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Preface

This (very) special issue is devoted to Professor Arto Salomaa – a member of the Editorial Board of Fundamenta Informaticae - on the occasion of his 65th birthday. All contributions are by his former Ph.D. students (and their coauthors). This is an impressive testimony of the enormous influence that Professor Salomaa had as an educator of the Theoretical Computer Science community. In the spirit of high quality so characteristic for Professor Salomaa, all contributions to this special issue were carefully refereed.

Turku, February 1999

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Academy Professor Arto Salomaa

ARTO SALOMAA

It is a great honour for us to edit a special issue dedicated to Academy Professor Arto Salomaa.

Arto was born in Turku on the sixth of June 1934 to an academic family. His father was a professor of philosophy at Turku University, which became the home university of Arto as well. After graduating in 1954 at Turku University, Arto left for Berkeley for graduate studies, but he returned to Turku to defend his Ph.D. in 1960. Six years later he was appointed professor of mathematics at Turku University, a position he held since then. About half of this period he has been an academy professor – the most prestigious scientific position in Finland.

We feel that the following four keywords describe the professional life of Arto: scientist, Ph.D. supervisor, book writer, and editor.

First of all Arto is a *scientist.* He has published over 300 scientific articles. He started as a logician, but realized very soon the importance and the mathematical challenges of theoretical computer science. He moved already in the mid 1960s to automata theory, and became soon one of the founding fathers of formal language theory. This has been – in a broad sense – his main research area since then. Arto has also worked in other areas. Thus, e.g., he started to work on cryptography in the late 1980s, and became one of the authorities of this field.

Arto has worked on many classical problems, and he also initiated many, by now well established, research directions. Examples of the areas greatly influenced by his work are: formal power series, L systems, grammar forms, and most recently the formal aspects of molecular computing.

Although he chose Turku to be his home town, Arto is a true "scientist of the world". He has given lectures at more than 150 universities and research centers, and he has spent longer periods of time at the universities of Western Ontario, Waterloo and Aarhus. He has been also amply recognized by the international scientific community – he certainly is one of the most decorated computer scientists. He has received the Honorary Doctorate from six universities in four different countries, and he has been a member and the chair of committees awarding Gödel and Nevanlinna Prizes, just to mention some examples.

Secondly, Arto is a *Ph.D. supervisor.* He has supervised 24 Ph.D.'s in Canada, Denmark and Finland. Many of his former Ph.D. students are now university professors. As a supervisor, Arto is not particularly demanding, but rather he is extremely helpful, supportive and encouraging. He has a unique skill of formulating research problems for his Ph.D. students in such a way that they are just right to provide a maximal challenge for each of them.

Thirdly, Arto is a *book writer.* He has published 11 scientific monographs, many of which became the textbooks of the areas they cover. For example, his "Formal Languages" (Academic

Press, 1973) was among the top 100 most referenced books in mathematics, while his "Public-Key Cryptography" (Springer Verlag 1990 and 1996) has been translated into four languages including Russian, Chinese and Japanese.

Arto is an *editor*. Arto's role as a scientific editor is extraordinary. He is on the editorial boards of about 15 international journals and book series, including some of the most prestigious ones. The most impressive evidence of his editorial skills, is the three-volume, 2000-page "Handbook of Formal Languages" (Springer Verlag, 1997). It presents in unique form the research done by the formal language theory community during the past 40 years!

Finally, we want to mention the role of Arto as a skillful *organiser* of the theoretical computer science community. For example, Arto was the president of EATCS (European Association for Theoretical Computer Science) during the most important period for the association. He has organized a number of important meetings in theoretical computer science, including the International Colloquium on Automata, Languages and Programming (ICALP) in Turku in 1977, and in Tampere in 1988.

Arto is very much admired by his co-authors and colleagues. He has had 53 co-authors, and became a very good friend with many of them. He is very generous in supporting scientists from the "economically less fortunate" countries.

Arto is interested in many aspects of life outside science – e.g., classical music and sports are very important for him. His love for music shows up also in his scientific activities: he refers to his books as "symphonies".

The matters that are very special for Arto are: the Finnish Sauna and his Family, especially the grandchildren Suvi, Juhani and Daniel.

Arto's knowledge of Finnish Sauna is unmatched – both on the hardware and the software level. He is particularly proud of his Salosauna (read: Sauna of Wilderness) on his farm Rauhala (read: Place of Peace). It has been visited by many of Arto's visitors, with many of them holding all kinds of Salosauna records, but no one being able to withstand the full final seven cups of löyly! Whether this is due to the fact that the löylystones are carefully collected by Arto all over the world is an open problem.

