ΤΜΗΜΑ ΜΗΧΑΝΙΚΩΝ Η/Υ ΚΑΙ ΠΛΗΡΟΦΟΡΙΚΗΣ ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ
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ΔΙΔΑΚΤΟΡΙΚΗΣ ΔΙΑΤΡΙΒΗΣ

ΗΜΕΡΟΜΗΝΙΑ: Παρασκευή, 19 Δεκεμβρίου 2014

ΩΡΑ: 15.00

ΑΙΘΟΥΣΑ: Αίθουσα Σεμιναρίων (ισόγειο Ι1-Ι2)
Κτήριο Τμήματος Μηχανικών Η/Υ & Πληροφορικής

ΟΜΙΛΗΤΗΣ: **Μαρία Γ. Χρόνη**

Θ έ μ α

«Algorithmic Techniques for Encoding Permutations and Permutation Graphs for Watermarking Software, Image, Audio, and Text»

«Αλγοριθμικές Τεχνικές Κωδικοποίησης Μεταθέσεων και Μεταθετικών Γραφημάτων για Υδατοσήμανση, Λογισμικού, Εικόνας, Ήχου, και Κειμένου»

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ΤΜΗΜΑ ΜΗΧΑΝΙΚΩΝ Η/Υ ΚΑΙ ΠΛΗΡΟΦΟΡΙΚΗΣ ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ
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Π ε ρ ί λ η ψ η

Internet technology, in modern communities, has become an indispensable tool for everyday life since most people use it on a regular basis and do many daily activities online. This frequent use of the internet means that measures taken for internet security are indispensable since the web is not risk-free. One of those risks is the fact that the web is an environment where intellectual property is under threat since a huge amount of digital data are transferred every day, and thus such data may end up on a user who falsely claims ownership.

Digital watermarking is a technique for protecting the intellectual property of a digital object; the idea is simple: a unique marker, which is called *watermark*, is embedded into a digital object which may be used to verify its authenticity or the identity of its owners.

The issues addressed in this thesis concern the design of efficient and easily implemented codec systems for watermarking digital objects, such as software, image, audio, and text.

In the first part of the thesis we define a main data component of our codec system, namely, self-inverting permutation (*SiP*). We introduce the notion of a bitonic permutation, and present our algorithm *Encode-W.to.SiP* for encoding an integer w as a self-inverting permutation π^*, along with the corresponding decoding algorithm *Decode-SiP.to.W*. We then present the two algorithms, namely *Encode-SiP.to.RPG-I* and *II* for encoding the self-inverting permutation π^* as a reducible permutation flow-graph $F[\pi^*]$, and we propose a randomize encoding algorithm which takes as input a self-inverting permutation π^* and encodes the permutation π^* into a cograph $C[\pi^*]$. Then, we present the algorithm *Encode_Cograph.to.RPG*, along with its corresponding decoding algorithm, which embeds a cograph into an RPG by exploiting the structure and some important algorithmic properties of its cotree.

The second part of the thesis, presents how the different components of our codec system can be used for watermarking software, digital images and audio, as well as, digital text. We present a dynamic watermarking model, which we call WaterRPG, for embedding the watermark graph $F[\pi^*]$ into an application program P resulting thus the watermarked program P^*, by altering appropriate function calls of the program P. Next, we present our image watermarking technique where a watermark is transformed from a numerical form to a 2D form (i.e., 2D representation) through the exploitation of self-inverting permutation properties. The 2D representation can be efficiently marked on images resulting thus the watermarked images. Similarly, since audio signal is one dimensional object we present a transformation of a watermark from a numerical form to a 1D form (i.e., 1D representation) and the embedding into an audio signal. Based on the three different representations of self-inverting permutation (*SiP*), i.e., the two dimensional (2D-representation), the one dimensional (1D-representation), and the encoding of permutation π^* as a reducible permutation graph $F^*[\pi^*]$ (RPG-representation), we present the encoding algorithms, along with the corresponding extracting algorithms, for embedding a watermark number or, equivalently, a self-inverting permutation π^* or a reducible permutation graph $F^*[\pi^*]$ into a PDF document file.