ON THE MATHEMATICS LESSON ALEXANDER KARP AND LEONID ZVAVICH pdf

1: P versus NP problem - Wikipedia

This anthology, consisting of two volumes, is intended to equip background researchers, practitioners and students of international mathematics education with intimate knowledge of mathematics education in Russia.

Does P mean "easy"? Quadratic fit suggests that empirical algorithmic complexity for instances with 50â€”10, variables is O log n 2. It is a common and reasonably accurate assumption in complexity theory; however, it has some caveats. First, it is not always true in practice. A theoretical polynomial algorithm may have extremely large constant factors or exponents thus rendering it impractical. There are algorithms for many NP-complete problems, such as the knapsack problem , the traveling salesman problem and the Boolean satisfiability problem , that can solve to optimality many real-world instances in reasonable time. The empirical average-case complexity time vs. An example is the simplex algorithm in linear programming , which works surprisingly well in practice; despite having exponential worst-case time complexity it runs on par with the best known polynomial-time algorithms. A key reason for this belief is that after decades of studying these problems no one has been able to find a polynomial-time algorithm for any of more than important known NP-complete problems see List of NP-complete problems. It is also intuitively argued that the existence of problems that are hard to solve but for which the solutions are easy to verify matches real-world experience. For example, in these statements were made: This is, in my opinion, a very weak argument. The space of algorithms is very large and we are only at the beginning of its exploration. Vardi , Rice University Being attached to a speculation is not a good guide to research planning. One should always try both directions of every problem. Prejudice has caused famous mathematicians to fail to solve famous problems whose solution was opposite to their expectations, even though they had developed all the methods required. Either direction of resolution would advance theory enormously, and perhaps have huge practical consequences as well. It is also possible that a proof would not lead directly to efficient methods, perhaps if the proof is non-constructive , or the size of the bounding polynomial is too big to be efficient in practice. The consequences, both positive and negative, arise since various NP-complete problems are fundamental in many fields. Cryptography, for example, relies on certain problems being difficult. A constructive and efficient solution [Note 2] to an NP-complete problem such as 3-SAT would break most existing cryptosystems including: Existing implementations of public-key cryptography , [27] a foundation for many modern security applications such as secure financial transactions over the Internet. Cryptographic hashing as the problem of finding a pre-image that hashes to a given value must be difficult in order to be useful, and ideally should require exponential time. On the other hand, there are enormous positive consequences that would follow from rendering tractable many currently mathematically intractable problems. For instance, many problems in operations research are NP-complete, such as some types of integer programming and the travelling salesman problem. Efficient solutions to these problems would have enormous implications for logistics. Many other important problems, such as some problems in protein structure prediction , are also NP-complete; [30] if these problems were efficiently solvable it could spur considerable advances in life sciences and biotechnology. But such changes may pale in significance compared to the revolution an efficient method for solving NP-complete problems would cause in mathematics itself. Namely, it would obviously mean that in spite of the undecidability of the Entscheidungsproblem , the mental work of a mathematician concerning Yes-or-No questions could be completely replaced by a machine. After all, one would simply have to choose the natural number n so large that when the machine does not deliver a result, it makes no sense to think more about the problem. Similarly, Stephen Cook says [33] Example problems may well include all of the CMI prize problems. A method that is guaranteed to find proofs to theorems, should one exist of a "reasonable" size, would essentially end this struggle. It would allow one to show in a formal way that many common problems cannot be solved efficiently, so that the attention of researchers can be focused on partial solutions or solutions to other problems. For example, it is possible that SAT requires exponential time in the worst