The happiest moments for Arto is the time he spends with his wife Kaarina in Rauhala. He loves to heat the sauna, and after sauna either to sit in his rocking-chair thinking about mathematical problems or to play with his grandchildren if they are around. His constructive approach shows also in his private life. If he is missing his grandchildren and they cannot visit Rauhala, he packs the papers that he is currently working on into his (famous) brown briefcase, takes a bus and six(!) hours later he is in Kauhajoki for an "extended weekend" with his grandchildren.

We wish all the best to Arto and his family for many years to come.

February, 1999
Turku

J. Karhumäki
A. Mateescu
G. Rozenberg

List of Ph.D. students of Arto Salomaa

Professor Arto Salomaa has, so far, supervised 24 Ph.D. students at four different universities. Out of those 12 are now professors in Finland, Denmark and Canada. The students in the chronological order are:

Neil Jones	1967	University of Western Ontario, Canada
Paavo Turakainen	1968	University of Turku, Finland
Magnus Steinby	1969	University of Turku, Finland
Topi Urponen	1971	University of Turku, Finland
Andrew Szilard	1974	University of Western Ontario, Canada
Matti Penttonen	1974	University of Turku, Finland
Sven Skyum	1974	University of Aarhus, Denmark
Matti Linna	1975	University of Turku, Finland
Matti Soittola	1975	University of Turku, Finland
Keijo Ruohonen	1976	University of Turku, Finland
Mogens Nielsen	1976	University of Aarhus, Denmark
Juhani Karhumäki	1976	University of Turku, Finland
Raija Leipälä	1979	University of Turku, Finland
Tero Harju	1979	University of Turku, Finland
Juha Honkala	1988	University of Turku, Finland
Valtteri Niemi	1989	University of Turku, Finland
Jarkko Kari	1990	University of Turku, Finland
Lila Kari	1991	University of Turku, Finland
Jukka Koskinen	1994	Technical University of Lappeenranta, Finland
Ari Renvall	1994	University of Turku, Finland
Marjo Lipponen	1996	University of Turku, Finland
Cunsheng Ding	1997	University of Turku, Finland
Valeria Mihalache	1998	University of Turku, Finland
Lucian Ilie	1998	University of Turku, Finland

Publications by Arto SALOMAA[1]

A. Books

1. *Theory of Automata.* International Series of Monographs in Pure and Applied Mathematics, vol. 100, Pergamon Press, Oxford, 1969, 276 pp. (Japanese translation in 1974.)
2. *Formal Languages.* Academic Press, New York, 1973, 335 pp. (German translation by Springer-Verlag in 1979.)
3. (with M. Soittola) *Automata-Theoretic Aspects of Formal Power Series.* Springer-Verlag, 1978, 181 pp.
4. (with G. Rozenberg) *The Mathematical Theory of L Systems.* Academic Press, New York, 1980, xvi+352 pp.
5. *Jewels of Formal Language Theory.* Computer Science Press, Potomac, Maryland, 1981, x+144 pp. (Russian translation in 1986.)
6. *Computation and Automata.* Encyclopedia of Mathematics and Its Applications, vol. 25. Cambridge University Press, Cambridge and New York, 1985, XIII+282 pp. (Japanese translation in 1988, French translation in 1990 and Vietnamese translation in 1992.)
7. (with W. Kuich) *Semirings, Automata, Languages.* EATCS Monographs on Theoretical Computer Science, vol. 5, Springer-Verlag, 1986, vi+374 pp.
8. *Public-Key Cryptography.* Springer-Verlag, 1990, x+245 pp.; second, enlarged edition, 1996, x+271 pp. (Japanese translation in 1992, Romanian translation in 1993, Russian translation in 1996, and Chinese translation in 1998.)
9. (with G. Rozenberg) *Cornerstones of Undecidability.* Prentice Hall, New York, London, Toronto, Sydney, Tokyo, Singapore, 1994, xvi+197 pp.
10. (with C. Ding and D. Pei) *Chinese Remainder Theorem. Applications in Computing, Coding, Cryptography.* World Scientific, Singapore, 1996, viii+213 pp.
11. (with Gh. Păun and G. Rozenberg) *DNA Computing. New Computing Paradigms.* Springer-Verlag, 1998, x+402 pp.

