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Vítězslav Novák; Bedřich Půža

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NEWS AND NOTICES

SEVENTY YEARS OF PROFESSOR NOVOTNÝ

Vítězslav Novák, Bedřich Půža, Brno

A prominent Czechoslovak mathematician, Professor RNDr. Miroslav Novotný, DrSc., has reached seventy years of age on May 11, 1992 continuing his creative work in mathematics with unceasing energy. His work was already appraised in this journal ten years ago (Czechoslovak Math. Journal 32(107)(1982), 338–343). We then expressed our conviction that a scientist's work does not end with his reaching sixty years of age, and M. Novotný's results from the decade 1982–1992, comprising 34 original papers, have beautifully corroborated our statement. His research can be roughly divided into three domains.

(1) *Information systems.* This topic represents a large group of papers, mostly with Z. Pawlak as coauthor. By an information system we mean a quadruple (U, A, V, f) where U, A, V are finite sets, f is a mapping of the set $U \times A$ into V with the following interpretation: the elements of the set U are objects, those of the set A are attributes, those of V the values of attributes. $f(u, a) = v$ means that the attribute a assumes the value v for the object u. If $X \subset A$, then put $EQ(X) = \{(u_1, u_2) \in U \times U\,;\, f(u_1, a) = f(u_2, a)$ for every $a \in X\}$. Evidently, $EQ(X)$ is an equivalence on the set U so that the set X can be viewed as a test. In [57] M. Novotný solved the problem of determining whether a test X is better than a test Y. The information system is not able to distinguish some sets of objects; those are said to be roughly equal. In [66] the rough equalities are characterized by algebraic means, in [65] the analogous problem is solved for the so called top and bottom rough equalities. In [67] the top rough equalities are used for studying a certain type of black boxes. Analogous methods are applied in [72] to answer the question when two sets of attributes define the same notion in Wille's sense. If two sets of attributes X, Y satisfy $EQ(X) \subset EQ(Y)$, we say that the set Y depends on X. This notion can be generalized to the so called partial dependence and the latter notion can be used to introduce the notion of distance in the family of all subsets of the set A [75]. The set of attributes X is said to be independent if $EQ(X) \neq EQ(Y)$ for every proper subset Y of X. The family of independent subsets was studied in [74]. If X is a

set of attributes and X' is the minimal subset such that $EQ(X) = EQ(X')$ then X' is called a reduct of X; the reducts with a certain special property are called superreducts. In [84] Novotný constructed an algorithm for finding all superreducts of a given set. The fundamental notions of the theory of information systems can be introduced in the so called dependence spaces. In these spaces the desired relations can be established and the results can be interpreted both for information systems and for contexts in the sense of Wille. This is done is [85] for the notion of a reduct, in [89] for the notion of dependence. In [90] algorithms are presented for searching reducts in dependence spaces.

(2) *Construction of grammars.* These are described in [68], [69], [77] and [81]; the classes of languages generated by them are subclasses of linear languages. In [70] the so called evenly linear languages are grammatized in this way. In [80] and [82] the author exploits the special technique of the so called reducing operators, which had been formerly developed by himself. A number of Novotný's papers was devoted to the so called interference problem for grammars. It consists in an effective construction of the grammar of a language from its fragment; here the i-th fragment of a language is meant to be the set of chains of this language whose length is at most i. The research was focused on the cases when the grammars constructed from a sequence of fragments of a language coincide starting with a certain index, and each of them generates the given languages. The first construction of this type is given in [58], in a survey paper [76], and the results of M. Novotný and his student J. Ostravský related to this problem are described also in the book [F 13]. Another, similar construction is described in [83]. A full characterization of the so called harmonic languages was found in [88], while some measures of complexity related to the constructions described in [F 13] were studied in [71].

(3) *Monounary algebras and relation structures.* The paper [62] characterizes the monounary algebras assigned, in a certain natural way, to monoids. The construction presented in [86] and [87] is of special interest: here the author associates each relation of arity $n + 1$ with an operation of arity n on the power set formed for the support of the relation. This result makes it possible, for example, to reduce the problem of finding all strong homomorphisms of one relation structure into the other to the problem of finding all homomorphisms of the corresponding algebra into the other. M. Novotný had solved this problem for monounary algebras completely as soon as in the 50's. A series of papers of M. Novotný written in cooperation with the first author of the present paper is devoted to the study of ternary relations. The general theory of dimension, developed by the authors in the 70's, is applied to ternary structures in [59], [60]. In [78] the theorems on representation of ordered sets by cardinal powers are transferred to ternary structures; instead of a two-element chain, the basis of the corresponding power is now the disjoint union of a three-element cycle and a

one-element set. Operators transforming ternary relations to quasiorderings and vice versa are described in [79]. In [63] powers of cyclically ordered sets, and in [73] completions of such sets, are studied. In [64] a construction of an m-universal cyclically ordered set for an arbitrary cardinal m is given; here universality means that for every cyclically ordered set G of cardinality $\leqslant m$ there exists a subset of the universal set just constructed, such that G is its strong homomorphic image.

The above survey makes apparent the extraordinary width of the scientific interests of Prof. Novotný, originality of his constructions and depth of his results. During the last decade he has been deservedly awarded several distinctions for his achievements—the medals of merit of Comenius University (1987), Palacký University (1988) and Technical University of Brno (1989), as well as the prize of the Czechoslovak and Polish Academies of Sciences (together with Prof. Pawlak, 1988) and the Bernard Bolzano Golden Medal (1992).

