ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

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Semester/Bachelor's Thesis

Army of Two: Escape from the Arena

Imagine yourself being thrown into an arena, not alone, but with your friend. Your goal? Escaping the arena as fast as possible! You both know that there is exactly one exit – but due to fog, you can only see the exit when you are standing right in front of it. Just as this would not be difficult enough, the noise of the crowd is so loud, that you cannot communicate with your friend by shouting, but you need to meet him so that you can talk. Your strength? You can discuss a strategy beforehand, and you're both very smart, meaning, you have both infinite storage and computational power.

You might have realized that this problem craves for a formal specification. Of course, such a specification has been worked out: The arena is modeled as a circle with radius 1, both you and your friend have the same movement speed, the exit is infinitely small, the runtime of the algorithm is specified as the time it takes from the center of the arena, until both of you are at the exit – and, to make it morally correct, the term *human* is replaced by *robot*.

Should you be concerned that we are trying to fool you: This is not the case. Recently, an algorithm was developed, with which both of you reach the exit in time 5.628. The best known lower bound is 5.255. Combining these results, you might notice that there is an infinitely large space[1] of possibilities.

We are interested in finding better bounds, either on paper, or with the help of computers (maybe you can even find a tight bound?). To facilitate your start, we already have a couple of ideas that could be pursued. Note that there are also variations of this problem which could be studied.

Interested? If you are interested in developing better algorithms and/or improving the bounds, we are happy to hear from you and to have a small chat.

Requirements

- The student should be able to work independently on this topic.

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[1] $]5.255, 5.628[\in \mathbb{R}$