# ADVANCED ALGORITHMS 2021-2022



# Final Project - Minimum cut problem

## General Description

In this assigment your are asked to compare the performance of two algorithms for the min-

1. Stoer and Wagner's deterministic algorithm
2. Karger and Stein's randomized algorithm

## Dataset

The dataset contains 56 graphs, ranging in size from 10 to 500 vertices, generated randomly
Each file describes an undirected graph with positive integer weights using the following form

[number_of_nodes] [number_of_edges]
[one_node_edge_1] [other_node_edge_1] [weight_edge_1]
[one_node_edge_2] [other_node_edge_2] [weight_edge_2]
[one_node_edge_3] [other_node_edge_3] [weight_edge_3]
...

For example, a row "2 3 8874" indicates that there is an edge connecting vertex 2 to vertex 3
not necessarily distinct.

## Question 1

Run the two algorithms you have implemented on the graphs of the dataset. For the Karger
repetitions that guarantees a probability to obtain a global min-cut fo at least $1 - 1/n$.

Measure the execution times of the algorithms and create a graph showing the increase of e
the graph increases. Compare the measured times with the asymptotic complexity of the alg

the weight of the minimum cut obtained by your code.

You can use a timeout to limit the execution time of large instances if it became too large.

### Question 2

The Recursive_Contract procedure of the Karger-Stein randomized algorithm contracts the g
$n/\sqrt{2}+1$, then it recursively call Recursive_Contract on the contracted graph twice, returin
solution.

Define a hybrid algorithm that randomly contracts the graph until the number of nodes is $n$
Stoer and Wagner algorithm to find a solution on the contracted graph.

Run the hybrid algorithm on the graphs of the dataset, using a number of repetitions that gu
min-cut of at least $1-1/n$. Compare the execution times of the hybrid algorithm with the s

### Question 3

Measure the *discovery time* of the Karger and Stein algorithm and of the hybrid algorithm. Th
when the algorithm finds the minimum cost cut. Compare the discovery time with the overal
the dataset.

### Question 3

Comment on the results you have obtained: how do the algorithms behave with respect to th
that is always better than the other? Which algorithm is more efficient?

## What to deliver

- A brief report on your project. The report must contain:
  - an introductory section with a description of the algorithms and implementation choice
  - explanatory graphs of the results with the answers to the questions;
  - any originality you introduced in the implementation;
  - a concluding section with your comments and your conclusions on results.
- The source code of the implementation in a single archive file (.zip, .tar.gz, etc.).

## How to submit the assigment

- You have to do the project on your own. Group submissions are not allowed.

## Final remarks

- You can implement the algorithms with any programming language you like. Basic data str
  dictionaries or maps, provided by the standard libraries of the language, can be used with
  libraries that directly provide data structures and algorithms to represent and manipulate
  similar.
- Comment the essential parts of the code so that the reader can grasp the ideas that led yo

help to clarify whether a bug is a conceptual error or just a small mistake.

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| mincut_dataset.zip | 24 maggio 2021, 15:28 |

◄ Lab 6 - Stoer and Wagner

Vai a...