Blockchain Workshop
BLOCKASTICS: Stochastic models for blockchain analysis
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The last lecture of this course will take the form of a workshop.

You will form 7 teams of 2 and choose one paper in the list below. You will give a 10 minutes presentations (with slides) to discuss the paper you chose. The presentation is followed by a 5 minutes of Q&A with the audience (your fellow classmates and myself).

Please indicate your team and the paper you will discuss on https://docs.google.com/spreadsheets/d/1wvs-ywgF3asWbr7Frw2NznFk_-p1vmJsXPmJJbaqf4Q/edit?usp=sharing

Here is the list of papers to choose from

1. Blockchain Queue Theory, [1]
   Keywords: Blockchain Efficiency, Queueing model, Phase Type Distribution
2. Constant Function Market Makers: Multi-Asset Trades via Convex Optimization [2]
   Keywords: DeFi, Mathematical Finance, Automated Market Makers
3. Execution and Statistical Arbitrage with Signals in Multiple Automated Market Makers [3]
   Keywords: DeFi, Mathematical Finance, Automated Market Makers, Optimal Control
4. On the Profitability of Selfish Blockchain Mining Under Consideration of Ruin, [4]
   Keywords: Blockchain Security, Selfish Mining, Risk Theory, Actuarial Science
5. A Mean Field Games Model for Cryptocurrency Mining [5]
   Keywords: Blockchain Decentralization, Mean Field Game
6. Modeling and analysis of block arrival times in the Bitcoin blockchain [6]
   Keywords: Blockchain Efficiency, Counting processes, Statistics of Stochastic Processes
7. Modelling the dynamics of Bitcoin and Litecoin: GARCH versus stochastic volatility models, [7]
   Keywords: DeFi, Statistics, Time Series, Stochastic Volatility Models
8. Everything is a Race and Nakamoto Always Wins, [8]
   Keywords: Blockchain Security, Double spending attack, random walks
9. The Conceptual Flaws of Decentralized Automated Market Making, [9]
   Keywords: DeFi, Mathematical Finance, Automated Market Makers
10. Evolution of Shares in a Proof-of-Stake Cryptocurrency, [10]
    Keywords: Blockchain Decentralisation, Proof of Stakes, Urn model
11. Uniswap v3 Core, [11]

References

[1] Q.-L. Li, J.-Y. Ma, and Y.-X. Chang, *Blockchain Queue Theory*, pp. 25–40. Springer International Publishing, 2018.

[2] G. Angeris, A. Agrawal, A. Evans, T. Chitra, and S. Boyd, *Constant Function Market Makers: Multi-asset Trades via Convex Optimization*, pp. 415–444. Springer International Publishing, 2022.

[3] A. Cartea, F. Drissi, and M. Monga, "Execution and statistical arbitrage with signals in multiple automated market makers," in *2023 IEEE 43rd International Conference on Distributed Computing Systems Workshops (ICDCSW)*, pp. 37–42, 2023.

[4] H. Albrecher and P.-O. Goffard, "On the profitability of selfish blockchain mining under consideration of ruin," *Operations Research*, vol. 70, pp. 179–200, Jan. 2022.

[5] Z. Li, A. M. Reppen, and R. Sircar, "A mean field games model for cryptocurrency mining," *Management Science*, vol. 70, pp. 2188–2208, Apr. 2024.

[6] R. Bowden, H. P. Keeler, A. E. Krzesinski, and P. G. Taylor, "Modeling and analysis of block arrival times in the bitcoin blockchain," *Stochastic Models*, vol. 36, pp. 602–637, July 2020.

[7] A. K. Tiwari, S. Kumar, and R. Pathak, "Modelling the dynamics of bitcoin and litecoin: Garch versus stochastic volatility models," *Applied Economics*, vol. 51, pp. 4073–4082, Mar. 2019.

[8] A. Dembo, S. Kannan, E. N. Tas, D. Tse, P. Viswanath, X. Wang, and O. Zeitouni, "Everything is a race and nakamoto always wins," in *Proceedings of the 2020 ACM SIGSAC Conference on Computer and Communications Security*, CCS '20, ACM, Oct. 2020.

[9] A. Park, "The conceptual flaws of decentralized automated market making," *Management Science*, vol. 69, pp. 6731–6751, Nov. 2023.

[10] I. Roşu and F. Saleh, "Evolution of shares in a proof-of-stake cryptocurrency," *Management Science*, vol. 67, pp. 661–672, Feb. 2021.

[11] H. Adams, N. Zinsmeister, M. Salem, R. Keefer, and D. Robinson, "Uniswap v3 core," *Tech. rep., Uniswap, Tech. Rep.*, 2021.