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Supervisor's statement

Hereby I confirm that the presented thesis was prepared under my supervision and that it fulfils the requirements for the degree of Master of Computer Science.

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Author's statement

Hereby I declare that the presented thesis was prepared by me and none of its contents was obtained by means that are against the law.

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Abstract

W pracy przedstawiono prototypową implementację blabalizatora różnicowego bazującą na teorii fetorów σ-ρ profesora Fifaka. Wykorzystanie teorii Fifaka daje wreszcie możliwość efektywnego wykonania blabalizy numerycznej. Fakt ten stanowi przełom technologiczny, którego konsekwencje trudno z góry przewidzieć.

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Subject classification

D. Software
D.127. Blabalgorithms
D.127.6. Numerical blabalysis

Tytuł pracy w języku polskim

Tytuł po polsku

Contents

Introduction

Blabalizator różnicowy jest podstawowym narzędziem blabalii fetorycznej. Dlatego naukowcy z całego świata prześcigają się w próbach efektywnej implementacji. Opracowana przez prof. Fifaka teoria fetorów σ-ρ otwiera w tej dziedzinie nowe możliwości. Wykorzystujemy je w niniejszej pracy.

Chapter 1

Basic definitions

1.1. Structures

Definition 1.1. *Graph*

Definition 1.2. *Star*

Definition 1.3. *Spanning tree*

+Additional notation: e.g. $deg_G(v)$

1.2. Parameterized complexity

Definition 1.4. *Parameterized problem*

Definition 1.5. *FPT algorithm*

Definition 1.6. *Kernel*

Definition 1.7. *Kernelization algorithm*

1.3. Graph decomposition

Definition 1.8. *Path decomposition and pathwidth*

Definition 1.9. *Tree decomposition and treewidth*

Definition 1.10. *Nice tree decomposition*

Chapter 2

Spanning Star Forest Problem

For a given graph G, we say that S is a *Spanning Star Forest* if every connected component C is a star. In the *Spanning Star Forest Problem* given a graph G, the objective is to determine whether there exists a *Spanning Star Forest*.

It turns out that the problem formulated in such a way is relatively simple. Although, various parametrizations described in this paper make it more complex. The following lemma easily clarifies all the concerns.

Lemma 2.1. *A graph G has a Spanning Star Forest if and only if it does not contain any isolated vertices.*

Proof. If G has a Spanning Star Forest S, then trivially $\forall_{v \in V(G)} 1 \leq deg_S(v) \leq deg_G(v)$. Thus, none of the vertices is isolated.

For the opposite direction □

Theorem 2.1. *Decision version of Spanning Star Forest Problem can be solved in linear time.*

2.1. Obtaining a solution

In this section the focus will be set on obtaining an arbitrary solution for a given instance of the *Spanning Star Forest Problem.*

Theorem 2.2. *A solution for a Spanning Star Forest Problem can be found in linear time.*

2.2. Spanning Star Forest parameterized by the number of stars

In the *Spanning Star Forest Problem* parameterized by the number of stars, given a graph G and a natural number k, the objective is to determine whether there exists a *Spanning Star Forest S* such that the number of components is less than k.

It is natural to ask whether one can find a solution that minimizes the number of connected components. Even though the problem looks slightly different than the previous one, *Spanning Star Forest* parameterized by the number of stars is NP-Complete. The following theorem proves the statement:

Theorem 2.3. *Spanning Star Forest Parameterized by the number of stars is NP-Complete.*

Lemma 2.2. *There exists a reduction from Spanning Star Forest parameterized by the number of stars to Dominating Set.*

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