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Recreational Mathematics Colloquium IV – G4G Europe

BOOK OF ABSTRACTS

Pavilion of Knowledge, Lisbon
January 24th - January 27th, 2015



Organization:

Associação Ludus
Centro Interuniversitário de História das Ciências e da Tecnologia
Sociedade Portuguesa de Matemática
Ciência Viva

Organizing Committee:

Alda Carvalho (ISEL & CEMAPRE, Portugal)
Anabela Teixeira (Ludus, Portugal)
Carlos Santos (CEAFEL, Portugal)
Jorge Nuno Silva (University of Lisbon, Portugal)
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1 Foreword

“Recreational Mathematics” is a problematic expression. For some people, like most professional mathematicians, Mathematics is lots of fun; but for others, like some students, Mathematics can be a nightmare.

Historically, we know that some mathematical research areas are deeply linked to puzzles and games, probability and chance games. Graph theory and the Brigdes of Königsberg puzzle is a paradigmatic example.

The Associação Ludus, the Centro Interuniversitário de História das Ciências e da Tecnologia, the Sociedade Portuguesa de Matemática, and the Ciência Viva organize the Recreational Mathematics Colloquium IV.

Our Colloquium will be a Show and Tell of bright pearls of Mathematics, with varied levels of sophistication, entertaining many audiences. Its main goal is to foster mathematical appreciation, an important step if we are to see improvements in its practice. More information can be consulted in the following web page:

You can get more information at <http://ludicum.org/ev/rm/15>

The Organizing Committee

2 Program

Saturday, 24th January

- 9:30 **Opening Session**
- 10:00 **Mathemagic**
José Paulo Viana, Escola Secundária de Vergílio Ferreira
- 10:30 **Meno's slave, Lichtenberg, and bees don't need formulas!**
Carlos Pereira dos Santos, CEAFEL
Alda Carvalho, ISEL & CEMAPRE
Jorge Nuno Silva, University of Lisbon
- 11:00 Coffee-Break
- 11:30 **Early topological puzzles**
David Singmaster, London South Bank University
- 12:00 **The History of Mathematics in the classroom – a recreational approach**
Helder Pinto, CIDMA - University of Aveiro
- 12:30 **Cards with memory**
Ricardo Lopes (Student), University of Lisbon
Carolina Martins (Student), University of Lisbon
- 12:45 **Speedcubing: taking the Rubik's cube to the next level**
Vasco Vasconcelos (Student), University of Lisbon
- 13:00 Break for lunch
- 14:30 **Planets, solids, curves, and myths**
Carlota Simões, University of Coimbra
- 15:00 **On the relative value of chess pieces and their combinations**
Pedro Palhares, CIEC, Institute of Education, University of Minho
- 15:30 **The recreational Gerdes**
Jorge Nuno Silva, University of Lisbon
- 16:00 Coffee-Break
- 16:30 **The games tree and arborescence**
Ilda Perez, University of Lisbon

- 17:00 **Symmetries in Lisbon**
 Alda Carvalho, ISEL & CEMAPRE
 Carlos Pereira dos Santos, CEAFEL
 Jorge Nuno Silva, University of Lisbon
 Ricardo Teixeira, University of Azores
- 17:30 **Mathematics of deaf young children**
 Laura Nunes, DMCE, CED Jacob Rodrigues Pereira Casa Pia de Lisboa
 Alda Carvalho, ISEL & CEMAPRE
 Carlos Pereira dos Santos, CEAFEL
 Jorge Nuno Silva, University of Lisbon
- 17:45 **Latin Erdos, a mathematical app**
 Fábio Rito (Student), University of Lisbon
 Bruno Fernandes (Student), University of Lisbon
 Jorge Nuno Silva, University of Lisbon
- 18:00 **Knight's tours and its history**
 Joaquim Eurico Nogueira, New University of Lisbon
- 19:00 Welcome Cocktail

Sunday, 25th January

- 9:30 **Digital clock festival**
 Aviezri S Fraenkel, Weizmann Institute of Science
- 10:00 **Kindergarten activities for early mathematics**
 Ricardo Teixeira, University of Azores
 Carlos Pereira dos Santos, CEAFEL
- 10:30 **Edwinn Abbott Abbott and the fourth-dimensional world**
 Tereza Bártlová, Charles University
- 11:00 Coffee-Break
- 11:30 **An interesting flipping puzzle**
 Colin Wright, Liverpool Mathematical Society
- 12:00 **Hands-on symmetry**
 Andreia Hall, University of Aveiro
- 12:30 **A look at *De Viribus Quantitatis* and its author Luca Pacioli**
 Tiago Hirth, MUHNAC
- 13:00 Break for lunch
- 16:00 Círculo Mágico de Lisboa; Mathematical Circus – Open Show

