http://www.cs.unh.edu/~ruml/cs758
Algorithmic Trading Failures
Trading

- Summary
- May 6, 2010
  - Knight Capital
- October 15, 2014
  - Flash crash
- April 23, 2013
  - Flash crash

Craziness

- Algorithmic
- System
- Software Testing
- Autonomy
- Co-location
- Knight Capital
- May 6, 2010

- Flash crash
- US Treasury market flash crash
- Flash crash
- Bitcoin transfer bug
- US dollar flash crash
- US stocks flash crash
- Flash crash
- Knight Capital
- Flash crash
- June 21, 2017
- August 24, 2015
- March 18, 2015
- October 15, 2014
- February 7, 2014
- April 13, 2013
- August 24, 2015
- June 21, 2017
- Ethereum flash crash
- US dollar flash crash
- March 18, 2015
- US Treasury market flash crash
- November 21, 2014
- Bitcoin transfer bug
- US stocks flash crash
- Flash crash
- April 13, 2013
- Flash crash
- Knight Capital
- Flash crash
- May 6, 2010
- Flash crash
British trader Navinder Singh Sarao charged with 22 counts, including use of spoofing algorithms (create false market pressure, then cancel trades). One of the most turbulent periods in the history of financial markets, Nasdaq Composite DJIA lost 9% within minutes of 500.
1. new RLP (retail liquidity program) code not copied to one of 8 servers
2. new RLP re-used flag from old ‘power peg’ function
3. old server activated power peg, which executed trades
   notification of trade fulfillment never came (feature was deprecated)
4. major disruption to 148 stocks on NYSE
5. 4M trade executions on 154 stocks (397M shares) within 45 minutes
6. $440M loss, stock price dropped 75% the next day, destroyed the company
no single cause identified, several changes made

risk-free assets with a high degree of stability. "U.S. Treasury securities market is considered a benchmark for

clear cause" yield dropped 16 basis points and then rebounded, without a

rebounded

10-year US Treasuries lost 20% within 30 minutes, then
April 23, 2013: Twitter hoax that Obama had been injured. Dow Jones briefly lost 143 points.


June 21, 2017: Ethereum flash crash ($319 to $0.10) due to large 'sell at market price' order (rather than staged).

'fat finger' errors
In computerized high-speed trading, \(\textit{almost instantly when they become public.}\) As in real estate, location is everything. On Wall Street, high-speed trading firms have quietly been leasing "hot test" address on K Street.

CNBC, July 2013, \textit{Wall Street's Hottest Address? K Street.}
Autonomous Systems Failures
Wildcard Topic, CS 758 – 10 / 17
Other A V Accidents

Trading Autism

■ Tesla
■ Others AVs
■ Others

Algorithmic Bias
Software Testing
Autonomy
Trading

Cruise concrete
Cruise drag
Arizona Fatality
2018 Amazon recommends bomb-making material to people searching for pressure cookers.

2016 Microsoft’s Tay chatbot learns too much from users.

2001 Zillow home price prediction: $304M write-down, layoffs.

1998 Mars Climate Orbiter: $327M. Altitude too low during orbital insertion, either skipped off atmosphere or was destroyed. NASA used metric, Lockheed Martin used US units (contrary to spec). Unlike Ariane 4, diagnostic code interpreted as flight data, causing full nozzle deflection. Code should not have been active after lift-off. Unlike Ariane 4.

Ariane-5 maiden flight: $500M. Higher horizontal velocity than Therac-25: 6 fatalities.
Algorithmic Bias
be careful what you optimize for (value alignment)

face recognition, resume screening, loans, medical diagnosis
Software Testing
Are we building the right product?

Validation: Does X meet the high-level requirements? Is X the right thing to build?

Are we building the self-kernel?

Assuming we should build X, does our software system derivation/proof correctness by construction hold for executable code?

Compiler C compiler: Properties of source hold for executable.

See CS 745/845 Formal Specifications and Verification of Software Systems.
Feel free to collaborate on your studying.

Nope.

and good luck on the final exam!