Semigroups and Automata. SELECTA Uno Kaljulaid (1941–1999). Edited by Jaak Peetre (Lund, Sweden) and Jaan Penjam (Tallinn, Estonia), 2006, IOS Press, Amsterdam. ISBN 1-58603-582-7

The editors start the *Preface* to the book with the words that they have the pleasure of offering the mathematical public the *Selecta* of the eminent late Estonian algebraist Uno Kaljulaid, containing mainly papers published in his lifetime. Many of the papers were originally written in Russian (because Estonia belonged then to the Soviet Union), a few also in Estonian, and have now been translated into English, mostly by J. Peetre (senior editor of the book).

The *Preface* provides also some facts about Estonia and Estonian mathematics. For more details about mathematics in Estonia until 1940 the reader is referred to an article by Ülo Lumiste in the book *Edgar Krahn. A Centenary Volume 1894–1961* (edited by Ü. Lumiste and J. Peetre), IOS Press, 1994.

Next follows the *Biography of Uno Kaljulaid* written by J. Peetre. Uno Kaljulaid was born in a small village of Kõpu in the district of Viljandi, southwestern Estonia, on 21 October 1941. He got his secondary education in Pärnu. After graduating from the Pärnu First High School in 1959, U. Kaljulaid entered the University of Tartu to study mathematics. In the last study-year he was transferred to the Mechanical and Mathematical Faculty of Moscow State University. His diploma work was written under the supervision of Yuri Manin in 1966. In 1968–1972, after one-year military service in Moscow, U. Kaljulaid pursued post-graduate studies at the University of Tartu. The advisor of his Candidate of Science thesis was Professor Boris Plotkin (at Riga, now in Jerusalem). The thesis was defended in Minsk on 11 March 1979.

Uno Kaljulaid taught at the University of Tartu from 1972 on: as an assistant professor in 1972–1974 and as an associate professor in 1974–1983. He was made a docent in 1983. From 1993 on he was engaged in scientific work and provided consultative service at the Computer Science Institute of the Department of Mathematics of the University of Tartu. Simultaneously, he was a part-time senior research fellow at the Institute of Cybernetics in Tallinn, where he studied compositional theory of abstract state machines with memory.

After a short summary of U. Kaljulaid's scientific work J. Peetre gives his recollections of him. Jaak Peetre first met U. Kaljulaid during a trip to Soviet-occupied Estonia in the spring of 1989 and invited him to Sweden in the spring

of 1990. Afterwards U. Kaljulaid visited J. Peetre in Lund in 1992, 1994, and in October 1996; a short last trip was in May 1997. Jaak Peetre mentions that Uno Kaljulaid was a rather complex person. He was always very friendly, and utterly polite, but supposedly suffered from a kind of persecution mania. Some examples are given.

Uno Kaljulaid fell ill already at the end of 1987 and had surgery for stomach cancer. However, he was practically healthy until the middle of July 1999. In September he had to undergo another surgery, but its purpose was only to set a diagnosis: cancer in the stomach with remote metastasis in the lungs and liver. He passed away at the age of 57 in the pulmonary clinic at Tartu on 26 September 1999.

The *Bibliography of Uno Kaljulaid* contains 54 publications, mainly papers published in the Estonian-language journal *Matemaatika ja Kaasaeg* (translated as *Mathematics and Our Age*), in the *Proceedings of the Estonian Academy of Sciences Physics, Mathematics*, and in *Acta et Commentationes Universitatis Tartuensis*, also some abstracts of several colloquia, symposia, and conferences, and three text-books by the Tartu University Press. There are four reports from the Institute of Cybernetics, Tallinn.

The *Selecta* includes English translations of 21 of these publications, among them U. Kaljulaid's Candidate of Science thesis *Triangular Products and Stability of Representations*, originally a typescript of 150 pp. in Russian (University of Tartu 1979), translated by J. Peetre, translation revised by K. Kaarli.

All this is presented in six chapters:

I.   Representations of semigroups and algebras (Candidate of Science thesis and five publications);
II. Automata theorem (with Preamble by editors, Lecture notes by U. Kaljulaid, compiled with the assistance of J. Peetre, and two publications);
III. Majorization (fragment: Generalized majorization, coauthor J. Peetre, and two previously unpublished reports by J. Peetre);
IV. Combinatorics (a paper "On Stirling and Lah numbers", a letter of about 1991 from U. Kaljulaid to Torbjörn Tambour, and an unpublished manuscript "On Fibonacci numbers of graphs", edited by J. Peetre);
V.   History of mathematics (unpublished manuscript, ca. 1985, "Th. Molien, an innovator of algebra", translation from Estonian by J. Peetre; a Xerox copy of the handwritten original (ca. 1991) "Theodor Molien, about his life and mathematical work as seen a century later", edited by J. Peetre, corrections by A. Zubkov; a printed paper on the results of Molien about invariants of finite groups);
VI. Popularization of mathematics (papers on Diophantine geometry, the solving of equations, Galois theory, theory of automata, Mordell's problem).

The most important scientific results of U. Kaljulaid are represented in the works of Chapter I. The above-mentioned Candidate of Science thesis is the most voluminous one. The translation on 82 pages of the book makes for the first time its contents available to the wide mathematical public. The supervisor of the

thesis Boris Isakovich Plotkin wrote, on J. Peetre's request, the following lines (pp. xiii–xiv):

"At the beginning of 70-ties my interest was focused on the varieties of group representations. This topic attracted attention of Uno. Soon after he asked me to give him a problem for his [Candidate] thesis. I recommended him to build a similar theory for representations of semigroups. [...] Uno managed to prove a series of significant results and in the end of the 70-ties he brilliantly defended his [Candidate] thesis at the Institute of Mathematics in Minsk. His work was highly appreciated by the reviewers and the Council members.

[...] Methods, elaborated in the thesis, were extended and used in the automata theory. We considered automaton as a three-sorted mathematical system which possesses algebraic operations converting states to states and states to output signals. The system of input signals naturally constitutes a semigroup with the representation on the set (space) of states. This algebraic point of view on automata turns out to be very fruitful.

Last years he collaborated with his pupil Olga Sokratova and other pupils in automata theory."

The most important results of the thesis were previously summarized in a paper "Triangular products of representations of semigroups and associative algebras" published in *Uspekhi Matematicheskikh Nauk*, 1977, **32**. Its translation in the book is commented by R. Lipyanskiĭ, who concludes (p. 17): "I think that this paper of Uno Kaljulaid was a pioneer work in the theory of the variety of semigroup representations and the variety of linear automata. His results extend also [...] Bergman–Lewin Theorem (*J. London Math. Soc.*, 1975, **11**, 21–31)."

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