ΠΑΡΟΥΣΙΑΣΗ

ΔΙΔΑΚΤΟΡΙΚΗΣ ΔΙΑΤΡΙΒΗΣ

ΗΜΕΡΟΜΗΝΙΑ: Πέμπτη, 22 Δεκεμβρίου 2022

ΩΡΑ: 19:00 – 20:00

ΑΙΘΟΥΣΑ: Η παρουσίαση θα πραγματοποιηθεί στην Αίθουσα Σεμιναρίων του ΤΜΗΥΠ

ΟΜΙΛΗΤΗΣ: **Αννα Μπαντή**

Θ έ μ α

«Edge Modification on Perfect and Reducible Graphs with Application to Watermarking»

Επταμελής Εξεταστική Επιτροπή:

1. **Σταύρος Νικολόπουλος** (Επιβλέπων), Καθηγητής πρώτης βαθμίδας του Τμήματος Μηχανικών Η/Υ & Πληροφορικής, Πανεπιστήμιο Ιωαννίνων
2. **Λεωνίδας Παληός**, Καθηγητής πρώτης βαθμίδας, του Τμήματος Μηχανικών Η/Υ & Πληροφορικής, Πανεπιστήμιο Ιωαννίνων
3. **Χάρης Παπαδόπουλος**, Αναπληρωτής Καθηγητής του Τμήματος Μαθηματικών, Πανεπιστήμιο Ιωαννίνων
4. **Βασίλειος Ζησιμόπουλος**, Καθηγητής πρώτης βαθμίδας του Τμήματος Πληροφορικής & Τηλεπικοινωνιών, Ε.Κ.Π.Α.
5. **Αντώνιος Συμβώνης**, Καθηγητής πρώτης βαθμίδας της Σχολής Εφαρμοσμένων Μαθηματικών & Φυσικών Επιστημών, Ε.Μ.Π.
6. **Λουκάς Γεωργιάδης**, Αναπληρωτής Καθηγητής του Τμήματος Μηχανικών Η/Υ & Πληροφορικής, Πανεπιστήμιο Ιωαννίνων
7. **Χρήστος Νομικός**, Αναπληρωτής Καθηγητής του Τμήματος Μηχανικών Η/Υ & Πληροφορικής, Πανεπιστήμιο Ιωαννίνων

ΤΜΗΜΑ ΜΗΧΑΝΙΚΩΝ Η/Υ & ΠΛΗΡΟΦΟΡΙΚΗΣ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ
Τ.Θ. 1186, ΙΩΑΝΝΙΝΑ 45110
Τ: 265100 8817 - 8813 - 7196
http:/www.cse.uoi.gr/

DEPT. OF COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF IOANNINA
P.O. BOX 1186, IOANNINA
GR - 45110 GREECE
T: +30 265100 8817 - 8813 - 7196
http:/www.cse.uoi.gr/

Π ε ρ ί λ η ψ η:

In graph modification problems, we have to repair, improve, or adjust a graph to satisfy appropriate properties while minimizing the cost of the modification. The study of graph modification problems is crucial to computer science as they find applications in different areas, such as biology, mathematics, sociology, machine learning, data mining, and computer vision.

This PhD thesis has a theoretical and a more applied part, both related to edge modification problems on classes of graphs.

For the theoretical part, we study and present polynomial algorithms for the minimum completion problem (i) of a graph with a "tail" for four subclasses of perfect graphs and (ii) of a graph and an added edge for the class of P_4-sparse graphs. The minimum completion (fill-in) problem is defined as follows: Given a graph family $\mathcal{F}$ (more generally, a property Π) and a graph G, the completion problem asks for the minimum number of non-edges needed to be added to G so that the resulting graph belongs to the graph family $\mathcal{F}$ (or has property Π). This problem is NP-complete for many subclasses of perfect graphs and polynomial solutions are available only for minimal completion sets.

Given a graph G, a *tail* uw is an edge connecting a vertex $w \notin V(G)$ to a vertex $u \in V(G)$. We study the minimum completion problem for the graph $G + uw$ for the classes of split, quasi-threshold, threshold, and P_4-sparse graphs. Based on properties of the structure of split graphs and of the tree representation of quasi-threshold, threshold, and P_4-sparse graphs, we present linear-time algorithms to solve this problem.

Additionally, for the class of P_4-sparse graphs, we study the minimum completion problem of a P_4-sparse graph G with an added edge. For any optimal solution of the problem, we prove that there is an optimal solution whose form is of one of a small number of possibilities. This along with the solution of the problem when the added edge connects two non-adjacent vertices of a spider or connects two vertices in different connected components of the graph enables us to present a linear-time algorithm for the problem.

The applied part of this thesis focuses on the study of malicious edge modifications of reducible graphs used to encode an integer number as a watermark in a specific software watermarking codec system. The most important step in any software watermarking method is the choice of the right watermark, which, in the watermarking system we study, is a watermark producing a reducible graph in which edge modifications can be detected. Through the study of such edge modifications, we classify watermarks as strong, intermediate, or weak and we are able to give recommendations for the best choice of watermarks to use.

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