GIORNATE DI INFORMATICA TEORICA
DEDICATE ALLA MEMORIA DI ALDO DE LUCA
SAPIENZA UNIVERSITÀ DI ROMA
DIPARTIMENTO DI MATEMATICA "GUIDO CASTELNUOVO"
11 – 12 LUGLIO 2019

Giovedì 11 luglio

9.00 – 9.15 Introduzione e saluti di Isabeau Birindelli, Direttrice del dipartimento

9.15 –10.00 Antonio Restivo, Dalla cibernetica ai linguaggi e ai semigruppi

10.00 – 10.45 Dominique Perrin, From palindromes to Sturmian and dendric shifts

10.45 – 11.15 Pausa caffè

11.15 – 11.45 Giorgio Ausiello, Informatica teorica: gli albori

11.45 – 12:30 Settimo Termini, Sulle radici interdisciplinari della 'Weltanschaung' scientifica di Aldo

12.30 – 14.30 Pausa pranzo

14:30 – 15.15 Filippo Mignosi, A simple proof of an inequality of A. I. Khinchin

15.15 – 15.30 Pausa caffè

15.30 – 16.15 Arturo Carpi, Minimal linear grammars and codes

16:15 – 16:45 Gabriele Fici, Repetita iuvant!

17:00 – 18:00 Sessione di ricordi

20:30 Cena sociale

Venerdì 12 luglio

9.00 – 9.45 Claudio Procesi, Perpetuants: a lost treasure

9.45 – 10.30 Corrado De Concini, The rational homotopy of the complement of a toric arrangement

10.30 – 10.45 Pausa caffè

10.45 – 11.30 Christophe Reutenauer, Theory of Markoff and Christoffel words

11.30 – 12.00 Mercede Maj, Rewritability in groups: on a suggestion by Aldo de Luca

12.00 – 12.30 Patrizia Longobardi, Interconnections between the structure theory on set addition and rewritability in Groups

12.30 – 14.30 Pausa pranzo

14.30 – 15.15 Alessandro De Luca, Markov numbers, Christoffel words, and the uniqueness conjecture

15.15 – 15.30 Pausa caffè

15.30 – 16.00 Antoine Abram, Palindromization and Markoff triples

16.00 – 16.45 Flavio D'Alessandro, On the commutative equivalence of context-free languages

16.45 – 17.00 Conclusioni

Comunicazioni di giovedì 11 luglio

Antonio Restivo (Università di Palermo):

Dalla cibernetica ai linguaggi e ai semigruppi.

Nella prima parte del mio intervento accennerò allo straordinario percorso scientifico di Aldo, dalle prime ricerche in ambito "cibernetico" fino a quelle più recenti sulla combinatoria delle parole, passando attraverso le problematiche relative agli automi, ai linguaggi e ai semigruppi. Darò uno speciale rilievo ad alcuni momenti significativi di tale percorso, e cercherò di fare emergere i collegamenti fra le diverse tematiche trattate da Aldo. Nella seconda parte del mio intervento illustrerò alcune ricerche condotte con Aldo sui linguaggi "Locally Testable", che permettono di mostrare alcuni di questi collegamenti.

Dominique Perrin (Université de Marne-la-Vallée, Parigi, Francia):

From palindromes to Sturmian and dendric shifts.

In this talk, I will start with the palindromization map introduced by Aldo. I will first discuss an extension of this map to the free group, as imagined by Kassel and Reutenauer. I will then relate the palindromization map with the S-adic representation of shifts. I will next introduce dendric shifts, a generalization of Sturmian ones and discuss their S-adic representation.

Giorgio Ausiello (Sapienza Università di Roma):

Informatica teorica: gli albori.

