Digital Finance 3: Technology in Finance

Lesson 29: Algorithmic Trading Concepts

FHGR

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Summary of key concepts presented above.

Learning Objectives

By the end of this lesson, you will be able to:

- Classify different types of algorithmic trading strategies
- Design and execute backtesting frameworks
- Identify and avoid common backtesting pitfalls
- Understand overfitting in trading models
- Account for transaction costs and market impact
- Set realistic performance expectations

Summary of key concepts presented above.

What is Algorithmic Trading?

Definition:

- Automated execution based on rules
- No human intervention
- Computer algorithms make decisions
- Processes data faster than humans

Market Share:

- US equities: 70-80% of volume
- Futures: 60-70%
- FX: 50-60%

Key Advantages:

- Speed (microseconds)
- Consistency (no emotions)
- Backtesting capability
- Scalability

Challenges:

- Overfitting to historical data
- Model decay (regime changes)
- Technology costs
- Regulatory scrutiny

Clear definitions are essential for understanding complex technical concepts.

Types of Strategies

Execution Algorithms:

- VWAP, TWAP
- Minimize market impact
- Cost minimization

Market Making:

- Provide liquidity
- Profit from spread
- High-frequency trading

Statistical Arbitrage:

- Mean reversion
- Pair trading
- Market-neutral

Momentum:

- Follow trends
- Breakout strategies
- Moving averages

ML-Based:

- Prediction models
- Alternative data
- Classification/regression

HFT:

- Ultra-short holding
- Latency arbitrage
- Co-location required

Key concepts from this slide inform practical applications in finance.

Backtesting Framework

Steps:

1. Define strategy rules
2. Acquire historical data
3. Simulate trades
4. Calculate returns (net of costs)
5. Evaluate metrics
6. Iterate and refine

Key Metrics:

- Total return
- Sharpe ratio (risk-adjusted)
- Maximum drawdown
- Win rate
- Profit factor

Realistic Targets:

- Sharpe ¿ 1.5: Good
- Sharpe ¿ 2.0: Very good
- Sharpe ¿ 3.0: Exceptional (or overfitting?)

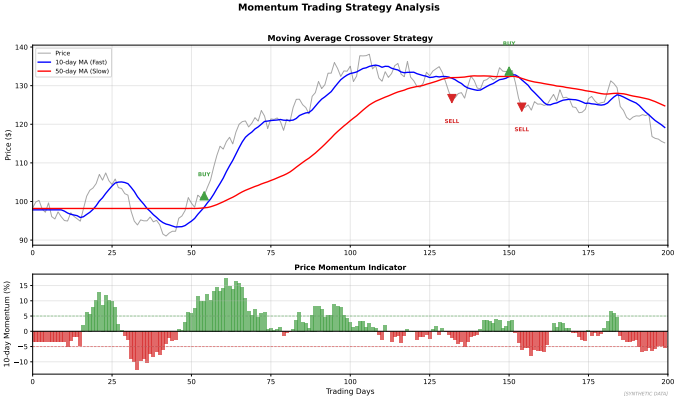
Common Pitfalls:

- Look-ahead bias
- Survivorship bias
- Data snooping
- Ignoring costs
- Market impact
- Overfitting

Warning: Backtest performance usually overstates live performance.

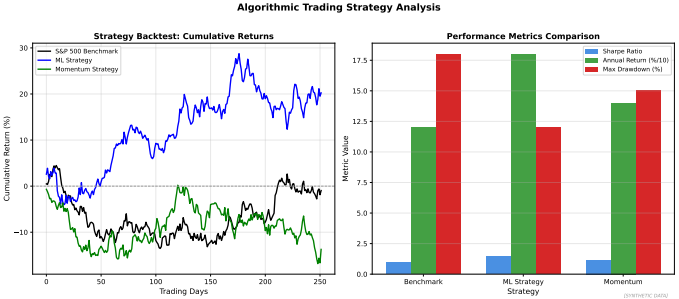
Key concepts from this slide inform practical applications in finance.

Momentum Strategy Performance



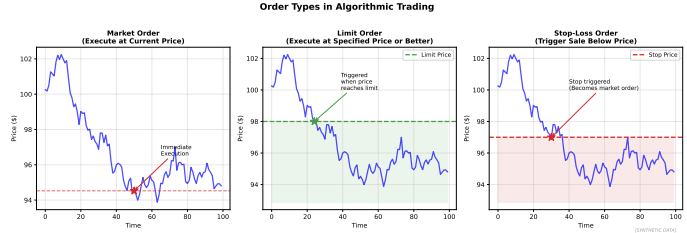
Momentum strategies buy winners and sell losers, exploiting short-term trends in asset prices.

Trading Strategy Backtest Results



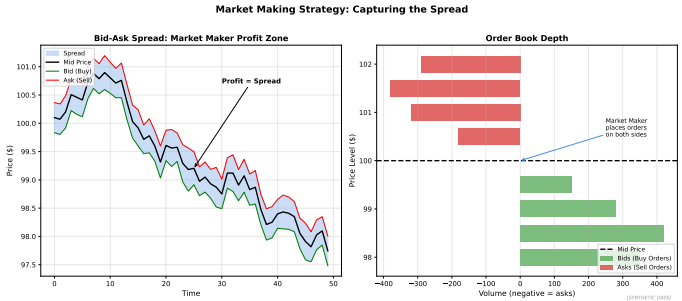
Backtesting reveals strategy performance metrics including returns, drawdowns, and Sharpe ratios.

Order Types and Execution



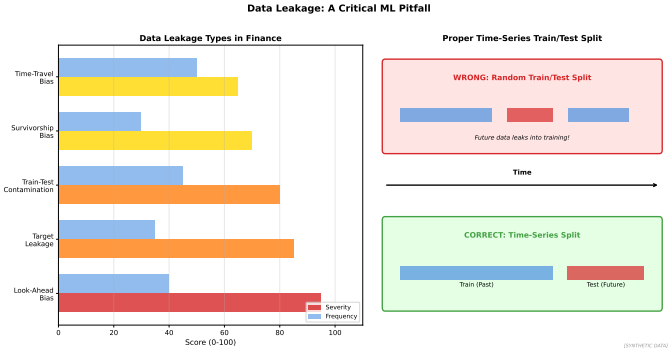
Different order types serve different execution objectives: market orders for speed, limit orders for price control.

Market Making Spread Dynamics



Market makers profit from bid-ask spreads while providing liquidity to the market.

Data Leakage in Backtesting



Look-ahead bias occurs when future information leaks into historical simulations, inflating backtest results.

Summary

Key Takeaways:

- Algorithmic trading dominates modern markets
- Many strategy types (execution, market making, stat arb, ML)
- Backtesting essential but has pitfalls
- Overfitting is the central danger
- Transaction costs matter (0.2-0.5% per round-trip)
- Realistic expectations: Alpha is scarce

Next Lesson: Credit Scoring and Risk Models

Summary of key concepts presented above.