009
- Aaron Brask, Wall Street Job Primer. A comprehensive guide for those aspiring to work in financial services, 2011.



What does a Quant Do?

A quant "aka rocket scientist" designs and implements mathematical models for the pricing of derivatives, assessment of risk, or predicting market movements.



What Sorts of Quants are There?

- Front office / desk quant
- Model validating quant
- Research Quant
- Quant developer
- Statistical arbitrage quant
- Capital quant

Front Office / Desk Quant

- A desk quant implements pricing models directly used by traders.
- **Pros:** close to the money and opportunities to move into trading.
- **Cons:** can be stressful and depending on the outfit may not involve much research.

Model Validation Quant

- A model validation quant independently implements pricing models in order to check that front office models are correct.
- **Pros:** more relaxed, less stressful.
- **Cons:** model validation teams can be uninspired and far from the money.

Research Quant

- Research quant tries to invent new pricing approaches and sometimes carries out blue-sky research.
- **Pros:** it's interesting and you learn a lot more.
- **Cons:** sometimes hard to justify your existence.

Quant Developer

- A glorified programmer but well-paid and easier to find a job. This sort of job can vary a lot.
- It could be coding scripts quickly all the time, or working on a large system debugging someone else's code.

Statistical Arbitrage Quant

- Statistical arbitrage quant, works on finding patterns in data to suggest automated trades.
- The techniques are quite different from those in derivatives pricing. This sort of job is most commonly found in hedge funds.
- The return on this type of position is highly volatile!

Capital Quant

- A capital quant works on modeling the bank's credit exposures and capital requirements.
- This is less sexy than derivatives pricing but is becoming more and more important with the advent of the Basel III banking accord.
- You can expect decent (but not great) pay, less stress and more sensible hours.
- There is currently a drive to mathematically model the chance of operational losses through fraud etc, with mixed degrees of success.

Thumb Rule: Where the Money is?

- People do banking for the money, and you tend to get paid more the closer you are to where the money is being made.
- As a general rule, moving away from the money is easy, moving towards it is hard.

Financial Derivatives

- Financial instruments to hedge risk
(as well as speculating risk)
- Examples
 - Options: Call and Put
 - Futures and Forwards
 - Fixed Income Derivatives
 - Credit Derivatives

Areas of Derivatives

- Foreign Exchange (FX)
- Equities
- Fixed Income
- Credit Derivatives
- Commodities
- Hybrids

Foreign Exchange

- Contracts tend to be short-dated with high volume and simple specifications.
- Emphasis is therefore on speed and smile modeling.

Equities

- Equities means options on stocks and indices.
- Techniques tend to be PDE based with the local volatility model being popular.
- A typical contract is a note paying some function of the stock price path.
- Not a particularly big market.

Fixed Income

- Fixed income means interest rate derivatives.
- This is probably the biggest area by value.
- The math is more complex because the underlying is multi-dimensional.
- Martingale techniques are used a lot.
- It's well paid.

Credit Derivatives

- Credit derivatives are derivatives that pay-off according to the defaults of corporate entities.
- This was a big growth area with lots of demand translating into very high pay.
- It displayed some bubble-like characteristics, however, and the bubble has now burst.

Commodities

- Commodities, this is also a big growth area with the general rally in commodity prices in recent years (especially in the nonrenewable ones e.g. energy and precious metals).
- This is the area that seems to be holding up best in the current job market.

Hybrids

- Hybrids are derivatives that pay off according to behaviors in more than one market – this is typically interest rates plus something else.
- The main advantage of working on such products is the ability to learn multiple areas.

Types of Employers

- Commercial banks
- Investment banks
- Hedge funds
- Accountancy firms
- Software companies

Commercial Banks

- Commercial banks ask less of you, and pay less.
- Better job security.

Investment Banks

- Investment banks tend to demand long hours but pay well.
- Not so good job security.

Hedge Funds

- Hedge funds tend to demand a lot of work. They are very volatile and a big growth industry currently.
- There is the potential to make a huge amount of money, but also the potential to be unemployed after a few months.

Accountancy Firms

- The big accountancy firms have quant teams for consulting.
- The main disadvantage is that you are far from the action, and high quality individuals tend to work in banks so it may be hard to find someone to learn from.
- Related places are consultancies and insurance companies.

Software Companies

- There is becoming more of a tendency to outsource quant modeling and buy in software models.
- One option is therefore to work for the software company instead.
- The issues are similar to those with working for accountancy firms.

Other careers related to QF: Risk Management and Actuary

- Reality Check:

With the tight market, not all of us will get a Quant Job ... perhaps some will go somewhat related to QF such as Actuary and Risk Management

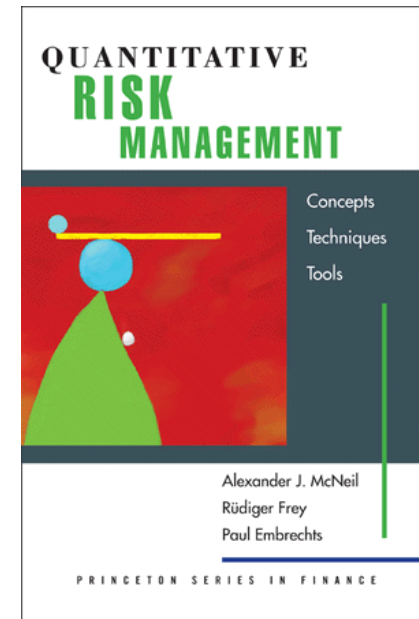
Top 10 Reasons to Consider Being an Actuary

Source: <http://www.beanactuary.com/college>

- You don't want to go to graduate school
- You want a professional title, but don't want to be a doctor, lawyer, or accountant
- You want a career that is dynamic and challenging
- You want a career that you control because advancement is merit-based
- You want a career with many opportunities that will provide you with skills that are transferrable across multiple industries
- You want a career with superior job security through economic cycles
- You would like to "earn while you learn"
- You want to be able to choose among outstanding job offers
- You are self-motivated, goal oriented, and have superior math aptitude and communication skills
- You want a highly competitive salary and excellent benefits

Risk Management

- Types of Risk
 - Market Risk
 - Credit Risk
 - Operational Risk
- Basel II compliance
(Basel III to be introduced by 2013)



New Course Offering!

