Distributed Graph Algorithms - Final Project

The final project will be done in groups of two students. It consists of the following ingredients:

1. **Choosing a paper in the area of distributed graph algorithms**. The paper can be chosen either from the list of suggestions that appears below, or from any conference or journal in the related area. The choice is subject to my approval. Approval will be given for a different paper for each group.

2. **Reading the paper**. Notice that some papers have additional versions online, which you can find using your favorite browser. Sometimes these versions have additional details which may be helpful in understanding the work.

3. **Getting familiar with the context of the related work**. This includes reading the description of related work that is covered in the paper and also searching for results that came after the paper. This can be found using, e.g., Google Scholar or similar databases.

4. **Studying a new question that is related to the paper**. This is the creative part of the project. You are expected to say something interesting that relates to the paper that is not known. Examples for directions to look into are: What can be said if we remove an assumption about the model? What can be said if we add an assumption about the model? What can be said if we restrict the family of graphs that are addressed? What can be said if we slightly relax the requirements of the problem? What can be said if we slightly strengthen the requirements of the problem?

   You are not expected to strictly improve upon the results of the paper, although this would be great and may even result in a publication. What you are expected to do is ask an interesting question, and try to answer it. If you have a good question but cannot come up with an answer, then you can describe the directions you tried and the ways in which they were hard.

5. **Submitting a report about the work**. The report should describe the paper you read, the related work and state-of-the-art, and the new question you studied and its results. It should be typed in English (not hand-written), using your own words, as a scientific report. The report must be written in LaTeX, using the given template. Instructions on using LaTeX are also provided.

The due date for requesting papers is **April 25, 2018**.
The due date for submitting the report is **July 29, 2018**.
These are firm due dates which will not be extended.

On **May 30, 2018**, each group will submit a mid-report. This report is intended to make sure that you are making progress, and is mandatory. It must contain at least the first part of the final report, which is the description of the paper you were assigned.

The grade for the project will be based on the following: (i) an estimate of how well you understand the paper, (ii) the quality and magnitude of the related work description (including later results), (iii) the creativity and novelty of the new result obtained in the project, (iv) the quality of the report, and (v) my general evaluation.

List of suggested papers:

[1] Alkida Balliu, Juho Hirvonen, Janne H. Korhonen, Tuomo Lempiäinen, Dennis Olivetti, and Jukka Suomela. New classes of distributed time complexity. *CoRR*, abs/1711.01871, 2017. **ASSIGNED**.

[2] Leonid Barenboim, Michael Elkin, and Uri Goldenberg. Locally-iterative distributed (delta + 1)-coloring below szegedy-vishwanathan barrier, and applications to self-stabilization and to restricted-bandwidth models. *CoRR*, abs/1712.00285, 2017.

[3] Leonid Barenboim, Michael Elkin, and Fabian Kuhn. Distributed (delta+1)-coloring in linear (in delta) time. *SIAM J. Comput.*, 43(1):72–95, 2014. **ASSIGNED**.

[4] Leonid Barenboim, Michael Elkin, Seth Pettie, and Johannes Schneider. The locality of distributed symmetry breaking. *J. ACM*, 63(3):20:1–20:45, 2016.

[5] Marthe Bonamy, Paul Ouvrard, Mikaël Rabie, Jukka Suomela, and Jara Uitto. Distributed recoloring. *CoRR*, abs/1802.06742, 2018. **ASSIGNED**.

[6] Keren Censor-Hillel, Ran Gelles, and Bernhard Haeupler. Making asynchronous distributed computations robust to channel noise. In *9th Innovations in Theoretical Computer Science Conference, ITCS 2018, January 11-14, 2018, Cambridge, MA, USA*, pages 50:1–50:20, 2018. **ASSIGNED**.

[7] Keren Censor-Hillel, Elad Haramaty, and Zohar S. Karnin. Optimal dynamic distributed MIS. In *Proceedings of the 2016 ACM Symposium on Principles of Distributed Computing (PODC)*, pages 217–226, 2016. **ASSIGNED**.

