UNIVERSITÀ DI TRENTO
Dipartimento di Matematica

# DOTTORATO

CYCLE 33th
ORAL DEFENCE OF THE PHD THESIS

**Wednesday 30 March 2022 – at 11:00 am**
**Seminar Room Fisica**

The event will take place online through the ZOOM platform.
To get the access codes please contact the secretary office


## Alice Raffaele

**PhD Student in Mathematics**


# From optimization to listing: theoretical advances in some enumeration problems


**Abstract**:
In this final seminar, I present the new theoretical results contained in my doctoral thesis, related to the investigation of some problems relevant in enumeration and optimization.
First, I focus on a classical enumeration problem in graph theory with several applications, such as network reliability. Given an undirected graph, the objective is to list all its bonds, i.e., its minimal cuts. I provide two new algorithms, the former having the same time complexity as the state of the art by [Tsukiyama et al., 1980], whereas the latter offers an improvement. Indeed, by refining the branching strategy of [Tsukiyama et al., 1980] and relying on some dynamic data structures by [Holm et al., 2001], it is possible to define an $\tilde{O}(n)$-delay algorithm to output each bond of the graph as a bipartition of the $n$ vertices. Disregarding the polylogarithmic factors hidden in the $\tilde{O}$ notation, this is the first algorithm to list bonds in a time linear in the number of vertices.
Then, I move to studying two well-known problems in theoretical computer science, that are checking the duality of two monotone Boolean functions, and computing the dual of a monotone Boolean function. These also are relevant in many fields, such as linear programming. [Fredman and Khachiyan, 1996] developed the first quasi-polynomial time algorithm to solve the decision problem, thus proving that it is not coNP-complete. However, no polynomial-time algorithm has been discovered yet. Here, by focusing on the symmetry of the two input objects and exploiting full covers introduced by [Boros and Makino, 2009], I define an alternative decomposition approach. This offers a strong bound which, however, in the worst case, is still the same as [Fredman and Khachiyan, 1996]. Anyway, I also show how to adapt it to obtain a polynomial-space algorithm to solve the dualization problem.


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**CONTATTI**
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