Gli anni '60 e i primi anni '70 del secolo scorso hanno visto la nascita e l'avvio di una nuova disciplina scientifica, la 'theoretical computer science' (o 'computing theory' o, in italiano, 'informatica teorica'). In questo ambito matematici, fisici, informatici hanno definito e studiato, su rigorose basi logico–matematiche, le propretà dei dispositivi di calcolo, dei linguaggi di programmazione, dei processi computazionali. In questo intervento si ripercorrono brevemente le principali tappe di questa prima fase degli studi di informatica teorica e si presenta un quadro delle principali linee di ricerca presenti in Italia in quegli anni, all'interno del quale un ruolo importante fu svolto dalla scuola napoletana, basata sul Laboratoro di Cibernetica di Arco Felice e sull'Istituto di Fisica Teorica dell'Universit`. In quegli stessi anni nascevano importanti collaborazioni scientifiche sia a livello italiano sia a livello europeo che portavano nel 1972 alla nascita della EATCS e delle principali conferenze europee del settore: ICALP ed MFCS.

Settimo Termini (Università di Palermo):

Sulle radici interdisciplinari della 'Weltanschaung' scientifica di Aldo.

Aldo's research activity spans over a wide variety of arguments from neural networks to information theory and measures of fuzziness besides, of course, theoretical computer science which gives its name to these "Giornate". To understand his ability to afford very different questions it may be useful to remember that Aldo began to work on general relativity and, as a physicist, not only he was well accounted with quantum mechanics but, very early, elaborated a vision on its interpretation very similar to the one attributed to Richard Feynman. Moreover, he was exposed to very different questions as the ones treated in the outstanding Ravello School on "Automata Theory", attended when he was 23 years old.

In the talk I shall present some points supporting the thesis that his ability to move in the intricacy of problems and questions of very different nature follows from a real interdisciplinary vision of affording scientific problems forged in those (remote) years. While I shall present the

points in a colloquial style based on the daily discussions we had for many years starting from the end of the Sixties of the last Century as well as from a couple of "memoire" he wrote about ten years ago, I think that a thorough study of his "implicit epistemology" - professionally done - could shed some light both on the general questions of scientific creativity and on the most adequate path that scientific institutions should follow in order to obtain the best results.

One day - a few decades ago - Marco Schützenberger, after picking up from his library the book "Theory of Games and Economic Behaviour" by von Neumann and Morgenstern, gave it to Aldo after writing a dedication sounding, more or less, "To Aldo who will be able to extract from it new wonderful things". Marco was right although Aldo, as far as I know, never worked on The Theory of Games.

It is our duty to understand how creativity influences and is influenced by the "boundary conditions" formed by our Society, the Institutions, the comrades that, by chance, accompany us in our scientific and human travel. A duty for letting the society improve together with us.

Filippo Mignosi (Università de L'Aquila):

A simple proof of an inequality of A. I. Khinchin.

We prove that Entropy is a lower bound for the average compression ratio of any lossless compressor by giving a simple proof of an inequality that is a sligthy variation of an inequality firstly proved by A. I. Khinchin in 1953.

Arturo Carpi (Università di Perugia):

Minimal linear grammars and codes.

A linear grammar is minimal if it has a unique non-terminal symbol. Any minimal grammar with a unique terminating production naturally defines a correspondence between sequences of non-terminating productions and words of the language generated by the grammar. This correspondence is one-to-one if and only if the grammar is unambiguous. Thus, one may devise the use of unambiguous minimal linear grammars in place of variable length codes.

In this talk we consider extensions of some classical problems of the Theory of Codes to the more general framework of unambiguous minimal linear grammars.

Gabriele Fici (Università di Palermo):

Repetita iuvant!

Repetitions in finite words have been for long time the object of combinatorial study. This theoretical investigation has found applications in the areas of string algorithms, data compression and bioinformatics, among others. We will review some of Aldo's papers on special factors and show how these results have been exploited for solving efficiently some pattern matching problems.

Comunicazioni di venerdì 12 luglio

Corrado De Concini (Sapienza Università di Roma):

The rational homotopy of the complement of a toric arrangement.

Abstract: TBA

Claudio Procesi (Sapienza Università di Roma):

Perpetuants: a lost treasure.