case, but that almost all randomly selected instances of it are efficiently solvable. Russell Impagliazzo has described five hypothetical "worlds" that could result from different possible resolutions to the average-case complexity question. A Princeton University workshop in studied the status of the five worlds. Classification Relativizing proofs Imagine a world where every algorithm is allowed to make queries to some fixed subroutine called an oracle a black box which can answer a fixed set of questions in constant time, such as a black box that solves any given traveling salesman problem in 1 step , and the running time of the oracle is not counted against the running time of the algorithm. Most proofs especially classical ones apply uniformly in a world with oracles regardless of what the oracle does. These proofs are called relativizing. Natural proofs In , Alexander Razborov and Steven Rudich defined a general class of proof techniques for circuit complexity lower bounds, called natural proofs. However, Razborov and Rudich showed that, if one-way functions exist, then no natural proof method can distinguish between P and NP. These barriers have also led some computer scientists to suggest that the P versus NP problem may be independent of standard axiom systems like ZFC cannot be proved or disproved within them. The interpretation of an independence result could be that either no polynomial-time algorithm exists for any NP-complete problem, and such a proof cannot be constructed in e. ZFC, or that polynomial-time algorithms for NP-complete problems may exist, but it is impossible to prove in ZFC that such algorithms are correct. Additionally, this result implies that proving independence from PA or ZFC using currently known techniques is no easier than proving the existence of efficient algorithms for all problems in NP. Claimed solutions [edit] While the P versus NP problem is generally considered unsolved, [43] many amateur and some professional researchers have claimed solutions. Consider all languages of finite structures with a fixed signature including a linear order relation. Then, all such languages in P can be expressed in first-order logic with the addition of a suitable least fixed-point combinator. Effectively, this, in combination with the order, allows the definition of recursive functions. As long as the signature contains at least one predicate or function in addition to the distinguished order relation, so that the amount of space taken to store such finite structures is actually polynomial in the number of elements in the structure, this precisely characterizes P. Similarly, NP is the set of languages expressible in existential second-order logic â€”that is, second-order logic restricted to exclude universal quantification over relations, functions, and subsets. The languages in the polynomial hierarchy , PH , correspond to all of second-order logic. Thus, the question "is P a proper subset of NP" can be reformulated as "is existential second-order logic able to describe languages of finite linearly ordered structures with nontrivial signature that first-order logic with least fixed point cannot? Polynomial-time algorithms[edit] No algorithm for any NP-complete problem is known to run in polynomial time. However, these algorithms do not qualify as polynomial time because their running time on rejecting instances are not polynomial. The following algorithm, due to Levin without any citation , is such an example below. If there is an algorithm say a Turing machine , or a computer program with unbounded memory that can produce the correct answer for any input string of length n in at most cnk steps, where k and c are constants independent of the input string, then we say that the problem can be solved in polynomial time and we place it in the class P. Formally, P is defined as the set of all languages that can be decided by a deterministic polynomial-time Turing machine.

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2: Past Colloquia events in Mathematics | Mathematics | Oregon State University

On the mathematics lesson / Alexander Karp and Leonid Zvavich --The history and present state of elementary mathematical education in Russia / Olga Ivashova --On the teaching of geometry in Russia / Alexander Karp and Alexey Werner --On algebra education in Russian schools / Liudmila Kuznetsova [and others] --Elements of analysis in Russian.

Also, for years it was partitioned off the maps of Europe by Austria, Prussia, and Russia. Thus, numerous Poles came from areas that are now part of other countries, especially the Ukraine and Lithuania. This caveat applies to musicians as well. The author, however, does not wish to confuse nationality with religion. It is safe to say that composers and conductors start out as performing instrumentalists, typically on the piano Karol Szymanowski and Andrzej Panufnik or the violin Grazyna Bacewicz, considered by many the finest female composer. The theme of this essay, however, compels the author to focus on the performance as pianists or composers for the piano, and not on the artists as conductors or symphonic composers. The number of Polish pianists is quite impressive see table 1. Therefore, not all of them will be highlighted. The author takes full responsibility for deciding which to include and which to omit. The primary criterion for inclusion is international recognition. The list of internationally recognized pianists highlighted below will be arranged alphabetically rather than rank order so as to avoid unintentional bias. At the age of seven he and his family moved to Warsaw, Poland where he studied piano. Two years later, the family moved to Winnipeg, Canada where he continued his studies. Ax is currently on the faculty of the Julliard School. He has been the main duo recital partner of the popular cellist Yo-Yo Ma. His father, Nicolas Chopin, was a Frenchman who emigrated from France to Poland in at the age of sixteen, and in married Justyna Krzyzanowska. Nicolas was devoted to his adopted homeland, and insisted that the Polish language be used in his household. His first professional piano tutor was the pianist Wojciech Zywny. Chopin was a child prodigy who had begun giving public concerts by the age of seven, and started composing about the same time. From to Chopin attended the Warsaw Lyceum where he received organ lessons from the Czech musician Wilhelm Wurfel during the first year. In he started a three-year course under the Silesian composer Jozef Elsner at the Warsaw conservatory. In Chopin, already recognized in Poland as an exceptional pianist and composer, set out for other European countries never again to return to his homeland. He settled in Paris in , and by established himself among the Parisian musical elite; earning the respect of such peers as: Schumann, Mendelssohn, Hiller, Liszt, and Berlioz, inter alia. He became friends with Liszt. While in Paris, Frederic became a sought after piano teacher. Chopin had one fiancee, Maria Wodzinska, but her parents successfully discouraged marriage. In Paris, Chopin developed a prolonged and intimate relationship with the French writer George Sand her nom de plume. Toward the end of his short life, she was more of a nurse than anything else. Chopin preferred intimate venues to large ones. He favored salons and his Paris apartment, where he entertained small audiences. It is estimated that during his lifetime, he gave about 30 public concerts. Chopin composed within a self-imposed restriction of short compositions. He did, however, compose two piano concertos. Frederic tended to adopt Polish musical idioms, such as Mazurkas and Polonaises for his compositions, but it should be remembered the he was trained in the tradition of J. Therefore, his music is universal. Over works by Chopin survive. The ones that were lost were from his childhood. Chopin probably died from tuberculosis at the age of People from all over came to his funeral in Paris, where he is buried. His influence on piano music and piano virtuosi to this day is incalculable. As a tribute to Chopin, a museum featuring Chopin memorabilia, including his last Pleyel piano, was established in Warsaw; and the International Chopin Piano Competition in Warsaw, begun in and held every five years, requires that contestants play his music. For good measure, one of two premium Polish vodkas carries his name. J oanna Domanska Joanna started her piano studies at the Academy of Music in Krakow with Professor Jan Hoffman, and she graduated with distinction in from the Academy of Music in Katowice, in the piano class of professor Andrzej Jasinski. She continued her piano studies with Livia Rev in