[8] Keren Censor-Hillel, Seri Khoury, and Ami Paz. Quadratic and near-quadratic lower bounds for the CONGEST model. In *31st International Symposium on Distributed Computing, DISC 2017, October 16-20, 2017, Vienna, Austria*, pages 10:1–10:16, 2017. **ASSIGNED**.

[9] Yi-Jun Chang, Tsvi Kopelowitz, and Seth Pettie. An exponential separation between randomized and deterministic complexity in the LOCAL model. In *IEEE 57th Annual Symposium on Foundations of Computer Science, FOCS 2016, 9-11 October 2016, Hyatt Regency, New Brunswick, New Jersey, USA*, pages 615–624, 2016. **ASSIGNED**.

[10] Michael Elkin and Ofer Neiman. Efficient algorithms for constructing very sparse spanners and emulators. In *Proceedings of the Twenty-Eighth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pages 652–669, 2017.

[11] Guy Even, Orr Fischer, Pierre Fraigniaud, Tzlil Gonen, Reut Levi, Moti Medina, Pedro Montealegre, Dennis Olivetti, Rotem Oshman, Ivan Rapaport, and Ioan Todinca. Three notes on distributed property testing. In *Proceedings of the 31st International Symposium on Distributed Computing (DISC)*, pages 15:1–15:30, 2017.

[12] Mohsen Ghaffari. Near-optimal scheduling of distributed algorithms. In *Proceedings of the 2015 ACM Symposium on Principles of Distributed Computing (PODC)*, pages 3–12, 2015. **ASSIGNED**.

[13] Dan Hefetz, Fabian Kuhn, Yannic Maus, and Angelika Steger. Polynomial lower bound for distributed graph coloring in a weak LOCAL model. In *Proceedings of the 30th International Symposium on Distributed Computing (DISC)*, pages 99–113, 2016. **ASSIGNED**.

[14] Taisuke Izumi and François Le Gall. Triangle finding and listing in CONGEST networks. In *Proceedings of the ACM Symposium on Principles of Distributed Computing, PODC 2017, Washington, DC, USA, July 25-27, 2017*, pages 381–389, 2017. **ASSIGNED**.

[15] Amos Korman, Shay Kutten, and David Peleg. Proof labeling schemes. *Distributed Computing*, 22(4):215–233, 2010. **ASSIGNED**.

[16] Fabian Kuhn and Roger Wattenhofer. On the complexity of distributed graph coloring. In *Proceedings of the Twenty-Fifth Annual ACM Symposium on Principles of Distributed Computing (PODC)*, pages 7–15, 2006. **ASSIGNED**.

[17] Tuomo Lempiäinen and Jukka Suomela. Constant space and non-constant time in distributed computing. *CoRR*, abs/1705.03876, 2017. **ASSIGNED**.

[18] Anisur Rahaman Molla and Gopal Pandurangan. Distributed computation of mixing time. In *Proceedings of the 18th International Conference on Distributed Computing and Networking, Hyderabad, India, January 5-7, 2017*, page 5, 2017. **ASSIGNED**.

[19] Shreyas Pai, Gopal Pandurangan, Sriram V. Pemmaraju, Talal Riaz, and Peter Robinson. Symmetry breaking in the congest model: Time- and message-efficient algorithms for ruling sets. In *31st International Symposium on Distributed Computing, DISC 2017, October 16-20, 2017, Vienna, Austria*, pages 38:1–38:16, 2017.

[20] Merav Parter. Bypassing erdős' girth conjecture: Hybrid stretch and sourcewise spanners. In *Proceedings of the 41st International Colloquium on Automata, Languages, and Programming (ICALP)*, pages 608–619, 2014. **ASSIGNED**.

[21] Merav Parter and Eylon Yogev. Distributed computing made secure: A new cycle cover theorem. *CoRR*, abs/1712.01139, 2017.

[22] Boaz Patt-Shamir and Mor Perry. Proof-labeling schemes: Broadcast, unicast and in between. In *Stabilization, Safety, and Security of Distributed Systems - 19th International Symposium, SSS 2017, Boston, MA, USA, November 5-8, 2017, Proceedings*, pages 1–17, 2017. **ASSIGNED**.