

## Numerical Computing

2020

Student: FULL NAME

Discussed with: FULL NAME

Due date: Wednesday, 14 October 2020, 11:55 PM

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## Solution for Project 2

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### Submission instructions

(Please, notice that following instructions are mandatory:  
submissions that don't comply with, won't be considered)

- Assignments must be submitted to Moodle (i.e. in electronic format).
- Provide both executable package (single .class or .jar file) and sources (.java files). If you are using non-sdk libraries, please add them in the file. Sources must be organized in packages called: *ch.usi.inf.ncc12.assignment<assignmentNumber>.exercise<exerciseNumber>.<name>.<surname>* and the jar file must be called:

*assignment<AssignmentNumber>.<Name>.<Surname>.jar*

Projects exported directly from Eclipse would be much appreciated (Please, be sure that you are including also the sources in the jar file).

- The produced files (one pdf and one jar file) must be collected into a single archive file (.zip) named:

*assignment<AssignmentNumber>.<Name>.<Surname>.zip*

The purpose of this assignment<sup>1</sup> is to learn the importance of sparse linear algebra algorithms to solve fundamental questions in social network analyses. We will use the coauthor graph from the Householder Meeting and the social network of friendships from Zachary's karate club [1]. These two graphs are one of the first examples where matrix methods were used in computational social network analyses.

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<sup>1</sup>This document is originally based on a blog from Cleve Moler, who wrote a fantastic blog post about the Lake Arrowhead graph, and John Gilbert, who initially created the coauthor graph from the 1993 Householder Meeting. You can find more information at <http://blogs.mathworks.com/cleve/2013/06/10/lake-arrowhead-coauthor-graph/>. Most of this assignment is derived from this archived work.

1. **The Reverse Cuthill McKee Ordering [10 points]**
2. **Sparse Matrix Factorization [10 points]**
3. **Degree Centrality [10 points]**
4. **The Connectivity of the Coauthors [10 points]**
5. **PageRank of the Coauthor Graph [10 points]**
6. **Zachary's karate club: social network of friendships between 34 members [50 points]**

#### **References**

- [1] The social network of a karate club at a US university, M. E. J. Newman and M. Girvan, Phys. Rev. E 69,026113 (2004) pp. 219-229.