Paris in While Szymanowski is best known as a composer, he was an outstanding pianist as well. Domanska is also appreciated for her interpretations of Brahms, Ravel, Mozart and, of course, Chopin. She is a laureate of several international piano competitions, and recorded for Polish radio and television, Radiotelevisione Italiana, and Radio France. Currently, Joanna conducts piano classes in Katowice, Poland. Godowsky was born in in Zasliai, now in Lithuania. Another child prodigy, Godowsky was already composing and becoming proficient on the piano and violin by the age of five. He gave his first concert at nine years of age, and toured throughout Lithuania and East Prussia. Godowsky is most unusual in that he was largely self-taught. After briefly studying under Ernst Rudorff in Berlin, he emigrated to the United States, where he made his debut in Boston in In Leopold continued his career by embarking on an extended tour of the northeastern United States and Canada with violinist Ovide Musin. In he returned to Europe where he gave numerous recitals in Paris and London, eventually becoming a protege and friend of Camille Saint-Saens. In he returned to the U. As a composer, Godowsky is best known for his paraphrases of piano works by other composers, which he enhanced considerably, as well as for his transcriptions. His piano compositions are considered among the most difficult works ever written. Even Vladimir Horowitz considered his compositions unplayable, and opined that to do so would require six hands. Yet, he inspired a number of musicians, among them Ravel, Prokofiev, de Pachmann, Rachmaninoff, and his fellow countryman, Jozef Hofmann. He died 1n at the age of 68 and is buried in New York. Hofmann was born in in Podgorze, Poland near Krakow. A child prodigy, he gave his first recital at the age of five. While touring the United States, the Society for the Prevention of Cruelty to Children intervened causing the tour to be cancelled. The donation permitted Hofmann to continue his studies in science and mathematics, and to take music lessons from Heinrich Urban composition and Moritz Moszkowski piano. In , Anton Rubinstein accepted Hofmann as his only pupil. Hofmann became the first director of the Curtis Institute of Music in Philadelphia in , and remained so until , when he was forced to resign. By then he had become an alcoholic, and this condition had a negative impact on his career as well as his life. By the time he passed away, he obtained over 70 patents, among them the windshield wiper and the pneumatic shock absorber. His understanding of the mechanics of the piano permitted him to modify his beloved Steinway to suit his playing. Many of his contemporaries considered Hofmann to be on the short list of the finest pianists of the 20th century. For example, Harold C. Schonberg has argued that Hofmann was the most flawless and possibly the greatest pianist of the 20th century. His remains are interred in California. He was initially taught by his mother, but became a pupil of Theodor Leschetizky at the age of seven in Vienna. In Horszowski put his performing career on hold to study literature, philosophy, and the arts in Paris. Horszowski was barely five feet tall and had small hands. It has been suggested that this is one possible reason he never attained superstar status. From he lived first in in New York City and later in Philadelphia. He often appeared at the Prades and Marlboro Festivals, and performed twice for U. Also, he was widely recorded. Horszowski had one of the longest performing careers on record, and he died in Philadelphia in one month before his st birthday. Mieczyslaw gave his final piano lesson a week before his death. P aderewski was born in the village of Kurylowka in what is now Ukraine. Initially, he took piano lessons with a private tutor. In , at the age of 12, he was admitted to the Warsaw Conservatory. After graduating in , he was asked to become a tutor of piano classes at his alma mater, which he accepted. In , he moved to Vienna to become a pupil of Theodore Leschetizky. He made his debut in Vienna in , followed by successful appearances in Paris in , London in , and the U. Paderewski was a prolific composer as well, including many pieces for the piano. His charisma was displayed early in his career, and accounted for the elevated level of enthusiasm for his concert performances, especially among the ladies. Paderewski was a philanthropist as well, especially when it came to encouraging young composers. It was he who financed the Grunwald Monument in Krakow, Poland. During World War I, Paderewski became an active member of the Polish National Committee in Paris, and was instrumental in persuading Woodrow Wilson to include an independent Poland as point 13 of his fourteen points. In , in the newly independent Poland, Pilsudski appointed Paderewski as the prime minister of foreign affairs. On December 4, , Paderewski resigned as foreign minister and became Polish ambassador to the

