How to Make a Market on an Item in an Interview for HFT or Market Making Roles (GUIDE)

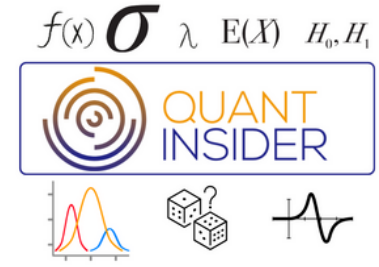
Theoretical Value Determination

Objective: Calculate the intrinsic worth of the item to guide your market quotes.

Method:
Use statistical models or historical data to estimate the true value.

For example, if you're quoting for a stock, you might use a combination of fundamental analysis, statistical arbitrage models, or a machine learning model trained on historical data.

Numerical Example:
Suppose you're quoting for a stock that you estimate has a fair value of $100 based on your model. This is your theoretical value.



2. Adjusting Market Width Based on Uncertainty

Objective: Determine the width of your bid-ask spread based on your confidence in the theoretical value.

Method:

- If the theoretical value is well known (e.g., a highly liquid stock), keep the spread narrow.

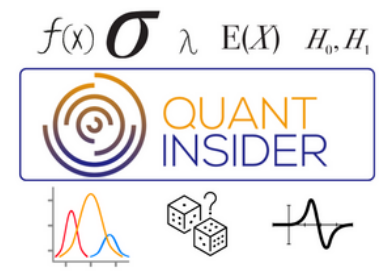
- If there's uncertainty (e.g., a volatile or less liquid stock), widen the spread.

Numerical Example:

- For the same stock with a fair value of $100:

- High confidence: Bid at $99.90, Ask at $100.10 (spread = $0.20)

- Low confidence: Bid at $99, Ask at $101 (spread = $2).



3. Current Position and Risk Management

Objective: Maintain a neutral position to minimize risk, and adjust quotes based on your current position.

Method:

- If you're net long (holding more of the item), make selling more attractive by quoting a slightly lower ask.

- If you're net short, make buying more attractive by quoting a slightly higher bid.

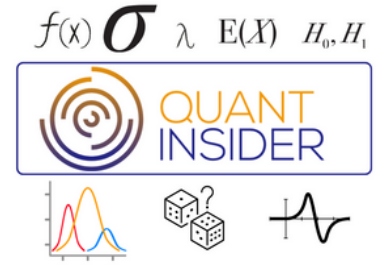
Numerical Example:

If you hold 500 shares of the stock with a theoretical value of $100:

- Bid at $99.90, Ask at $100.05 (tighter ask to encourage selling).

If you are short 500 shares:

- Bid at $100.05, Ask at $100.10 (tighter bid to encourage buying).



4. Incorporating Last Traded Price

Objective: Align your quotes with the current market price while considering deviations from the theoretical value.

Method:

- If the last traded price is close to your theoretical value, maintain your spread around it.
- If there's a significant deviation, assess whether the market knows something your model doesn't.

Numerical Example:
Last traded price is $101, but your theoretical value is $100.
Quote: Bid at $100.50, Ask at $101.50 (wider spread due to deviation).

5. Confidence Interval and Spread Adjustment

Objective: Adjust the spread width dynamically based on the confidence interval.

Method:

- Use a statistical measure like a standard deviation or a historical volatility estimate to quantify your confidence.
- Higher confidence (narrower confidence interval) leads to a narrower spread.
- Lower confidence (wider confidence interval) leads to a wider spread.

Numerical Example:

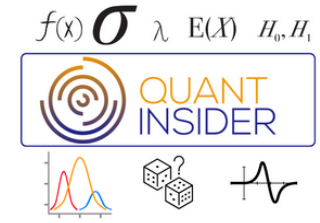
- For a stock with high confidence (narrow confidence interval):
- Bid at $99.95, Ask at $100.05 (spread = $0.10).

- For a stock with low confidence (wide confidence interval):
- Bid at $98, Ask at $102 (spread = $4).

6. Reacting to Market Events

Objective: Adjust quoting behavior during economic events or unusual market conditions.

Method:



- Pause quoting or widen spreads significantly before high-impact news releases.
- Resume normal quoting once volatility stabilizes.

Numerical Example:

Before a major economic announcement (e.g., CPI release):

- Widen spreads: Bid at $95, Ask at $105 (very wide spread to protect against volatility).

After the market stabilizes:

- Narrow spreads: Bid at $99.90, Ask at $100.10.

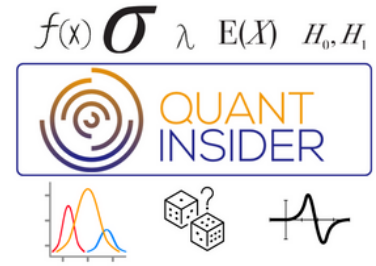
7. Edge, Spreads, and Risk in Market Making

Objective: Leverage statistical edge, optimal spread settings, and risk management to maximize profitability.

Edge:
Develop a predictive model to forecast mid-prices accurately and use it to set your quotes.

Spreads:
Set spreads based on market volume and liquidity.
Adjust dynamically using EWMA (Exponentially Weighted Moving Average) or similar models.

Risk:
Monitor and control inventory risk using real-time analytics.
Avoid toxic inventory accumulation due to erroneous correlation assumptions.



Numerical Example:

- Predictive model indicates fair value at $100 with high confidence.
- Quote spreads dynamically: Bid at $99.90, Ask at $100.10.
- Adjust for risk by reducing position size or widening spreads when volatility spikes.

8. Putting It All Together with a Numerical Example

- Suppose you are making a market in a stock with a theoretical value of $100.
- Your predictive model gives high confidence in this value.
- Current position: Net long 200 shares.
- Last traded price: $100.50 (above your theoretical value).
- Spread before news event: Bid at $99.90, Ask at $100.05.
- Spread during news event: Bid at $98, Ask at $102.
- Spread after event: Bid at $100.10, Ask at $100.20.