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LATIN 2022: Theoretical Informatics

15th Latin American Symposium Guanajuato, Mexico, November 7–11, 2022 Proceedings

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Preface

This volume contains the papers presented at the 15th Latin American Theoretical Informatics Symposium (LATIN 2022) held during November 7–11, 2022, in Guanajuato, Mexico. Previous editions of LATIN took place in São Paulo, Brazil (1992), Valparaíso, Chile (1995), Campinas, Brazil (1998), Punta del Este, Uruguay (2000), Cancún, Mexico (2002), Buenos Aires, Argentina (2004), Valdivia, Chile (2006), Búzios, Brazil (2008), Oaxaca, Mexico (2010), Arequipa, Perú (2012), Montevideo, Uruguay (2014), Ensenada, Mexico (2016), Buenos Aires, Argentina (2018), and São Paulo, Brazil (2021).

The symposium received 114 submissions from around the world. Each submission was reviewed by four Program Committee members, and carefully evaluated on quality, originality, and relevance to the conference. Committee members often reviewed the submissions with the help of additional external referees. Based on an extensive electronic discussion, the committee selected 46 papers. In addition to the accepted contributions, the symposium featured keynote talks by David Eppstein (University of California, Irvine, USA), Mauricio Osorio (Universidad de las Américas, Mexico), Merav Parter (Weizmann Institute of Science, Israel), and Jeffrey D. Ullman (Stanford University, USA).

LATIN 2022 featured two awards: the 2022 Imre Simon Test-of-Time Award and the Alejandro López-Ortiz Best Paper Award. In this edition, the Imre Simon Test-of-Time Award winner was Johannes Fischer for his paper "Optimal Succinctness for Range Minimum Queries," which appeared in LATIN 2010. For the Alejandro López-Ortiz Best Paper Award, the Program Committee selected the paper "Theoretical Analysis of Git Bisect," by Julien Courtiel, Paul Dorbec, and Romain Lecoq. We thank Springer for supporting both awards.

A round table to honor the research and legacy of Héctor García-Molina was held as part of the LATIN 2022 program. The panel comprised Carlos Coello Coello (Cinvestav, Mexico), Jeffrey D. Ullman (Stanford University, USA), and Gio Wiederhold (Stanford University, USA). The round table was moderated by Mariano Rivera (CIMAT, Mexico).

The program of the symposium included tutorial sessions devoted mainly to theory students and young researchers. Edgar Chávez (CICESE, Mexico) chaired the Tutorial Session Committee.

The main organizer of the conference was the Centro de Investigación en Matemáticas (CIMAT), located in Guanajuato, Mexico. Mariano Rivera chaired the Local Arrangements Committee.

Many people helped to make LATIN 2022 possible. First, we would like to recognize the outstanding work of the members of the Program Committee. Their commitment contributed to a very detailed discussion on each of the submitted papers. The LATIN Steering Committee offered valuable advice and feedback; the conference benefitted immensely from their knowledge and experience. We would also like to

recognize Conrado Martínez, Jacques Sakarovitch, and Yoshiko Wakabayashi for their work in the 2022 Imre Simon Test-of-Time Award Committee.

Finally, the conference would not have been possible without our generous sponsors, Springer, the Cryptography Research Center of the Technology Innovation Institute, Abu Dhabi, United Arab Emirates, and the Centro de Investigación en Matemáticas (CIMAT), Guanajuato, Mexico. We are also grateful for the facilities provided by EasyChair for paper evaluation and the preparation of this volume.

November 2022

Armando Castañeda
Francisco Rodríguez-Henríquez

The Imre Simon Test-of-Time Award

The winner of the 2022 Imre Simon Test-of-Time Award, considering papers up to the 2012 edition of the Latin American Theoretical Informatics Symposium (LATIN), is

Optimal Succinctness for Range Minimum Queries by Johannes Fischer, LATIN 2010, LNCS 6034, 158–169, 2010.

Range Minimum Query (RMQ) is used on arrays to find the position of an element with the minimum value between two specified indices. This simple problem—in its formulation—has many different applications including the fundamental problem of finding the *least common ancestor* (LCA) of two nodes in a tree or the *longest common prefix problem* (LCP), as well as other exact and approximate string matching problems. A witness of the relevance of these problems is the first Imre Simon Test-of-Time award won in 2012 by the LATIN 2000 paper *The LCA Problem Revisited*, by Martin Farach-Colton and Michael Bender.

In order to make RMQs very efficient, there has been a long quest for preprocessing algorithms and data structures with which RMQs could later be answered very efficiently, ideally in constant time. The first non-trivial solution to the problem, presented by Berkman and Vishkin (SIAM J. Computing, 1993), required linear time for preprocessing and linearithmic space ($\Theta(n \log n)$ bits, for an array of n items). Many authors have thus been looking for succinct data structures; in this case, data structures using a linear number of bits, without sacrificing the preprocessing or the query times. The first solution which does not need to keep the original input to answer RMQs (*non-systematic*, in the terminology of the awarded paper) was by Sadakane (J. Discrete Algorithms, 2007), using $4n + o(n)$ bits for the balanced-parentheses-encoding of the Cartesian tree. Besides the query and preprocessing times, the space used in the final data structure **and** during the preprocessing phase has been of concern. The LATIN paper of 2010 presented the first scheme achieving $O(1)$ time for queries, $O(n)$ preprocessing time, using only $2n + o(n)$ bits in the final succinct data structure to answer queries—thus meeting the information-theoretic bound—, and only $n + o(n)$ additional bits during construction time.

To achieve the space and time efficiency above, the paper introduced *2d-min-heaps*, which are equivalent to the also well-known LRM-trees (left-to-right minima trees) of Navarro and Sadakane (ACM Trans. Algorithms, 2014). The 2d-min-heaps were originally intended to efficiently support RMQs, but they have proved also very useful for several other applications, e.g., the succinct representation of ordinal trees.

Fischer's contributions in the LATIN 2010 paper made their way into the journal article *Space-Efficient Preprocessing Schemes for Range Minimum Queries on Static Arrays*, published in *SIAM Journal on Computing* 40(2):465–492, together with Volker Heun, in 2011. That paper became very influential in the area of compressed and succinct data structures, and it is a milestone in the quest for the best solutions in time and space to RMQs, with numerous quotations and references too.

The relevance of the problem addressed, the originality of the technique used to solve it, the clarity of presentation, and the continued and widespread recognition of this contribution throughout the years since its publication heavily weighed in the committee's choice.

The committee for the 2022 Imre Simon Test-of-Time Award.

Conrado Martínez
Jacques Sakarovitch
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