Monday, 26th January

- 9:30 **Street Maths: What's the chance of that?**
Steve Humble, Newcastle University
- 10:00 **Raising public awareness of mathematics: outreach@EMS**
Jorge Buescu, University of Lisbon
- 10:30 **Bold play and timid play with multiple payoffs**
Cristina Serpa, University of Lisbon
Jorge Buescu, University of Lisbon
- 11:00 Coffee-Break
- 11:30 **Unusual problems that can be solved using chess pieces and a chessboard**
Yossi Elran, Weizmann Institute of Science
- 12:00 **Atractor's software for mathematics - AtrMini and GeCla**
Ana Cristina Oliveira, Atractor
- 13:00 Break for lunch
- 14:30 Social Program
- 20:00 Conference Dinner

Tuesday, 27th January

- 9:30 **Sudokus for mathematicians**
António Machiavelo, University of Porto
- 10:00 **Mathematical glazed tiles (azulejos) in Portugal**
Henrique Leitão, University of Lisbon
Samuel Guessner, CIUHCT
- 10:30 **Why can't we visualize beyond three dimensions?**
Rogério Martins, New University of Lisbon
- 11:00 Coffee-Break
- 11:30 **The mathematical problems of Almada Negreiros**
Pedro Freitas, University of Lisbon
- 12:00 **Right angle proof**
Adam Atkinson
- 12:30 **Negative prices in supermarkets**
Adam Atkinson

- 13:00 Break for lunch
- 14:30 **Mathematics in the making**
Maria do Céu Soares, New University of Lisbon
Maria de Fátima Rodrigues, CMA & New University of Lisbon
Gracinda Guerreiro, CMA & New University of Lisbon
Nelson Chibeles Martins, CMA & New University of Lisbon
Susana Baptista, CMA & New University of Lisbon
- 15:00 **2-player Tower of Hanoi**
Urban Larsson, Dalhousie University
- 15:30 **Mathematics and fiber arts: knitting, crochet and cross-stitch**
Maria do Carmo Martins, University of Azores
Helena Melo, University of Azores
Sandra Vinagre, University of Evora
- 16:00 Coffee-Break
- 16:30 **Portuguese Mathematical Olympiads**
Alexander Kovacec, University of Coimbra
- 17:00 **Where mathematics ends**
Fernando Lima
- 17:15 **Ideal, a new abstract game for three players**
Bernardo Fernandes (Student), University of Lisbon
Hugo Almeida (Student), University of Lisbon
Jorge Mendonça (Student), University of Lisbon
- 17:30 **Playing serious ... maths, arts and life**
Noémia Maria Simões, ISEL, CLEPUL
- 18:00 Closing Session

3 Abstracts

Negative prices in supermarkets

ADAM ATKINSON

Several UK supermarkets occasionally offer goods with negative prices, possibly not deliberately. I will explain how this happens. The best I've seen is items at -40% of their usual price but I believe even better deals may be achievable.

Right angle proof

ADAM ATKINSON

There is a fairly old fallacious proof that all angles are right angles which seems to be less well known than it used to be. Just in case there is anyone at RM15 who has not seen it before, here it is.

When in Lisbon, look at the pavement!

ALDA CARVALHO, ISEL & CEMAPRE

CARLOS PEREIRA DOS SANTOS, CEAFEL

JORGE NUNO SILVA, University of Lisbon

RICARDO TEIXEIRA, University of Azores

The frieze group (seven elements) and the wallpaper group (seventeen elements) classify repetitive designs in one or two directions. Also, rosettes are beautiful designs in which the repetition occurs within a limited region of the plane. The mathematical study of these objects led to the pursuit of interesting art objects throughout the world. We will show some research done about gorgeous sidewalks of Lisbon, enriched by the traditional *Portuguese Pavement*. Their most common colors are the black and the white of the basalt and the limestone used, and the result is a large variety and richness in patterns. Something especially appealing for building a gorgeous deck of cards. . .