IE 59000 – Credit Risk

Spring, 2013

CRN 64319

TR 09:00 am-10:15 am

Agostino Capponi

Academic Preparation

- Computational Finance Program
 - MS Math/Stat Program
 - PhD Math/Stat Program
- Undergraduates may get core CF courses provided they satisfy the prerequisites

Quant Prospects Outside CF Program

- Preferably in a Quantitative Area such as:
Stat/Math (non-CF), CS, EE, IE, Econ
- Math and Stat Preparation
Advanced Calculus
Real Analysis
Differential Equations
Linear Algebra
Numerical Analysis
Probability
Statistical Theory
Simulations
- Knowledgeable in some high level programming language such as Matlab, R, C/C++

Fundamental Courses

- Mathematics of Finance
(MA 515/ STAT 540)
- Advanced Probability, Options, and
Numerical Methods (MA 516/ STAT 541)
- Design and Analysis of Financial Algorithms
(STAT 598W)

Mathematics of Finance

(MA 515/ STAT 540)

Offered in Spring Semester

- Discrete Time Models
- Stochastic Calculus for Finance
- Black Scholes Model
- European Option Pricing and Hedging
- Incomplete Models
- Forwards and Futures
- Exotic Options

Adv. Prob., Options, and Numerical Methods (MA 516/ STAT 541)

Offered in Fall Semester

- Fixed Income Models
- American Options
- Numerical Methods

- Group Project
- Oral Exam required for graduation in the MS STAT CF Program

Design and Analysis of Financial Algorithms (STAT 598W)

Offered in Spring Semester

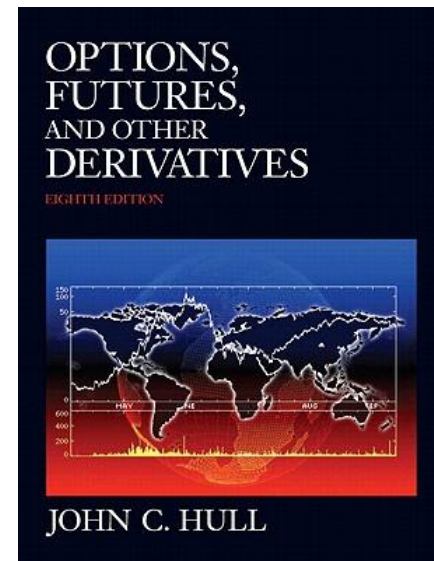
- Programming in the following languages:
 - Visual Basic
 - Matlab
 - R
 - C/C++

Quant Finance Texts: Beginner

- **Hull Options, Futures, and Other Derivatives, 8th ed., 2011 (John Hull)**

MBA-Level Financial
Derivatives Course

Good for getting grasp of
financial models in relation
to the real-world financial
markets



Quant Finance Texts: Intermediate

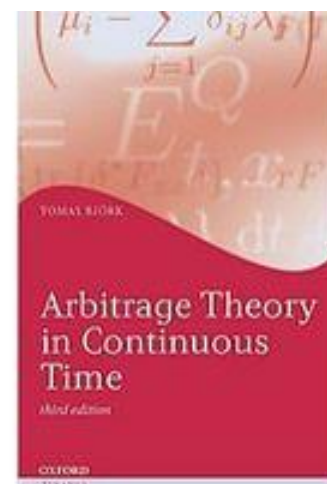
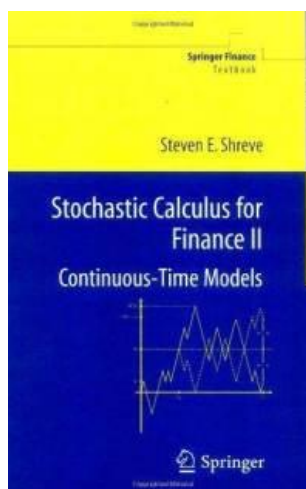
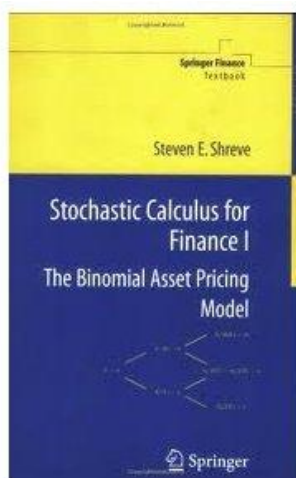
Steven E. Shreve