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United Nations. In , at age 80, Paderewski died in New York. He was buried at first in Arlington Cemetery, and re-buried in St.

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3: Ronald L. Rivest: Publications and Talks

On the Mathematics Lesson Alexander Karp Teachers College, Columbia University New York, USA Leonid Zvavich School #, Moscow, Russia 1 Introduction.

Early in the s the Dantzig family moved from Baltimore to Washington. His mother became a linguist at the Library of Congress , and his father became a math tutor at the University of Maryland, College Park. After a two-year period at the Bureau of Labor Statistics, he enrolled in the doctoral program in mathematics at the University of California, Berkeley , where he studied statistics under Jerzy Neyman. Air Force Office of Statistical Control. In , he returned to Berkeley to complete the requirements of his program and received his Ph. A year later, the Program in Operations Research became a full-fledged department. Later he became the C. Criley Professor of Transportation Sciences at Stanford , and kept going, well beyond his mandatory retirement in Dantzig was the recipient of many honors, including the first John von Neumann Theory Prize in , the National Medal of Science in , [5] an honorary doctorate from the University of Maryland, College Park in Dantzig Prize , bestowed every three years since on one or two people who have made a significant impact in the field of mathematical programming. Dantzig died on May 13, , in his home in Stanford, California , of complications from diabetes and cardiovascular disease. He was 90 years old. Based on his work tools are developed "that shipping companies use to determine how many planes they need and where their delivery trucks should be deployed. The oil industry long has used linear programming in refinery planning, as it determines how much of its raw product should become different grades of gasoline and how much should be used for petroleum-based byproducts. It is used in manufacturing, revenue management, telecommunications, advertising, architecture, circuit design and countless other areas". Near the beginning of a class for which Dantzig was late, professor Jerzy Neyman wrote two examples of famously unsolved statistics problems on the blackboard. When Dantzig arrived, he assumed that the two problems were a homework assignment and wrote them down. According to Dantzig, the problems "seemed to be a little harder than usual", but a few days later he handed in completed solutions for the two problems, still believing that they were an assignment that was overdue. Years later another researcher, Abraham Wald , was preparing to publish an article that arrived at a conclusion for the second problem, and included Dantzig as its co-author when he learned of the earlier solution. Linear programming arose as a mathematical model developed during World War II to plan expenditures and returns in order to reduce costs to the army and increase losses to the enemy. It was kept secret until Postwar, many industries found its use in their daily planning. The founders of this subject are Leonid Kantorovich , a Russian mathematician who developed linear programming problems in , Dantzig, who published the simplex method in , and John von Neumann , who developed the theory of the duality in the same year. The computing power required to test all the permutations to select the best assignment is vast; the number of possible configurations exceeds the number of particles in the universe. However, it takes only a moment to find the optimum solution by posing the problem as a linear program and applying the Simplex algorithm. The theory behind linear programming drastically reduces the number of possible optimal solutions that must be checked. Rich in insight and coverage of significant topics, the book quickly became "the bible" of linear programming. Books by George Dantzig: Notes on linear programming. Linear inequalities and related systems. Linear programming and extensions. On the continuity of the minimum set of a continuous function. Folkman and Norman Shapiro. Mathematics of the decision sciences. Summer Seminar on Applied Mathematics 5th: Lectures in differential equations. Natural gas transmission system optimization. Compact city ; a plan for a liveable urban environment. Mathematical Association of America. The Basic George B. Edited by Richard W. Proceedings of the first Stanford symposium, Stanford mathematical studies in the social sciences, IV, Stanford, California: Stanford University Press, pp. The Annals of Mathematical Statistics.

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4: Poland's Love Affair with the Piano

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