The Delfos Project: Since fourteen years racking student's brains

ALEXANDER KOVACEC, University of Coimbra

“Delfos” is the name of a mathematical school for youngsters that takes place one or two weekends per month at the Department of Mathematics of the University of Coimbra. It is open to all interested students from 5th to 12th grade. Within its competencies falls the training for mathematical competitions. We inform about the impact it had in Portugal's standing in this endeavor and give examples of problems and solutions found by students.

Atractor's software for mathematics - AtrMini and GeCla

ANA CRISTINA OLIVEIRA, Atractor

In the last years, Atractor's* efforts have been focused essentially on producing virtual contents, and two of its contributions in this area were the interactive programs AtrMini and GeCla, which can be downloaded from Atractor's website - `atractor.pt`. This talk will give a brief presentation of these two programs and, in the final part, a competition using GeCla will be hold.

AtrMini: aimed at children, more specifically at students of elementary school, it is a set of games published by Atractor, which can be a useful tool in teaching mathematics at an elementary level. With AtrMini, children can develop several mathematical skills: train mental calculation, improve some daily tasks (such as the use of money), use a basic version of the Logo language, have a first contact with simple combinatorial questions, develop some notions related to Symmetry,...

GeCla: this program, whose name corresponds to an abbreviation for "Generator and Classifier" is a tool that can be useful in the teaching of Symmetry, and which also allows an entertaining use by conducting competitions between students at different educational levels. A GeCla competition will take place at the end of the talk.

* Atractor is a non-profit association for the popularisation of Mathematics.

Hands-on symmetry

ANDREIA HALL, University of Aveiro

The study of symmetry is now an important part of the mathematics curriculum at the primary and secondary school levels. It is very appealing to use applications and examples of symmetry in the real world to address the topic of symmetry in the classroom. The decorative arts are a nourishing field for that purpose. Symmetry is strongly related to isometry and since there are four types of isometries in the plane, there are also four types of symmetry in the plane. Using only rotational and/or reflection symmetry, cyclic and dihedral groups of symmetry are generated. Figures with these types of symmetry are usually named rosettes. If translation symmetry is involved, friezes and wall-paper patterns are obtained. Friezes (periodic patterns along one direction) exhibit only 7 distinct symmetry groups and wall-paper patterns (periodic patterns along two directions) exhibit 17 symmetry groups. If a wall-paper pattern is generating through infinite repetition of a certain figure without any overlapping and completely covering the plane we say we have a tessellation.

In this talk we shall present the results of two continuing education courses for mathematics teachers involving about 40 primary and secondary school teachers (grades 1 to 12). In both courses we studied symmetry and the groups of symmetry of friezes and wallpaper patterns and produced applications using certain specific crafts techniques. In one of the courses we explored friezes and wallpaper patterns through patchwork and quilting, obtaining examples of all the 17 groups of symmetry. Because these works were machine sewed, we only used polygonal figures, sewing along straight lines. In the other course we explored tessellations using the same type of techniques used by M.C. Escher in some of his works, producing animal and figurative shapes, starting from some simple polygons such as squares, triangles and rectangles. The basic shapes were distorted in specific ways in order to produce tiling figures with different symmetry properties. These tessellations were then used to produce real glazed and colored ceramic pieces.

In these two courses the teachers had the opportunity to link mathematics and art through two particular crafts techniques: patchwork and ceramics. It was a very stimulating experience to see how the teachers could improve their mathematical skills on symmetry and at the same time learn some crafts techniques which allowed them to apply these skills.

Sudokus for Mathematicians

ANTÓNIO MACHIAVELO, University of Porto

After showing some evidence that none other than Sherlock Holmes may have invented sudokus, we will show how to generalize sudokus to problems for mathematicians working in any field. We will then present some examples and some partial results for some sorts of those generalized sudokus.

Digital clock festival

AVIEZRI FRAENKEL, Weizmann Institute of Science

The digits of a digital clock are composed of segments. With each digit n we associate $f(n)$ = number of segments of n . Thus $f(0) = 6$, $f(1) = 2$, $f(2) = 5, \dots$ We iterate this function, investigate its orbits, palindromes, and end with an open problem.

Ideal, a new abstract game for three players

BERNARDO FERNANDES, University of Lisbon

HUGO ALMEIDA, University of Lisbon

JORGE MENDONÇA, University of Lisbon

We will describe a new game for three players, invented by us, and the con-

text in which this invention happened.