Stochastic Calculus for Finance I: The Binomial Asset Pricing Model

Stochastic Calculus for Finance II: Continuous-Time Models

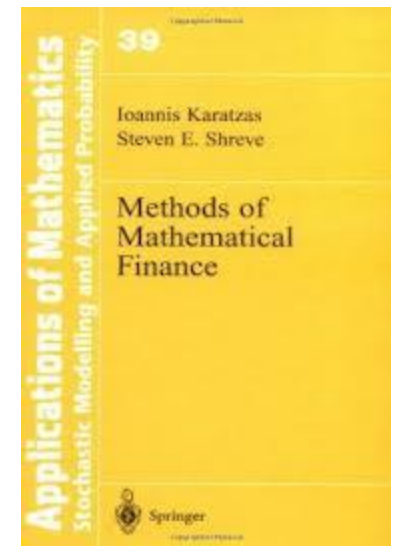
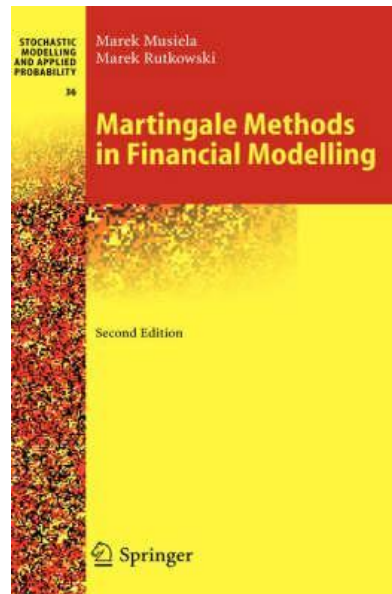
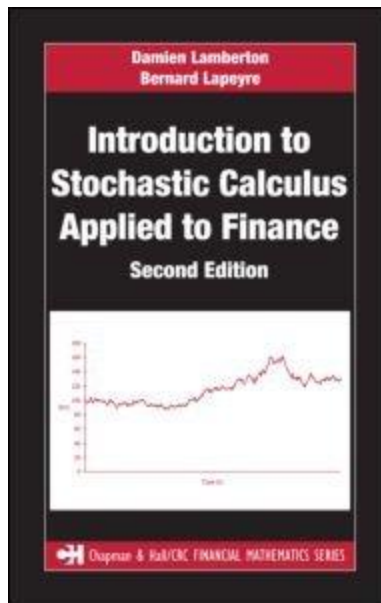
Tomas Bjork

Arbitrage Theory in Continuous Time, 3rd. Ed., 2009



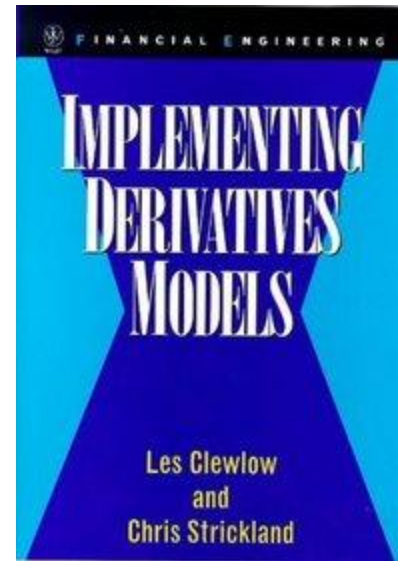
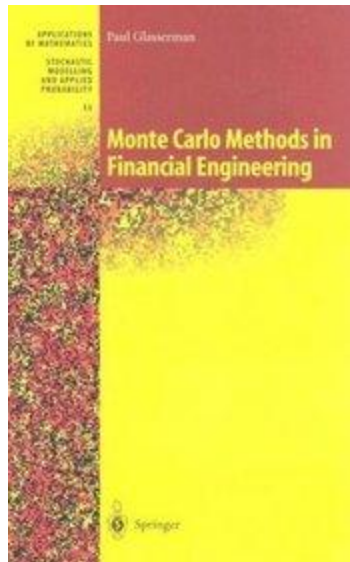
Quant Finance Texts: Advanced

- Introduction to Stochastic Calculus Applied to Finance, 2nd ed. (Lamberton and Lapeyre, 2008)
- Martingale Methods in Financial Modelling (Marek Musiela and Marek Rutkowski, 2011)
- Methods of Mathematical Finance (Karatzas and Shreve, 1998)



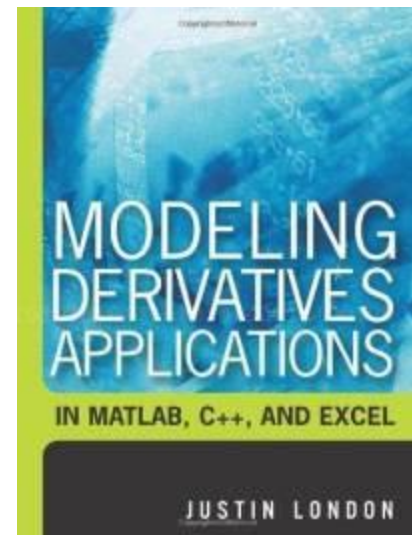
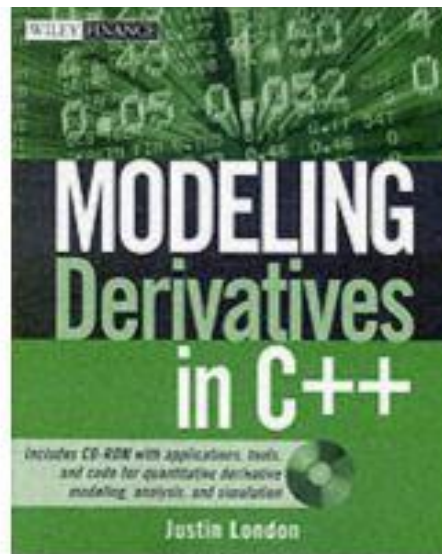
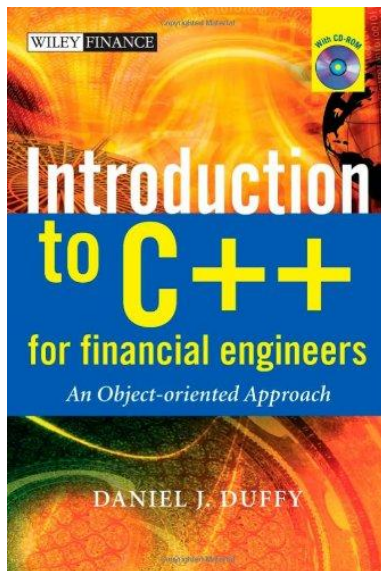
Numerical Methods

Les Clewlow and Chris Strickland
Implementing Derivative Models
Paul Glasserman
Monte Carlo Methods in Financial Engineering



