2018/19 Advanced Algorithms Project

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1. The aim of this project is to study efficient and scalable approaches to compute some measures commonly used in complex network analysis. The target will be large graphs for which even polynomial time algorithms may not work in practice. Students should select at least two measures such as:

- The size of the minimum cut of graph.
- The average path length of a graph.
- The clustering coefficient of a graph.
- The betweenness centrality for each vertex of a graph.

Other measures may be proposed, just let us know about your ideas. Although one can start with basic implementations, since we are targeting large graphs, approximation/randomized schemas can be helpful. Succinct graph representations can be also useful if a large graph must be kept in main memory for processing.

2. Students should deliver working implementations, along with a report including the experimental setup, time and space analysis, both theoretical and experimental, and appropriate references, for the algorithms and data structures proposed and implemented. Students should not use existing code, either from software libraries or other electronic sources, unless explicitly allowed. The deadline for the submission of both project code and report is May 15th, at 17:00.

3. Grades will be given as follows up to 20 points:

i. Implementation of suitable algorithmic techniques and data structures (6 points).

ii. Analysis of used algorithms and data structures, and of their implementation (6 points).

iii. Experimental evaluation and results discussion (8 points).

iv. Report writing and presentation quality (2 points).

4. The report and the code should be delivered in the Fenix web page as a ZIP archive. Implementations should be coded in `C/C++`, `Java` or `Python`, and properly documented. Other languages may be also allowed, but you should confirm with us beforehand. The report should be in PDF format with at most 10 pages A4, fonts of at least 11pt and margins of at least 3cm. The report should contain a brief introduction, relevant theoretical results and references, any relevant implementation decisions, extensive experimental results for the algorithms, including performance graphs for all the algorithms and comparison to the projected theoretical bounds, using several families of inputs, measuring both time and space, and also some brief conclusions. Reports that are not presented in PDF, will be graded 0. Reports and code that are not delivered in Fenix by the designated deadline will be graded 0. Notice that you can submit

the archive with the report and code to Fenix several times, you are strongly advised to submit several times and as early as possible. Only the last version is considered for grading purposes, all other submissions are ignored. There will be **no** deadline extensions. Submissions by email will **not** be accepted.