

Corso di Laurea Magistrale in Scienze Computazionali (LM40)

Dip.to di Matematica e Fisica, Univ. Roma Tre - Largo S. L. Murialdo, 1, 00146 Roma.

Titolo del corso: “Structure and dynamics of Boolean networks”

Docente: Paul Ruet, CNRS, IRIF, Université Paris Diderot - Paris 7

Lingua del corso: Inglese

Crediti: 5 CFU validi per il Corso di Laurea Magistrale in Scienze Computazionali (LM40)

Calendario delle lezioni: Lun. 19/3 ore 9-11, Mer. 21/3 ore 11-13, Gio. 22/3/2018 ore 9-11.

Luogo: Aula 211, Il piano, Blocco C, Dip Mat. e Fis., Univ. Roma Tre, L.go S. L. Murialdo, 1, Roma.

Abstract. — Boolean networks are discrete dynamical systems in which finitely many interacting components can take two values, 0 and 1. They can be presented by directed graphs (with additional structure) in which vertices represent the interacting components, and edges the dependencies between components.

They have plenty of applications, in particular as models of various biological (neural, genetic...) networks, but their dynamics can be very complex, and difficult to characterize in simpler terms. Several independent lines of research have attempted to characterize this dynamics in terms of cycles in the associated graphs:

- In the 1970's, the biologist R. Thomas proposed rules relating certain cycles in Boolean networks to biological dynamical properties such as differentiation and homeostasis.
- Independently, since the 1940's, some theorems of von Neumann, Boros, Galeana-Sanchez and others relate kernels in graph theory (which may be viewed as fixed points) to the absence of certain cycles.
- In the 2000's, Shih and Dong proved that the absence of cycles in well-defined discrete Jacobian matrices is a sufficient condition for the existence of a unique fixed point.

The course is an introduction to the relationships between asymptotic dynamical properties (fixed points or other types of attractors) of Boolean networks and their structural properties in terms of cycles.

After preliminaries on Boolean networks, attractors, interaction graphs, subnetworks, we shall review some of the results obtained mainly during the last decade. Time permitting, we shall study some special classes of Boolean networks (and-nets, non-expansive...) and the generalization to discrete networks (in which components can take more than two values).

Per maggiori info, scrivete a: “roberto.maieli@uniroma3.it” o “marco.pedicini@uniroma3.it”