C++ Programming

- Introduction to C++ for Financial Engineers: An Object-Oriented Approach (Daniel Duffy, 2006)
- Modeling Derivatives in C (Justin London, 2004)
- Modeling Derivatives Applications in Matlab, C++, and Excel (Justin London, 2006)



Quant Interview Checklist

- ☐ Stochastic Calculus for Finance
- ☐ Discrete Time Models
- ☐ Black Scholes Model
- ☐ Derivatives Pricing and Hedging
- ☐ Fixed Income Modeling
- ☐ Portfolio Optimization
- ☐ Numerical Methods
- ☐ C++ programming
- ☐ Brainteasers
- ☐ Frequently Asked Questions
- ☐ Quant Savvy Questions: Being upbeat in the market
- ☐ Question Related to your soft skills and CV

Word of Advice

- Don't memorize the formulas without deriving it! ... (especially the Greeks!)
- You should memorize how to derive Black-Scholes PDE and European Call/Put option price formulas by heart including the case with dividends and non-fixed r and σ
- Devote some time in the Winter Break mastering C++ concepts (especially those who will be graduating or having internships).
STAT 598W is Fast-Paced!

Delta of the Option: Part 1

Source:

<https://studentweb.hhs.se/CourseWeb/CourseWeb/Public/PhD401/1102/F3B.pdf>

- We will just mention the concept to be studied Derivatives Pricing and Hedging checklist

Delta of the Option: Part 2

- Rate of change of option value with respect to changes in the underlying asset's price

[http://en.wikipedia.org/wiki/Greeks_\(finance\)](http://en.wikipedia.org/wiki/Greeks_(finance))

$$\Delta = \frac{\partial V}{\partial S}$$

- European Call

$$\Delta = \Phi(d_1)$$

- European Put

$$\Delta = 1 - \Phi(d_1) = \Phi(-d_1)$$

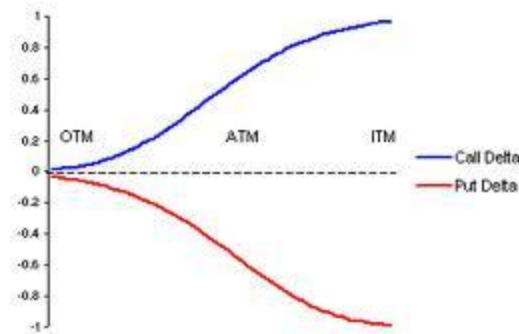
Delta of the Option: Part 2

- Interpret Delta in terms of
- <http://www.optiontradingtips.com/greeks/delta.html>

At the Money (ATM)

Out of the Money (OTM)

In the Money (ITM)



Delta of the Option: Part 3

Given a portfolio Π with underlying S . Consider two derivatives with pricing functions F and G .

x_F = number of units of F

x_G = number of units of G

Problem:

Choose x_F and x_G such that the entire portfolio is delta- and gamma-neutral.

Value of hedged portfolio:

$$V = \Pi + x_F \cdot F + x_G \cdot G$$

Delta of the Option: Part 3

Value of hedged portfolio:

$$V = \Pi + x_F \cdot F + x_G \cdot G$$

We get the equations

$$\frac{\partial V}{\partial s} = 0,$$

$$\frac{\partial^2 V}{\partial s^2} = 0.$$

i.e.

$$\Delta_{\Pi} + x_F \Delta_F + x_G \Delta_G = 0,$$

$$\Gamma_{\Pi} + x_F \Gamma_F + x_G \Gamma_G = 0$$

Solve for x_F and x_G !

Friendly Advice

- Use the checklist button in your preparation to assess whether the concepts presented below are already master.
- This is to guide you the strength or weakness in a given area

Stochastic Calculus for Finance

- Brownian Motion
- Adapted Processes and Martingales
- Conditional Probability
- Markov Processes
- Stochastic Differential Equations
- Ito Processes and Ito Lemma
- Feynman-Kac Representation Theorem
- Levy's Representation Theorem
- Martingale Representation Theorem
- Radon Nikodym Theorem
- Girsanov and Novikov's Theorem

Basic Concepts

- Arbitrage
- Completeness
- Contingent Claim
- Martingale
- Risk Neutral Valuation
- Self-financing Model

Fundamental Theorems of Finance

First Theorem (Arbitrage Free Condition)

- The market is arbitrage free iff there exists a martingale measure \mathbb{Q}

Second Theorem (Replicability/Completeness Condition)

- Assume that the mode is arbitrage-free. Then the market is complete iff the martingale measure is complete

Discrete Time Models

- Binomial and Trinomial Models
(in particular the CRR model)
- Hedging in Discrete Time Models
- Convergence of Binomial Model to the Black Scholes Model

Black Scholes (BS) Model

- ❑ Black Scholes Model
- ❑ Black Scholes SDE
- ❑ Black-Scholes Equation
- ❑ Call-Put Parity Relationship
- ❑ Modifications within the BS Framework Presence of Dividends
 - Continuous Dividends
 - Discrete Dividends
 - Non-constant risk-free rate
 - Non-constant volatility
- ❑ Multivariate Models

Derivatives Pricing and Hedging

Trading Strategies Involving Options (Hull, 2011)

Strategies Involving a Single Option or Stock

- ☐ Covered Call
- ☐ Protected Put

Spreads

- ☐ Bull Spread
- ☐ Bear Spread
- ☐ Butterfly Spread
- ☐ Calendar Spread

Combinations

- ☐ Straddle
- ☐ Strips and Straps
- ☐ Straddle

Derivatives Pricing and Hedging

- ❑ **Sensitivities (The Greeks)**

 - Delta

 - Gamma

 - Theta

 - Rho

 - Vega

- ❑ **Relationship of the Greeks with respect to Stock Prices**

- ❑ **Relation of Greeks with respect to Time to Maturity in the following scenarios**

 - In The Money (ITM)

 - At The money (ATM)

 - Out of the Money (OTM)