In the light of Prof. Novotný's scientific results achieved recently we realize once more how severe a loss was suffered by the Brno University in 1971 when he left the Faculty owing to the unfavourable atmosphere of political "normalization". Because, apart from his utmost scientific erudition, M. Novotný has been above all an excellent teacher. Mathematicians of the middle generation, graduates from the Brno University, have remembered with respect and gratitude his lectures whose main features were exactness, grasping of the essence of every problem, as well as clarity and adequacy to the needs and abilities of the students. For all this he was heartily welcome when he returned to Brno University, resuming his former activities in the life of the school.

On behalf of Czechoslovak mathematical community the authors extend to Prof. Novotný the wishes of many years of happy personal life and of outstanding scientific achievements to the benefit of both Czechoslovak and world science.

Supplement to the list of papers of Prof. Novotný

Original scientific papers

[57] Remarks on sequents defined by means of information systems, Ann. Soc. Math. Polon. Ser. IV. Fund. Informaticae *6* (1983), 71–79.

[58] On an effective construction of a grammar generating a given language, Prague Studies in Math. Linguistics *8* (1983), 123–131.

[59] On determination of a cyclic order, Czech. Math. J. *33* (1983), 555–563 (with V. Novák).

[60] Dimension theory for cyclically and cocyclically ordered sets, Czech. Math. J. *33* (1983), 647–653 (with V. Novák).

[61] On a representation of rough sets by means of information systems, Ann. Soc. Math. Polon. Ser. IV. Fund. Informaticae *3–4* (1983), 289–296 (with Z. Pawlak).

[62] On a relationship between monoids and monounary algebras, Čas. pěst. mat. *109* (1984), 277–285.

[63] On a power of cyclically ordered sets, Čas. pěst. mat. *109* (1984), 421–424 (with V. Novák).
[64] Universal cyclically ordered sets, Czech. Math. J. *35* (1985), 158–161 (with V. Novák).
[65] Characterization of rough top equalities and rough bottom equalities, Bull. Pol. Acad. Sci. Math. *33* (1985), 91–97 (with Z. Pawlak).
[66] On rough equalities, Bull. Pol. Acad. Sci. Math. *33* (1985), 99–104 (with Z. Pawlak).
[67] Black box analysis and rough top equality, Bull. Pol. Acad. Sci. Math. *33* (1985), 105–113.
[68] On some constructions of grammars for linear languages, Intern. Journ. of Computer Math. *17* (1985), 65–77.
[69] Remarks on linearly grammatizable languages, Prague Dtudies in Math. Linguistics *9* (1986), 113–118.
[70] On family of linearly grammatizable languages, Ann. Soc. Math. Polonae, Fund. Informaticae *10* (1987), 143–148 (with G. Paune).
[71] On some parameters occuring in certain effective constructions of grammars, Ann. Soc. Math. Polonae, Fund. Informaticae *10* (1987), 69–80.
[72] Concept forming and black boxes, Bull. Pol. Acad. Sci. Math. *35* (1987), 133–141 (with Z. Pawlak).
[73] On completion of cyclically ordered sets, Czech. Math. Journ. *37* (1987), 407–141 (with V. Novák).
[74] Independence of attributes, Bull. Pol Acad. Sci. Math. *36* (1988), 459–465 (with Z. Pawlak).
[75] Partial dependence of attributes, Bull. Pol. Acad. Sci. Math. *36* (1988), 447–452 (with Z. Pawlak).
[76] Effective constructions of grammars, Banach Center Publ. Ed. Rasiowa H., Mathematical Problems in Computation Theory *21* (1988), 315–328.
[77] Any linear language is weakly grammatizable by means of categories, Publ. Pol. Acad. Sci. Math. *76* (1988), 447–452.
[78] On representation of cyclically ordered sets, czech. Math. J. *39* (1988), (with V. Novák).
[79] Transitive ternary relations and quasiorderings, Arch. Math. (Brno) *25* (1989), 5–12 (with V. Novák).
[80] Construction of grammars by means of reducing operators, Fund. Inform. *12* (1989), 401–412.
[81] On construction of linear grammars, Prague studies in Math. Linguistics *10* (1990), 135-143.
[82] Reducing operators of generalized grammars, Fund. Inform. *13* (1990), 237–244.
[83] Grammatical inference problem for a certain family of languages, Bull. Pol. Acad. Sci. Math. *36* (1988), 722–735.
[84] On superreducts, Bull. Pol. Acad. Sci. Tech. Sci. *38* (1990), 101–102 (with Z. Pawlak).
[85] Algebraic theory of independence in information systems, Fund. infor. *14* (1991), 454-476 (with Z. Pawlak).
[86] Construction of all strong homomorphisms of binary structures, Czech. Math. Journ. *41* (1991), 300–311.
[87] Ternary structures and groupoids, Czech. Math. J. *41* (1991), 90–98.
[88] A characterization of harmonic languages, Arch. Math. (Brno) *27* (1991), 7–14 (with M. Drášil).
[89] Notes on the algebraic approach to dependence in information systems, Fund. Inform. (approved for publication) (with J. Novotný).
[90] On a problem concerning dependence spaces, Fund. Inform. (approved for publication) (with Z. Pawlak).