Latin Erdos, a mathematical app

BRUNO FERNANDES, University of Lisbon

FÁBIO RITO, University of Lisbon

JORGE NUNO SILVA, University of Lisbon

We will give a short account on the creation of a smartphone app of the mathematical game “Latin Erdos”, which combines Sudoku with an old result of the Hungarian mathematician.

Meno’s slave, Lichtenberg and bees don’t need formulas!

CARLOS PEREIRA DOS SANTOS, CEAFEL

ALDA CARVALHO, ISEL & CEMAPRE

JORGE NUNO SILVA, University of Lisbon

Socrates illustrated his method by interrogating a slave in Meno’s house. The discussion showed a slave able of learning geometry. This happened in 385 before Christ; without precise mathematical terms, positional notation, calculus. . . Socrates used a “pure” argument and it is amazing what it is possible to achieve with smart logical thinking. In this work we will show more examples and how they are subtly related. Good mathematics is good thought; we will try to preserve Socrates’s style!

Planets, solids, curves and myths

CARLOTA SIMÕES, University of Coimbra

The Sun and the Moon appear as husband and wife in several myths, perhaps due to their similar apparent diameter, despite the fact that the Sun’s is 400 times larger than the Moon’s. In Ovid’s *Metamorphoses* we learn the myth of Callisto, condemned to stay in the heavens and not dip in the pure waters of the ocean. Indeed, in Ovid’s time, the constellations Ursa Minor and Ursa Major were above the sea in all northern places above latitude 30°N , which includes Ovid’s Rome. During the XVI Century, with the help of extremely accurate astronomical data by Tycho Brahe, Kepler obtained excellent values on the relative distances of planets to the Sun. It is surprising the fact that he managed to relate these distances with the five platonic solids, proposing the *Mysterium Cosmographicum* as a model to our solar system, but we may call astonishing his considerations on the non existence of *Ano Mundi* based on his new cosmological model.

During this talk we describe several ancient myths and their relation both with astronomy and mathematics.

An interesting flipping puzzle

COLIN WRIGHT, Liverpool Mathematical Society

We have a 4×4 grid of pieces of paper, white on one side, black on the other. Currently they are all white-side up. You hide an item of great value under one of them, I turn one of them over, and ask my accomplice to find your item. Trivially possible, as I can simply reverse the paper your item hides beneath.

So we make it harder. You flip any or all of the papers, and then hide your item. I'm still only allowed to flip one. Can I still give away the position of your secret?

Bold play and timid play with multiple payoffs

CRISTINA SERPA, CMAF & University of Lisbon

JORGE BUESCU, University of Lisbon

We extend the concept of bold play in gambling, where the game has a unique win payoff (it returns twice the original wager). We model a game where the player can bet all his money in each stake. The probability that a gambler reaches his goal using the bold play strategy is the solution of a functional equation. We refer to the game of scratch cards and note the impossibility of a gambler playing a bold play strategy for multiple payoffs.

Early Topological Puzzles

DAVID SINGMASTER, London South Bank University

For some time, I have considered the 1723/1725 edition of Ozanam as the first book to cover topological puzzles in detail and I only knew of a few earlier examples. Ozanam certainly gives many more examples than any previous book. In the last few years, I have discovered some early sources which show several topological puzzles as being considerably older than I previously knew. Here I show them.

Where mathematics ends

FERNANDO LIMA

In this talk, a prediction game, without prior communication with the audience, is presented. We discuss the building of the magical effect. Also, we speak about the history of illusionism and related creativity.

The importance of History of Mathematics in school curricula is increasing. For example, in Portugal, in the Mathematics program, the History of Mathematics appears as a crosscutting theme throughout the secondary school teaching and that should come along on several and different themes. On the other hand, note that “we are always looking for good problems to strengthen and broaden our student’s knowledge of mathematics as well as to refine concepts taught in the class room. The history of mathematics supplies thousands of useful and interesting problems, problems that are mathematically and pedagogically sound and which, by their historical nature, possess an additional intellectual appeal for students” [Swetz, *Learning Activities from the History of Mathematics*, 1994, p.2]. In fact, this appeal could be very important to attract more interested students to mathematics. Note that today one problem of modern mathematics is so complex and difficult that is almost impossible to explain it to an undergraduate student; that distance between superior mathematics and the common students’ makes it difficult to see “that mathematics is everywhere”. Is there mathematics in a car? And in a computer? Yes, but where? It’s impossible for a student to actually “see” and fully understand the mathematics in a computer... it’s just a leap of faith (the teacher said so)...