Derivatives Pricing and Hedging

- **Complementary Relationship of the Greeks from Call Put Parity Relationship**
- **Hedging Strategies**
 - Delta Neutral
 - Gamma Neutral
 - Generalized Neutrality
 - Overnight Profit

Derivatives Pricing and Hedging

□ Plain Vanilla Options

Call Option

Put Option

□ Exotic Options

Asian Options

Binary (Digital) Options

Barrier Options

Basket Options

Lookback Options

Other Derivative Products

- Forwards and Futures

- Currency Derivatives

 - Foreign exchange market model

 - Domestic and foreign risk-neutral measure

CAPM Theory and Incomplete Models

CAPM Theory

- Mathematical Framework
- Efficient Frontier
- Market Price of Risk
- Shortcomings of CAPM Theory

Incomplete Models

- Risk Neutral Valuation
- Hedging

Stochastic Volatility Models

Models

- ❑ Constant elasticity of variance model (CEV)
- ❑ GARCH Modeling
- ❑ Heston's Model
- ❑ Implied Volatility
- ❑ Local Volatility and Dupire Equation
- ❑ SABR (Stochastic Alpha, Beta, Rho) model
- ❑ Volatility Smile

Drift and Volatility Estimation

American Options

- American versus European Option
- Snell Envelope
- Optimal Stopping Time
- American Call Option
- Perpetual American Put Option
- Finite Expiry American Put Option

Fixed Income Derivatives

- ❑ Bank Account
- ❑ Coupon Bond
- ❑ Floating Rate Bond
- ❑ Forward Contract
- ❑ Interest Rate Swaps
- ❑ Interest Rate Caps and Floors

Fixed Rate Terminology

- ❑ LIBOR Forward Rate
- ❑ LIBOR Spot Rate
- ❑ Continuously Compounded Forward Rate
- ❑ Continuously Compounded Spot Rate
- ❑ (Instantaneous)Forward Rate
- ❑ (Instantaneous)Short Rate
- ❑ Zero Coupon Yield
- ❑ Yield to Maturity
- ❑ Duration and Convexity

Fixed Income Checklist

- ☐ Short Rate Models

- ☐ Affine Models

- ☐ Short Rate Models

 - Vasicek (an mean reversion interpretation)

 - CIR (Cox-Ingersoll-Ross) Model

 - Dothan

 - Ho-Lee

 - Hull-White (Vasicek and CIR extensions)

Fixed Income Checklist

- ❑ Risk Neutral Valuation
- ❑ Martingale Models for Short Rate
- ❑ Heath, Jarrow, and Morton (HJM) Framework
- ❑ Change in Numeraire
- ❑ Forward Measure and General Option Pricing Formula
- ❑ LIBOR and Swap Models
 - Black-76 Formula
 - LIBOR BGM Models
 - Swaption Models

Sample Questions

- What is the price of a Forward?
- How do you hedge it?
- What is its delta?
- When is gamma the highest?
- How does the gamma moves with the volatility?
- What are the first and second derivatives in function of the strike?
- How can we build a digital?
- If we have an increase in volatility, how would the price move?

Numerical Methods Checklist

- ❑ Generation of Random Variables
 - Inverse transformation
 - Box-Muller Method
 - Accept Reject Sampling
 - Mixture Representation
- ❑ Pay attention simulation of common distributions such as exponential and Gaussian as well as Multivariate Gaussian distribution
- ❑ Monte Carlo methods and Integration

Numerical Methods Checklist

- ☐ Binomial methods
- ☐ Trinomial trees
- ☐ Finite difference methods
- ☐ Solutions of linear systems
- ☐ Numerical integration

Comparative Performance in Numerical Methods

- Source:(Paul and Dominic's Guide to Getting a Quant Job)
- **Thumb Rule**

Subject	Finite difference	Monte Carlo	Quadrature
Low dimensions	Good	Inefficient	Good
High dimensions	Slow	Excellent	Good
Path dependent	Depends	Excellent	Not good
Greeks	Excellent	Not good	Excellent
Portfolio	Inefficient	Very good	Very good
Decisions	Excellent	Poor	V. poor

- **Advice:** Implement it!

C++ Programming Checklist

Adapted from:

<http://www.math.utah.edu/ugrad/finance/interviewprep1.pdf>

Variables, types and Expressions:

- ☐ Identifiers
- ☐ Data Types
- ☐ Declarations
- ☐ Constants and Enumerations
- ☐ Assignment and Expressions

Branch and loop statements:

- ☐ Boolean Values
- ☐ Expressions and Functions
- ☐ 'For', 'While' and 'Do....While' Loops
- ☐ Multiple selection and Switch statements
- ☐ Blocks and Scoping

C++ Programming Checklist

Functions and Procedural abstraction:

- ☐ User-defined functions
- ☐ Value and Reference parameters
- ☐ Polymorphism and Overloading
- ☐ Procedural abstraction and good programming style
- ☐ Splitting programs into different files

Files and streams:

- ☐ Input and Output using files and streams
- ☐ Streams as arguments to functions
- ☐ Input and Output using '<' and '>'

Arrays and Strings:

- ☐ Declaring arrays and strings
- ☐ Arrays as parameters
- ☐ Sorting arrays
- ☐ Two-dimensional arrays
- ☐ String manipulation

C++ Programming Checklist

Pointers:

- ☐ Declaring pointers
- ☐ The '*', '&', 'new' and 'delete' operators
- ☐ Pointer arithmetic
- ☐ Automatic and dynamic variables

Recursion:

- ☐ Recursion and iteration
- ☐ Mechanics of a recursive call
- ☐ Recursive data structures
- ☐ Quick sort

Classes:

- ☐ The object-oriented paradigm
- ☐ Encapsulation and inheritance in C++
- ☐ Constructors, friends and overloaded operators
- ☐ Static members

Standard Template Library (STL)

Basic C++ Questions

- What is the difference between passing by value and passing by reference?
- What is the difference between a pointer and a reference?
- When would you use a pointer/reference?
- What does it mean to declare a function or variable as static?
- What is a class?
- What is the difference between a struct and a class in C++?
- What is the purpose of a constructor/destructor?
- What is a constructor, destructor, default constructor, copy constructor?
- What does it mean to declare a member function as virtual/static?
- What is virtual inheritance?
- What is polymorphism?
- What is the most difficult program you have had to write?

