ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

## Bachelor/Master Thesis

# Maker Breaker Triangle Game

Maker Breaker games evolved from positional games and are a well studied topic in combinatorics. We want to study in particular the maker breaker triangle game. This game works as follows. We play on the complete graph with $n$ vertices and two players, Maker and Breaker. We additionally fix some $q$ and then the rules are as follows. Maker can claim one of the edges for himself, then Breaker claims $q$ edges for himself. This repeats until either Maker can claim the 3 edges of a triangle or until all edges are claimed and Maker has not won yet in which case we call this a win for Breaker.

This game has gotten some attention. Clearly both players have optimal strategies as there is no uncertainty involved. Maybe less obvious, for $q = 1$ this is a makers win, that is playing optimally, Maker can always force a victory. On the contrary for $q = n - 1$ this is a breakers win. Now the interesting question is, for what value of $q$ does this switch?

It has been known for a while that the rough point of how large $q$ must be for Breaker to win is of the order $\theta(\sqrt{n})$. In a recent paper [1] the gap was narowed down to $q \in [\sqrt{2}, \sqrt{8/3}]n + o(n)$. This was done with a clever strategy for Breaker using a potential function describing what the most urgent vertices are.

The goal of this thesis would be to take a closer look at this potential function, see if it can be optimized and implement it on with some strategies for Maker to see how it performs in practice.

**Prerequisites**: Passing grade in at least one of the courses APC or Randomized Algorithms.

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## References

[1] C. Glazik and A. Srivastav. A new Bound for the Maker-Breaker Triangle Game. *arXiv e-prints*, page arXiv:1812.01382, Dec 2018.