Complexity Theory - IIC3242
Homework 3
Deadline: Monday, 27th of June

In this course we saw many fundamental results about the theory of computation, but there are many more results on the topic that we did not have the time to cover. The goal of this homework is that the student selects some result connected to the topics we covered, or any related topic, which they think is fundamental, important or interesting (and not necessarily all three), and hands in a **written report** which justifies why the result is important, and provides a brief proof, or an explanation of why the result is correct.

More specifically, the homework is to prepare a short report about a certain result in Complexity Theory (or computation in general) which was not covered in the lessons. This report should include:

- An explanation of why the result is important.

- A precise formulation of the result.

- A proof of the result, or, in the case when the proof is extremely long, a detailed sketch of the proof.

The expected length is anywhere between 3 and 7 pages. If you need more space (or less), please explain why is this so. The assignments will be graded based on the clarity of the presentation, the justification of why the problem is important, and on the quality of your English language skills (although this part will only be work up to 10% of the mark).

Finding a topic of the assignment

The first source are the books we used in the course, more specifically, the book by Papadimitriou, and the one by Arora-Barak. Both of these contain a big number of very interesting results that we did not cover in class.

The second source are lecture notes of Complexity Theory courses given at different universities around the world. Some of these cover substantially more material than we did, or cover more advanced topics, so using these is also allowed. The notes I particularly like are by Johnatan Katz from the University of Maryland, but there are many others as well.

A great starting point is also the blog by Lance Fortnow (`http://blog.computationalcomplexity.org`) which discusses some of the most important modern advancements in Complexity Theory. Another good blog is run by Richard Lipton at `http://rjlipton.wordpress.com`.

Next, we have the webpage of the Complexity Zoo, which defines most of the complexity classes which are currently known (`https://complexityzoo.uwaterloo.ca/Complexity_Zoo`). The page also lists some of the most important results about these classes.

Of course, if you want to get to know about the most recent results in the area, you will have to go through the relevant journals and conferences in the area. A partial list of these is:

- Journal of the ACM: `http://www.informatik.uni-trier.de/~ley/db/journals/jacm/index.html`

- SIAM Journal on Computing: `http://www.informatik.uni-trier.de/~ley/db/journals/siamcomp/index.html`

- ACM Symposium on Theory of Computing (STOC): `http://www.informatik.uni-trier.de/~ley/db/conf/stoc/index.html`

- IEEE Symposium on Foundations of Computer Science (FOCS): `http://www.informatik.uni-trier.de/~ley/db/conf/focs/index.html`

In case you want something more, a good general repository of information about journals and conferences in Computer Science is The DBLP Computer Science Bibliography available at `http://www.informatik.uni-trier.de/~ley/db/`.

Remark. Once you select the topic please send me an email confirming which topic it is, so that we do not end up with duplicates.