Perpetuant is one of the several concepts invented (in 1882) by J. J. Sylvester in his investigations of *covariants* for binary forms. It appears in one of the first issues of the American Journal of Mathematics which he had founded a few years before. It is a name which will hardly appear in a mathematical paper of the last 70 years, due to the complex history of invariant theory which was at some time declared dead only to resurrect several decades later. I learned of this word from Gian-Carlo Rota who pronounced it with an enigmatic smile.

In this talk I want to explain the concept, a Theorem of Stroh, and some new explicit description.

Christophe Reutenauer (Université du Québec à Montréal, Canada):

Theory of Markoff and Christoffel words.

After a short survey of the theory of Markoff for approximations, Markoff numbers and triples are defined through the Markoff Diophantine equation $x^2 + y^2 + z^2 = 3xyz$. Then Christoffel words (conjugates of the standard words of Aldo de Luca) and their standard factorization (Borel, Laubie) are defined. They are in bijection with Markoff triples (Cohn, Bombieri, the speaker), through a representation μ of the free monoid into $SL_2(Z)$. Christoffel pairs turn to be bases of the free group in two generators, and their image under μ a basis of the commutator group $SL_2(Z)'$ (the latter is a free group ion two generators). A theorem of Perrine shows that each basis of this group leads to a Markoff triple. This talk is completed by a talk of Antoine Abram.

Mercedes Maj (Università di Salerno):

Rewritability in groups: on a suggestion by Aldo de Luca.

In this talk some rewritability properties in groups are presented. The starting point is the property P_n: if n is an integer > 1, a group G has the property P_n if for each n-tuple of elements of G there is a non-trivial permutation σ in the symmetric group S_n such that

$$x_1 x_2 \cdots x_n = x_{\sigma(1)} x_{\sigma(2)} \cdots x_{\sigma(n)}.$$

The property P_n was studied in semigroups by A. Restivo and C. Reutenauer. Aldo de Luca suggested us to consider this property in groups. His idea has led to a flourishing research line, which is still actual today (see also Patrizia Longobardi's talk).

Patrizia Longobardi (Università di Salerno):

Interconnections between the structure theory on set addition and rewritability in groups.

In recent years semigroups and groups satisfying the so-called permutation or rewritable properties attracted considerable attention, as discussed in Mercede Maj's talk. Problems connected with permutation and rewritable properties of groups and semigroups find their natural place in the structure theory of set addition. Some aspects of this topic will be presented.

Alessandro De Luca (Università di Napoli Federico II):

Markov numbers, Christoffel words, and the uniqueness conjecture.

Among their many remarkable properties, Christoffel words are known to be linked to Markov numbers, i.e., positive integer solutions to the equation $x^2 + y^2 + z^2 = 3xyz$. We express Markov numbers as coefficients of Christoffel words for a rational series S, defined from a morphism μ mapping words to 2×2 integer matrices.

Trying to tackle the long-standing uniqueness conjecture by Frobenius, we study matrices $\mu(w)$, where w is a Christoffel word, or just a word $w = aub$ with u a palindrome, and consider even more general cases leading to identities for S. We prove some bounds on the entries of such characteristic matrices, and discuss the special cases $w = a^n b$ and $w = ab^n$ corresponding to Fibonacci and Pell numbers respectively.

Antoine Abram (Université du Québec à Montréal, Canada):

Palindromization and Markoff triples.

We use the palindromization mappings of Aldo de Luca and Alessandro De Luca to solve the Markoff Diophantine equation using combinatorics on words: we give a bijection between the free monoid on two letters and the set of Markoff triples (joint work with E. Lapointe and C. Reutenauer).

Flavio D'Alessandro (Sapienza Università di Roma):

On the commutative equivalence of context-free languages.

In this talk, we discuss some results on the problem of the commutative equivalence of languages. Given two languages L_1, L_2 on the same alphabet, we say that L_1 is commutatively equivalent to L_2 if there exists a bijection $f : L_1 \longrightarrow L_2$ from L_1 onto L_2 such that, for every $u \in L_1$, $f(u)$ is obtained from u by a permutation of the letters of u. We analyse conditions ensuring that a context-free language is commutatively equivalent with a regular one. In particular, we present the result that shows that every bounded context-free language is commutatively equivalent with a regular language.