B. Edited Books

1. (with G. Rozenberg) *L Systems.* Springer-Verlag, *Lecture Notes in Computer Science*, 15 (1974), 338 pp.
2. (with M. Steinby) *Automata, Languages and Programming.* Proc. of ICALP-77, Springer-Verlag, *Lecture Notes in Computer Science*, 52 (1977), 569 pp.
3. (with G. Rozenberg) *The Book of L.* Springer-Verlag, 1985, xv+471 pp.
4. (with J. Demetrovics and G. Katona) *Algebra, Combinatorics and Logic in Computer Science*, I-II. North-Holland, Amsterdam, New York, 1986, 887 pp.
5. (with T. Lepistö) *Automata, Languages and Programming.* Proc. of ICALP-88, Springer-Verlag, *Lecture Notes in Computer Science*, 317 (1988), 741 pp.
6. (with G. Rozenberg) *Lindenmayer Systems.* Springer-Verlag, 1992, x+514 pp.

[1] Compiled in December 1998

7. (with G. Rozenberg) *Current Trends in Theoretical Computer Science.* World Scientific, Singapore, 1993, ix+628 pp.
8. (with G. Rozenberg) *Developments in Language Theory.* World Scientific, Singapore, New Jersey, London, Hong Kong, 1994, xii+492 pp.
9. (with J. Dassow and G. Rozenberg) *Developments in Language Theory II. At the Crossroads of Mathematics, Computer Science and Biology.* World Scientific, Singapore, 1996, x+491 pp.
10. (with G. Rozenberg) *Handbook of Formal Languages*, vol. 1: *Word, Language, Grammar.* Springer-Verlag, 1997, xxiv+873 pp.
11. (with G. Rozenberg) *Handbook of Formal Languages*, vol. 2: *Linear Modeling: Background and Application.* Springer-Verlag, 1997, xxii+528 pp.
12. (with G. Rozenberg) *Handbook of Formal Languages*, vol. 3: *Beyond Words.* Springer-Verlag, 1997, xx+625 pp.
13. (with Gh. Păun) *New Trends in Formal Languages. Control, Communication, and Combinatorics.* Springer-Verlag, *Lecture Notes in Computer Science*, 1218 (1997), x+466 pp.
14. (with J. Mycielski and G. Rozenberg) *Structures in Logic and Computer Science.* Springer-Verlag, *Lecture Notes in Computer Science*, 1261 (1997), x+370 pp.
15. (with Gh. Păun) *Grammatical Models of Multi-Agent Systems.* Gordon and Breach, Amsterdam, 1999, viii+356 pp.

C. Papers

1. On many-valued systems of logic. *Ajatus*, 22 (1959), 115–159
2. On the composition of functions of several variables ranging over a finite set. *Annales Universitatis Turkuensis*, Ser. A I, 41 (1960), 48 pp.
3. A theorem concerning the composition of functions of several variables ranging over a finite set. *Journal of Symbolic Logic*, 25 (1960), 203–208
4. On the number of simple bases of the set of functions over a finite domain. *Annales Universitatis Turkuensis*, Ser. A I, 52 (1962), 4 pp.
5. Some completeness criteria for sets of functions over a finite domain, I. *Annales Universitatis Turkuensis*, Ser. A I, 53 (1962), 10 pp.
6. Some analogues of Sheffer functions in infinite-valued logics. *Proc. Colloq. Modal and Many-valued Logics*, Helsinki, 1962, 227–235
7. Some completeness criteria for sets of functions over a finite domain, II. *Annales Universitatis Turkuensis*, Ser. A I, 63 (1963), 19 pp. (Russian translations of the previous two papers in *Kibernetitseskii Sbornik*, 8 (1964), 8–32.)
8. On sequences of functions over an arbitrary domain. *Annales Universitatis Turkuensis*, Ser. A I, 62 (1963), 5 pp.
9. On basic groups for the set of functions over a finite domain. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 338 (1963), 15 pp.
10. On essential variables of functions, especially in the algebra of logic. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 339 (1963), 11 pp.