Intermediate C++ Questions

- What happens when you have a non-virtual method in a base class and a method of the same name in a derived class?
- What about “overriding” a virtual method in a base class with one in a derived class? Why doesn't this work the same?
- Can you call a virtual function in a base class when you have overridden it?

Basic Math Questions

Basic math equations can't be understated in Quant Finance Interview

One has to be snappy enough to solve such questions quickly.

Single Variable Calculus

- ❑ Ordinary calculus
- ❑ Ordinary differential equations
- ❑ Simple integral equations (Laplace and Fourier Transforms included)

Basic Math Questions

Multivariate Calculus

- ❑ Partial differential calculus
- ❑ Partial differential equations
- ❑ Classification of PDEs
- ❑ The diffusion equation

Basic Numerical Methods

- ❑ Bisection Method
- ❑ Newton-Raphson Method
- ❑ Basic numerical methods

Basic Math Questions

Matrices

- ❑ Matrix manipulation
- ❑ Eigenvalues and eigenvectors
- ❑ Exponentiation

Example: Find the eigenvalues and eigenvectors of the matrix

$$\begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$$

Series and sequences

- ❑ Maclaurin /Taylor series
- ❑ Maclaurin Series
- ❑ Convergence Tests

Probability and Statistics

Elementary probability theory

- Distributions, discrete and continuous
- Moments and Central Moments
- Important distributions
- Central Limit Theorem

Elementary statistics:

- Data representation
- Regression
- Confidence intervals
- Parameter Estimation
- Hypothesis Testing
- Test for Normality

Brainteasers

- **Straightforward calculation**

Example: How many trailing zeroes are there in 100 factorial?

- **Lateral thinking**

Example: Several co-workers would like to know their average salary. How can they calculate it, without disclosing their own salaries?

- **Open to discussion**

Example: What's the probability that a quadratic function has two real roots?

- **Off the wall**

Examples: How many gas stations in the USA?
Why are manhole covers round?

- **General Probability and Combinatorics**

Examples:

You toss a coin 20 times, what is the probability that you get *exactly 10 heads*?

There are 36 people in a room, what is the probability that at least 2 of them share a birthday?

Brain teasers

- **Conditional Probability**

Example: Monty Hall problem

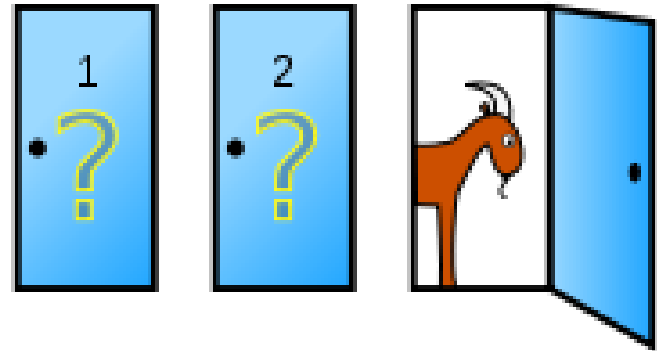
http://en.wikipedia.org/wiki/Monty_Hall_problem

Suppose you're on a game show, and you're given the choice of three doors:

Behind one door is a car; behind the others, goats.

You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat.

He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?



Brainteasers

- ❑ How many gas stations are there in the United States?

Aim: Test your aptitude on Magnitude of Scale

Do a ratio and proportion

West Lafayette Population: 30000

Gas Stations in West Lafayette: 12

US Population: 31200000

By doing the math gives us: 124800

A nice approximation is around 150000

Actual (as of 2011): 159141

Source: <http://www.howmanyarethere.org/how-many-gas-stations-are-there-in-the-united-states/>

Moral Lesson

- Review all STAT 519 problems and its text First Course in Probability, 8th ed. (by Sheldon Ross)
 - Birthday Problem
 - Card and Urn Drawing Problems
 - Conditional Probabilities
- Who says these problems aren't that useful?
It will either make or break one's Quant career!
- Other source of Brain Teasers
 - Brainteaser Forum on wilmott.com

Moral Lesson

- classic High School Algebra Problem Solving may pop-up in the interview including
 - Clock Problems
 - Upstream Down stream problems,etc ...
- **Brain Teaser:** How many zeros are there in $100!$?
- **Answer:** 24
- The classic brain teasers comes over and over again on interviews!
- Practice makes perfect!

Strategic Networking (15 mins)

Purdue Quantitative Finance Club

<http://web.ics.purdue.edu/~quantit/>



- PQFC is an organized group of students at Purdue University interested in quantitative finance, financial engineering, risk management and other similar domains.
- PQFC is a student organization and a student initiative to serve the Purdue CF community which in turn serves the Finance industry in a virtuous-cycle feedback mechanism.

