ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

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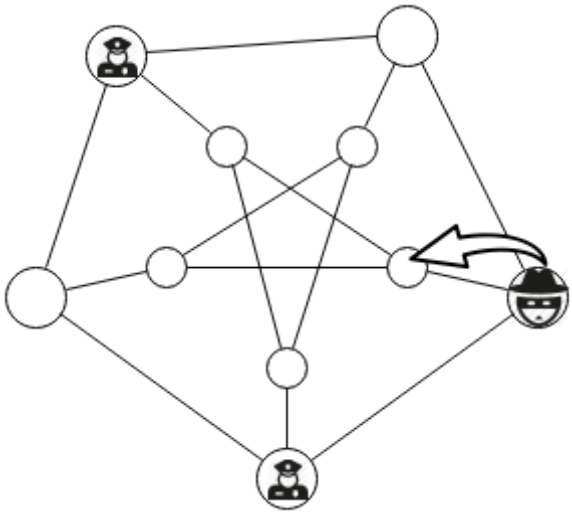
BA/SA:

Cops & Robbers

Imagine you want to make Zurich a crime-free place and in order to do that you buy a helicopter and fly over the city until you spot a criminal. Then you call the police and since you are the guy who is familiar with algorithms they trust you to direct their forces. So you tell each cop where to go. Unfortunately, the criminal has noticed your brightly painted helicopter and starts to run. Of course, exactly at this point, your boyfriend/girlfriend calls and asks when you will be home. Recalling what happened last time when you were later than you promised to be, you intend to be safe this time and choose a point in time that you can manage even in the worst case. But how much time will it take to capture the criminal?

In this thesis, we want to examine this question and possibly related topics in a formal setting known as "cops and robbers". In this game played on graphs, two players, a "cop player" and a "robber player" take turns in moving all their pieces to adjacent nodes. The robber player has only one piece (the robber) whereas the cop player can have many cops. The goal of the robber is to escape forever, the goal of the cops to catch the robber.



We assume that there are just enough cops to catch the robber. It is known that if the robber can be caught by one cop, the capture time is linear in the number of nodes with optimal play. There seems to be a new result dealing with the case of a constant number of cops, but the graph constructions involved are quite complicated, calling for a verification by computational methods.

Your first task is to implement the lower bound idea and verify its correctness for computationally manageable graph sizes. A next/concurrent step is to develop a (better) tool for visualizing the play from both sides. From there the thesis can evolve in a number of ways. If you have your own ideas for this project, we are happy to hear about them.

Requirements: Programming experience will come in very handy as you will have to write code in this thesis. Also, an affinity to graph theory will be helpful as there are many interesting theoretical questions regarding cops and robbers. But don't worry, you will meet on a weekly basis with your advisor to discuss progress and open questions.

Interested? Just drop us an email and we fix a time for a small chat.

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