11. Theorems on the representation of events in Moore automata. *Annales Universitatis Turkuensis*, Ser. A I, 69 (1964), 14 pp.
12. On infinitely generated sets of operations in finite algebras. *Annales Universitatis Turkuensis*, Ser. A I, 74 (1964), 13 pp.
13. Axiom systems for regular expressions of finite automata. *Annales Universitatis Turkuensis*, Ser. A I, 75 (1964), 29 pp.
14. On the reducibility of events represented in automata. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 353 (1964), 16 pp.
15. On the heights of closed sets of operations in finite algebras. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 363 (1965), 12 pp.
16. On some algebraic notions in the theory of truth functions. *Acta Philosophiae Fennica*, 18 (1965), 193–202
17. On probabilistic automata with one input letter. *Annales Universitatis Turkuensis*, Ser. A I, 85 (1965), 16 pp.
18. Automaattien teoriasta. *Arkhimedes*, 1965, 7–20
19. Two complete axiom systems for the algebra of regular events. *Journal of the Association for Computing Machinery*, 13 (1966), 158–169
20. Aksiomatizatsija algebry sobytii, realizuemyh logitseskimi setjami. *Problemy Kibernetiki*, 17 (1966), 237–246
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22. On events represented by probabilistic automata of different types. *Canadian Journal of Mathematics*, 20 (1968), 242–251
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27. On regular expressions and regular canonical systems. *Mathematical Systems Theory*, 2 (1968), 341–355
28. Matematiikka ja tietokone. *Arkhimedes*, 1968, 5–10
29. On the index of a context-free grammar and language. *Information and Control*, 14 (1969), 474–477
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31. On grammars with restricted use of productions. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 454 (1969), 32 pp.
32. On some families of formal languages obtained by regulated derivations. *Annales Academiae Scientiarum Fennicae*, Ser. A I, 479 (1970), 18 pp.

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34. Periodically time-variant context-free grammars. *Information and Control*, 17 (1970), 294–311
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39. On exponential growth in Lindenmayer systems. *Indagationes Mathematicae*, 35 (1973), 23–30
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61. Sequential and parallel rewriting. In: R. Aguilar (ed.), *Formal Languages and Programming*, North-Holland, 1976, 111–129
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64. (with G. Rozenberg) New squeezing mechanisms for L systems. *Information Sciences*, 12 (1977), 187–201
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70. (with H. Maurer and D. Wood) Uniform interpretations of L forms. *Information and Control*, 36 (1978), 157–173
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79. D0L language equivalence. *EATCS Bulletin*, 8 (1979), 4–12
80. Power from power series. Springer-Verlag, *Lecture Notes in Computer Science*, 74 (1979), 170–181
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82. (with H. Maurer, G. Rozenberg and D. Wood) Pure interpretations of E0L forms. *RAIRO, Theoretical Informatics*, 13 (1979), 347–362
83. (with H. Maurer and D. Wood) Context-dependent L forms. *Information and Control*, 42 (1979), 97–118
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85. Morphisms on free monoids and language theory. In: R. Book (ed.), *Formal Language Theory*, Academic Press, 1980, 141–166
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88. (with H. Maurer and D. Wood) On generators and generative capacity of E0L forms. *Acta Informatica*, 13 (1980), 87–107
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90. (with H. Maurer and D. Wood) Context-free grammar forms with strict interpretations. *Journal of Computer and System Sciences*, 21 (1980), 110–135
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106. (with K. Culik and F.E. Fich) A homomorphic characterization of regular languages. *Discrete Applied Mathematics*, 4 (1982), 149–152
107. (with K. Culik and J. Gruska) On non-regular context-free languages and pumping. *EATCS Bulletin*, 16 (1982), 22–24
108. (with H. Maurer and D. Wood) On predecessors of finite languages. *Information and Control*, 50 (1982), 259–275
109. (with K. Culik) On infinite words obtained by iterating morphisms. *Theoretical Computer Science*, 19 (1982), 29–38
110. (with H. Maurer and D. Wood) Finitary and infinitary interpretations of languages. *Mathematical Systems Theory*, 15 (1982), 251–265
111. (with K. Culik and J. Gruska) Systolic automata for VLSI on balanced trees. *Acta Informatica*, 18 (1983), 335–344
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113. (with H. Maurer and D. Wood) A supernormal-form theorem for context-free grammars. *Journal of the Association for Computing Machinery*, 30 (1983), 95–102
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115. (with H. Maurer and D. Wood) On finite grammar forms. *International Journal of Computer Mathematics*, 12 (1983), 227–240
116. (with K. Culik and J. Gruska) On a family of L languages resulting from systolic tree automata. *Theoretical Computer Science*, 23 (1983), 231–242

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