Officers and Advisors

■ Officers:

President: [Xiaoguang Wang](#)

Vice President: [Rolando Navarro](#)

Vice President: [Thomas Tian Qiu](#)

Secretary: [Jeffrey Nisen](#)

Treasurer: [Luis Barboza](#)

■ Club Faculty Advisors

[Dr. Frederi Viens](#)

[Dr. Jose E. Figueroa-López](#)

[Dr. Michael Levine](#)

Quant Savvy Questions:

Being upbeat in the market

- Genuine interest in the field is key for further success in the Quant Finance Industry

This includes but not limited to

- Knowledge of current events both Local and International
- Keeping an eye in the Wall Street Journal on trends and know the companies who are hot pick or not
- Keeping abreast with some key economic indicators such as GDP, Unemployment, Treasury Yield Curve Rates

Quant Savvy Questions:

Being upbeat in the market

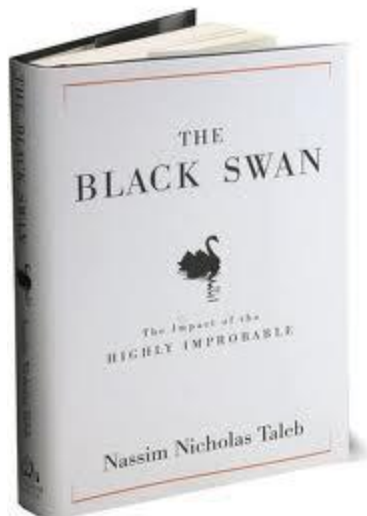
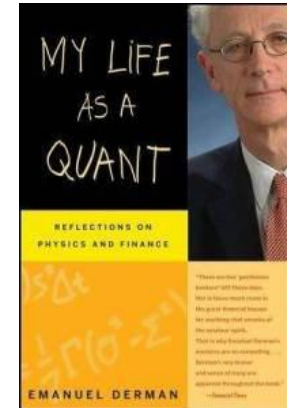
- Print Media: The Economist, Financial Times, Wall Street Journal
- TV / Cable: Bloomberg
- Market trends can be viewed such as <http://finance.yahoo.com/>
www.google.com/finance
- In the era of smart phones, mobile app of these resources can be downloaded at ease.

Trivia!

- What's the current US unemployment rate (Oct, 2012)?
- What is the latest (Q3, 2012) growth of the US?
- Current news about the "Financial Cliff"?

Suggested Reading

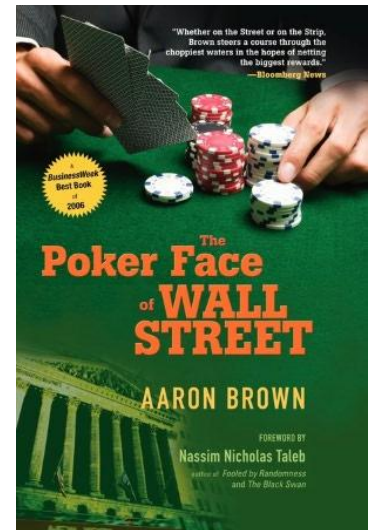
- **My Life as a Quant**
Emanuel Derman



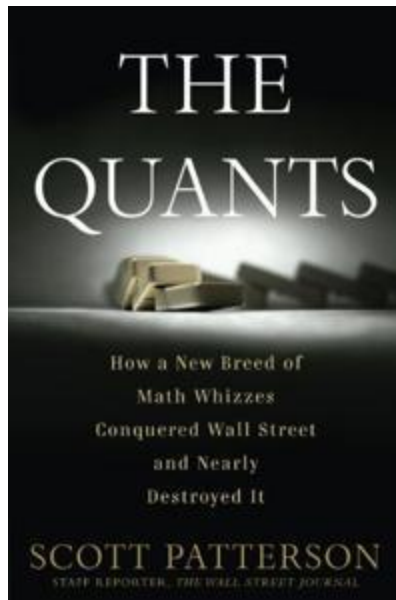
- **The Black Swan**
Nassim Nicholas Taleb

Suggested Reading

- **The Poker Face of Wall Street**
Aaron Brown

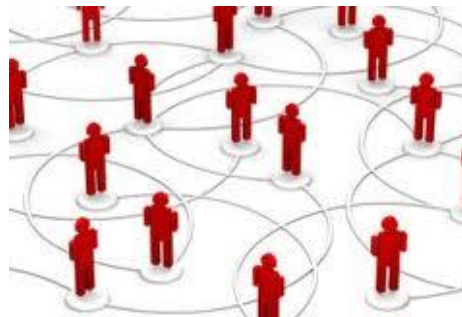


- **The Quants: How a New Breed of Math Whizzes Conquered Wall Street and Nearly Destroyed**
Scott Patterson



Tapping the Hidden Job Market

- Reality Check: “Who you know is more important than who you know!”
- This works equally ranging from meritocratic institutions such as ACADEMIA and INDUSTRY as well!



Tapping the Hidden Market

- Published job opportunities are more difficult to obtain since you have a lot of competitors
- Example:
New Front Desk Team is currently expanding for the next 6 months
An Front Quant Desk Role (3-5 positions)
Number of resumes submitted: 200
- What if you know somebody from that team and you think that you can play the role specified in that job search?

START NETWORKING NOW!

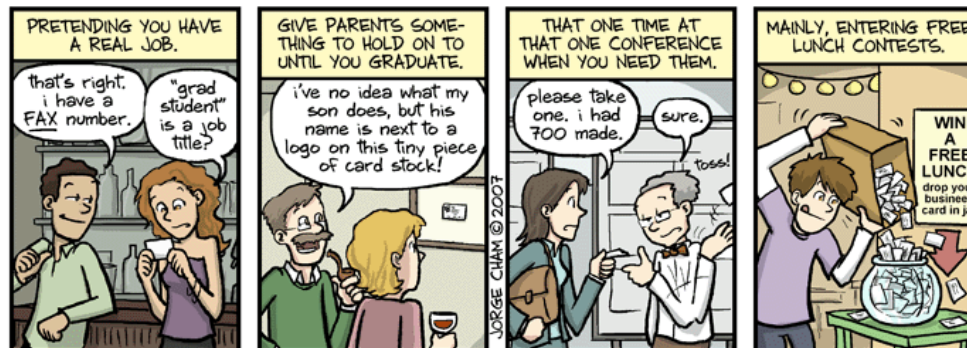
Some ways of Networking

- Group mates, Close Friends ... (even close buddies from High School!)
- Cherish the moments being assigned in a group project, being involved in a club like PQFC ... who knows your career will leapfrog by someone who you know! ...
- Involvement in on some Activities such as
 - PQFC Activities
 - Seminars
 - Conferences
 - Job Fairs and Campus Recruitment
- Social Media such as LinkedIn
 - ... even on Facebook!

