



PhD Course on “Game Theory for Computer Science: Synthesis and Graph-based games”

Pietro Sala

The aim of this course consists of providing the foundations of synthesis problems and how they are strongly connected to the winning strategies for games on graphs.

The course is divided into four main topics:

- (i) first we will define the synthesis problem in its general form and we will establish a connection to games on graph with single-objective;
- (ii) in the second part we will analyze the algorithms, and the related complexity, for solving single-objective games on graphs;
- (iii) then we will analyze recent results, both positive and negative w.r.t. to decidability, on multi-objective games on graphs;
- (iv) finally we consider how to solve stochastic games on graphs.

At the end of this course the student will be able to:

- a) formalize and analyze real-world synthesis problems;
- b) find the right technique and tools for solving a synthesis problem;
- c) know the basic results underlying graph games together with an idea of the main research directions in the field.

Program

- 1 The synthesis problem (5 hours)
- 2 Graph games with single objective (5 hours)
- 3 Graph games with multiple objectives (5 hours)
- 4 Stochastic games (5 hours)

References

[1] W. Zielonka : Infinite games on ω -nately coloured graphs with applications to automata on infinite tree, TCS, 200(1-2):135-183, 1998

[2] E. Gradel, W. Thomas, T. Wilke (Eds.) : Automata, Logics, and Infinite Games, Springer LNCS 2500 (2003), ISBN 3-540-00388-6

[3] Krishnendu Chatterjee, Mickael Randour, and Jean-Francois Raskin, Strategy synthesis for multi-dimensional quantitative objectives, Acta Inf. 51 (2014), no. 3-4, 129{163.

[4] Marta Kwiatkowska, David Parker and Clemens Wiltsche. PRISM-games: Verification and Strategy Synthesis for Stochastic Multi-player Games with Multiple Objectives. International Journal on Software Tools for Technology Transfer, 20(2), pages 195-210, Springer. April 2018.

2



UNIVERSITÀ
di **VERONA**

Scuola di Dottorato
di **SCIENZE NATURALI ED INGEGNERISTICHE**

Corso di Dottorato in Informatica

CLASS MEETING

11 Febbraio - 2 ore 10 – 12 – AULA L – CA' VIGNAL 2
14 Febbraio - 3 ore 10 - 12 e 13-14 - AULA L – CA' VIGNAL 2
18 Febbraio - 3 ore. 10 - 12 e 13-14 - AULA L – CA' VIGNAL 2
21 Febbraio - 3 ore. 10 - 12 e 13-14 – **mattina** Sala riunioni II piano - **pomeriggio** AULA L
25 Febbraio - 3 ore. 10 - 12 e 13-14 – AULA ATRIO CA' VIGNAL 1
28 Febbraio - 3 ore. 10 - 12 e 13-14 – SALA RIUNIONI PIANO TERRA
3 Marzo - 3 ore 10 - 12 e 13-14 – AULA DA DEFINIRE