Formal Models - Computability, Complexity, Applications

Preface

This special issue honours the founding fathers of the Bucharest School of Theoretical Computer Science, in alphabetical order, V. E. Căzănescu, L. Livovschi, M. Malița, S. Marcus, C. Popovici, S. Rudeanu, I. Tomescu and D. Vaida.

The mathematician and logician Gr. C. Moisil (1906–1973) played a fundamental role in the introduction and the development of computer science in Romania and in raising the first generations of Romanian computer scientists. In 1996, Moisil was awarded posthumously the Computer Pioneer Award by the Institute of Electrical and Electronics Engineers Computer Society (`https://en.wikipedia.org/wiki/Computer_Pioneer_Award`).

Not surprisingly, the Bucharest School of Theoretical Computer Science, based at the University of Bucharest, was strongly influenced by Moisil: all the founding fathers of this school have been Moisil's students and collaborators [6].

Virgil E. Căzănescu (b. 1943) is a pioneer in the applications of category theory to automata and machines. Gradually his research switched to algebraic models for the syntax and semantics of programming languages and declarative programming, his main field. Căzănescu has carefully "grown" and guided a number of well-known scientists like Gh. Stefanescu, R. Diaconescu and G. Roșu. In 1993 Căzănescu established the Department of Fundamentals of Computer Science of the Faculty of Mathematics which he headed untill his retirement. His numerous textbooks had a strong influence on many generations of students.

In late 1950's Leon Livovschi (1921–2012) brought to the attention of Gr. C. Moisil the applications of logics to the design of electronic circuits. He published a pioneering book [7], which together with Moisil's books [10, 11], synthesise the Romanian research in this area. He was always on the frontline of introducing novel concepts, topics or technologies into the syllabus of the computer science programmes at the University of Bucharest.

In 1960's Mircea Malița (b. 1927), a mathematician as well as a professional diplomat, taught the first lectures on mathematical models for the analysis of international relations ([6], p. 152), followed, in the mid 1970's, by lectures on mathematical and computer science methods in social sciences. The course has stimulated students interest and work, and as a result, more accurate models. Malița has published many books in applied mathematics (for example, [8]), logic and artificial intelligence, as well as in political sciences, futurology (see [1]) and higher education (see [2]).

Solomon Marcus (b. 1925), a scholar with "at least five research careers, all at the top level" (see Gh. Păun [12], p. 352), has many important results in a broad range of fields including mathematical analysis, mathematical and computational linguistics, theoretical computer science, poetics, linguistics, semiotics, philosophy and history of science, and education. With 50 books and more than 400 articles, 24 PhD students and 83 descendants listed by Mathematics Genealogy Project, `http://www.genealogy.math.ndsu.nodak.edu/id.php?id=49018`, Marcus is one of the best internationally known and appreciated Romanian scientists. Marcus has influenced probably the largest number of active Romanian mathematicians and theoretical computer scientists, including most of the contributors to this issue.

G. Păun called him "an institutions man" ("omul instituţii", in Romanian), emphasising the plural of the first word, a scholar with at least five research careers, all at the top level ([12], p. 352).

Professor Marcus Axioms (S Istrail, `http://www.brown.edu/Research/Istrail_Lab/resources/MarcusAxioms101011final.pdf`)

Axiom 0. Be a language theorist
Axiom 1. Be a first-class scientist in at least one of the disciplines of your interdisciplinary research
Axiom 2. Be a mathematician of the continuous and discrete
Axiom 3. Be an intra-math, inter-sciences, and cross-cultures scientist
Axiom 4. Be the guardian of high standards
Axiom 5. Know a lot - really a lot - of mathematics
Axiom 6. Be a storyteller (povestitor)

In 1959–1960 Constantin Popovici (b. 1930) was one of the first lecturers on computers and programming at the University of Bucharest ([6], p. 136). His research was mainly in number theory, automata theory and recursive function theory. Popovici's textbook [13] was used for many generations of students in computer science at the University of Bucharest.

The research activity of Sergiu Rudeanu (b. 1935) in lattice theory, algebra of logics, universal and Boolean algebras (see [15, 16]), pseudo-Boolean programming (a subject he has initiated with P. L. Hammer, see [3, 4]), automata theory and graph theory is internationally well-known and appreciated. A very good lecturer, who devoted time and energy to write many textbooks, Rudeanu is also an excellent supervisor: the Mathematics Genealogy Project, `http://www.genealogy.math.ndsu.nodak.edu/id.php?id=60012`, lists his 12 PhD students (including well-known researchers as D. Simovici, A. Iorgulescu and S. Istrail) and 13 descendants.

Ioan Tomescu (b. 1942) is a prolific mathematician and theoretical computer scientist, with more than 140 scientific papers and 15 books and textbooks (see [18]). His main research areas are combinatorics and graph theory and, singularly nowadays, most of his papers have one author. He has supervised 16 PhD students, according to the Mathematics Genealogy Project, `http://www.genealogy.math.ndsu.nodak.edu/id.php?id=124236`, including well-known researchers like E. Mândrescu and C. Vertan. Tomescu was the head of one of the Departments of Computer Science of the Faculty of Mathematics since 1990 until very recently.

Dragoş Vaida (b. 1933) is one of the Romanian pioneers in the field of computer science ([6], pp.135–136, 143). His research activity started with the use of computers in solving various practical problems [19], then moved to formal languages and compiling techniques [20] and applications of semi-rings and other algebraic structures in formal semantics. An active researcher in various fields of theoretical computer science, he has also a broader area of interests including international cooperation in the sphere

of higher education (he was deputy-director of the European Centre for Higher Education, CEPES). Vaida has been also a mentor and close collaborator to some of his younger colleagues, Tudor Bălănescu, Alexandru Mateescu, Rodica Ceterchi, as well as some of the contributors to this special issue.

It is also remarkable that most professors and scholars to whom we dedicate this special issue are still very active in research. Here is a rather convincing argument: [5, 9, 14, 17].

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The contributors to this volume, students or collaborators of the founders of the school of theoretical computer science at the University of Bucharest or their students, have covered a broad spectrum of theoretical computer science areas. The topics covered include contextual grammars, controlled P systems, networks of evolutionary picture processors, non-archimedian discretisation of timed languages, quantitative results regarding dependent and independent strings, semantics of asynchronous concurrency, nominal groups, structural operational semantics using measure theory for a stochastic extension of CCS, reaction systems models for systems driven by biochemical interactions, formal grammars and machine learning applied to natural language understanding and prediction, the use of machine learning in training oracles involved in solving NP problems, the use of P systems in providing solutions to ill-posed one-dimensional global optimisation problems.

The diversity of areas and types of results is characteristic for the general philosophy of the Bucharest School of Theoretical Computer Science.

All contributors have attended lectures of many professors honoured in this issue, they have been scientifically influenced by them or their students as PhD supervisors, mentors, and, later, collaborators. We all express our gratitude for the chance we had to be educated and trained in this remarkable school.

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