Connecting People

- Being a student is not a hindrance of having a business card.
- To facilitate networking order your Purdue Business card (can be done in the Printing office)
- Avoid putting a caption "Student"
Instead: MS/PhD Student
Do: MS/PhD Candidate

Business cards in grad school: Why you need them



WWW.PHDCOMICS.COM

Business Etiquette 101

- The art of handshaking
- The art of giving and receiving business cards

Meeting Like Minded People

Some conferences and seminars that would not break the bank!
(Corporate prices usually costs around 4 digits!)

Computational Finance Seminar at Purdue
(every Spring Semester)

http://www.stat.purdue.edu/purdue_comp_finance/seminars.php

Modeling High Frequency Data in Finance Conference , New
Jersey

(every July)

<http://kolmogorov.math.stevens.edu/>

SIAM Conferences on Financial Mathematics and Engineering
(biennial event)

<http://www.siam.org/meetings/fm12/>

Meeting Like Minded People

R Finance, Chicago (every May)

(People from both academia, industry, as well as people doing Trading and Start-ups converges here)

<http://www.rinfinance.com/>

National Financial Mathematics Career Fair, New York

(registration deadline around September,
career fair event around October)

<https://www.finmathjobfair.org/>

CAREER FAIR PARTICIPATION AND ELIGIBILITY

To register, you must meet all of the following criteria:

Full-time students only;

Currently enrolled in the [specified degree program](#) at one of the participating schools

Graduating before September 1, 201X

Not an alumnus/alumna, not a recent graduate

LINKEDIN

- Don't forget to post your best picture (to show that you are a real person indeed!)
- Highlight your summary of expertise
- List projects done in class (e.g. STAT 541 Project on Pricing Energy Derivatives and Indicate your role)
- Use active tenses to indicate your initiative
- Ask for recommendations
- Follow the company you are aspiring to work with

Connecting People via Forums

- <https://www.quantnet.com/>
- <http://www.wilmott.com/>
- <http://www.linkedin.com/>

via groups and associations such as
High Frequency Trading
Algorithmic Trading
Link to Wall Street etc...

Useful Job Search Resources (Besides Networking)

- www.selbyjennings.com
- www.efinancialcareers.com
- www.glassdoor.com

Know what it takes to be hired!

- **Technical Competence**

Often take the form not only of technical questions, but also brain teasers.

CV details and what you deliver in the interview has to be on the same page.

- **Self Starter and Assertive as Well as a Team Player**

- **Excellent Social and Soft Skills**

The value of excellent communication skills cannot be undermined

- **Excellent Time and Organization Management Skills**

- **Commitment and Passion**

Who reads your resume?

- **Head Hunters (of course!)**

... assuming that your resume was not filtered out!

- **Potential Teammates**

Department Head

Immediate Supervisor

Team Members

They will give an initial impression of your resume!

They also have lots of other things to do (shorter attention span) ... so you need to stand out and KISS (Keep It Short and Simple)!

Question Related to your soft skills and CV

- Recruiters will appreciate if you put a line or two some other skills outside QF such as special skills (e.g. member of a band), leadership skills (e.g. led a committee).
- It is an indicator that the candidate is well-rounded.

Some resume writing advice

- Don't forget your cover letter as well as thank you letters
- Custom-made your resume into a specific firm you want to apply with
- Emphasize the projects you made as well as your role in that project that are relevant to your job description
- Emphasize skill sets such as C++ programming, Monte Carlo Simulations, or Mathematical Finance

Some resume writing advice

- 1-2 page resume (back to back) is the standard length
- Check your grammar and spelling: It will surely make or break your job search
- DON'T PAD ANY INFORMATION especially on the Front Page of your CV (Be yourself!)

Interview Advice

- The easiest questions are the usually the ones that make or break (They just test you if you have the mastered the fundamentals)
- Follow the company your are targeting with so that you are also updated

Interview Advice

- The easiest questions are the usually the ones that make or break (They just test you if you have the mastered the fundamentals).
- If the problem is too difficult and you might be able to solve immediately, then back to the basics to demonstrate that you have the solid fundamentals

Example

Q: What is the Vega of the European Call Option?

A: (Clueless) ... Measures sensitivity of the underlying asset with respect to volatility ... from the price of the European Call Option.

Interview Advice

- Review Frequently Asked Questions over and over again.
- Don't mess up Black-Scholes (BS) terminologies:
 - BS Model
 - BS PDE
 - BS European Call/Put Option Formula
- Do memorize the above BS Terminologies into your heat.
- Custom-made your review. If you are applying in a fixed-income job, then focus on there but don't neglect the other components of QF and C++ programming as well.
- Know the products and key people in the company you are working with

Interview Advice Specifically for Quant Finance

- Do wear a suit.
- Don't tell them they shouldn't use C++ because *my niche language* is better.
- Do demonstrate an interest in financial news.
- Do be able to talk about everything on your CV (even the little details matter)
- Don't say you want to work in banking for the money

Interview Advice Specifically for Quant Finance

- After the Interview you will be ranked among the other candidates that has been interviewed competing for the roles
- Stand out and be at your best!
- *Remember, that now living in a small world!*

GOOD LUCK!

Upcoming PQFC Activities

- Technical Analysis (Xiaoguang Wang)
- Resume Writing (Jeff Nisen)

Internship Experience and Quant Preparation Advice

JEFFREY ALAN NISEN
Past President (2011-12)
Purdue Quantitative Finance Club

Open Forum

THANK YOU VERY MUCH!

**“The difference between the ordinary and
the extraordinary is that little extra”**

Jimmy Johnson