Essential skills for Quants

Weiguan Wang
Shanghai University

Overview

1. Common skills
2. Q-Quant
3. P-Quant
4. New generation quants
5. Interview preparation materials

A job description of Institutional Equity Division Quantitative Finance Summer Analyst at Hong Kong from Morgan Stanley

Qualifications and Skills

- You are pursuing a Bachelor's degree or an additional one year Master's program with a technical proficiency in areas such as Mathematics, Statistics, Physics, Computer Science, Financial Engineering, Financial Math, and Engineering or a related quantitative field
- Your expected graduation date is between October 2023 and July 2024
- While no prior knowledge of finance or trading is required, you must have a keen interest in finance and markets
- You are familiar with coding languages such as Python, Q, R, SQL, or VBA, C++, Java, Matlab, or Scala
- You have strong verbal and written communication skills
- You enjoy solving complex problems that require deep analytical reasoning and quantitative analysis
- You are collaborative, a quick learner, a team player, adaptable, versatile, a multi-tasker and possess a strong work ethic
- Fluency in English required, and Asian language skills preferred.

Common skills

Solid mathematical skills are required for a Quant position, with education background from STEM subjects.

- Mathematics
  - Calculus
  - Probability
  - Linear algebra
- Statistics
  - Estimations
  - Hypothesis testing
  - ...
- Coding
  - Python
  - C++
  - ...
- Others
  - Languages
  - Financial markets
  - Motivations

Preferences for skills vary across specific positions.

- Q-Quant: pricing. Investment banks as sells side.
- P-Quant: portfolio management. Hedge funds or asset management firms as buy side.

Four roles from Morgan Stanley

Role and Responsibilities

- Desk Strategists sit on the trading desk and create models and strategies the desk will use to drive trading decisions, analyze and manage the risk of the positions currently on the books, and create pricing and market models.
- Market Modelers enhance Morgan Stanley's ability to manage risk and generate profits through the development of mathematical finance to create effective valuation and hedging models.
- Core Analytics develops domain-specific languages, algorithms, analytic libraries and tools to specify, value, trade and process financial positions.
- Model Standards and Enforcement works with strats, market modelers, the Market Risk Department and the Firm's Chief Risk Officer to set standards for the models used in valuation.

Skills for each role

- Desk strategists work very closely with traders and are responsible for the profit and loss of their own trading book. Active in developing and validating trading idea. Numerical techniques, PDEs, etc
- Market Modellers contribute more to the bank's global library for valuation. Stochastic analysis and probability.
- Core Analytics, a.k.a Quant Developers. These quants requires even solid coding skills to improve fundamental library for trading, analytics and so on. C++ and/or Java almost compulsory.
- Model Standards and Enforcement, a.k.a Risk Quants. Know regulations, validate models, and oversee risk control.

A P-Quant job description from BlackRock

A job description of Quantitative Modelling position for graduates from BlackRock

Research & Modelling

- Apply sophisticated mathematical and programming techniques to develop models and analytics for areas such as interest rates, equities, macroeconomic variables and scenarios, corporate credit, mortgages, structured products and portfolio risk, return attribution, and optimization
- Collaborate with partners across the organization to empower our large number of clients to manage their investments and risks
- Learn, build, collaborate and innovate across a wide variety of topics and projects

Development/Engineering

- Architect our analytics platform to provide accurate, scalable, and reliable quantitative insights, for the trillions of dollars in assets that run on our investment platform, Aladdin
- Build and evolve applications to better deliver our analytics and models to clients
- Apply fast-growing technologies such as machine learning and cloud computing to enable more powerful modelling and analysis

- The development/engineering side is similar to the sell side.
- The P-Quants requires more statistical skills to analyse real data, including regressions, hypothesis testing and so on.
- Not much stochastic analysis or differential equations
- Portfolio construction and return attribution.

Next generation quants

The gap between P-Quants and Q-Quants is not always a clear cut. For instance,

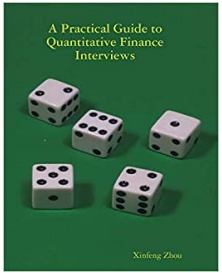
- The buy side P-Quant may be interested in trading options, where stochastic analysis are needed to determine the fair price;
- The sell side Q-Quant may also use regressions to predict volatility movement for market making.

Hence, a successful quant needs to have a broad set of skills no matter which side of the industry he/she wishes to work in.

The ability to apply machine learning is becoming another important skill cherished by both sides of industry as shown by both job advertisements.

Interview preparation materials

- Coding:
  - Leetcode `https://leetcode.com/`
  - Project Euler `https://projecteuler.net/`
- Maths:



Thanks for your attention!