The history of mathematics could give interesting examples of a simpler mathematics and with connection to real problems. How to measure a distance? How to measure the high of a pyramid? How to count correctly? How to calculate more easily? This kind of problems is closer to the level of expertise of the students than the binary language of computers... On the other hand, the history of mathematics could humanize the discipline giving the students the “proof” that mathematics is a science in evolution like the others.

This work will present some proposals related to the History of Mathematics in the school context (in the classroom and beyond, such as in an extra-curricular Math Club). We will see how to adapt some topics of mathematics to the school context using, for example:

- Euclid’s Elements (examples of how to use the computer and some interactive content in classroom will be presented in the approach of this book);
- Shadow Instrument of the Portuguese mathematician Pedro Nunes (it can be easily constructed with paper and cardboard in the classroom and then used to measure the altitude of the Sun);

- Napier’s rods and the Genaille-Lucas rulers that were used for the multiplication of natural numbers (they can also be easily constructed with paper and scissors in the classroom).

This work was supported by Portuguese funds through the CIDMA - Center for Research and Development in Mathematics and Applications, and the Portuguese Foundation for Science and Technology (“FCT-Fundação para a Ciência e a Tecnologia”), within project PEst-OE/MAT/UI4106/2014.

Mathematical glazed tiles (azulejos) in Portugal

HENRIQUE LEITÃO, University of Lisbon

SAMUEL GESSNER, CIUHCT

The 18th century mathematical glazed tiles – azulejos – of the Jesuit college in Coimbra (Portugal), are remarkable and unique artifacts. They seem to be the only known example of glazed tiles for classroom use displaying geometrical diagrams of true mathematical (Euclidean) demonstrations. Although scientific motifs have frequently been used as decorative elements, the mathematical azulejos of Coimbra are unique in that they are genuine didactical aids to the teaching of mathematics.

The games Tree and Arborescence

ILDA PEREZ DA SILVA, University of Lisbon

Y.O. Hamidoune and M. Las Vergnas introduced and studied in the 1980s directed versions of a game invented by C. Shannon circa 1955. In contrast with Shannon’s original game most of the variants introduced by Hamidoune and Las Vergnas remain unsolved.

Recently we have implemented computational versions of two games: Tree and Arborescence, which are at the core of the existing results both on Shannon and on Hamidoune-las Vergnas switching games. In a short version of [1], we review the main mathematical results and open questions concerning these games.

[1] A.P.Claudio, S. Fonseca, L. Sequeira, I.P.Silva , “Shannon switching games and directed variants”, to appear in *CIM - Mathematical Sciences*, Vol.I, Springer.

Knight’s tours and its history

JOAQUIM EURICO NOGUEIRA, CMA & New University of Lisbon

In this paper we discuss the knight’s tour, a chess puzzle related to graph theory, the history of the problem, and some techniques for finding the tours.

The number of open and closed knight's tours, and some ludic and artistic aspects, are also briefly discussed.

Raising public awareness of mathematics: outreach@EMS

JORGE BUESCU, University of Lisbon

The European Mathematical Society has established about 10 years ago a Committee to deal with Outreach activities. We have done quite varied work, from recreational maths to a maths dictionary or to popular activities, street maths and busking performances all over Europe. These are centered around the Webpage <http://www.mathematics-in-europe.eu>. We will convey some of our most relevant experiences and show how YOU can take advantage of what the EMS has to offer.

The recreational Gerdes

JORGE NUNO SILVA, University of Lisbon

Paulus Gerdes, the great ethnomathematician that died last November, left us many beautiful books and other works. We will show a few topics Gerdes addressed, which fall within our recreational scope.

Mathemagic

JOSÉ PAULO VIANA, Escola Secundária de Vergílio Ferreira

Mathematics is magic and, sometimes, Magic is mathematics. That's what we are going to explore, having fun mixing magic and mathematics.

Mathematics of deaf young children

LAURA NUNES, CED Jacob Rodrigues Pereira/Casa Pia de Lisboa

ALDA CARVALHO, ISEL & CEMAPRE

CARLOS PEREIRA DOS SANTOS, CEAFEL

JORGE NUNO SILVA, University of Lisbon

Preschool mathematics is based on four fundamental principles: Concrete → Pictorial → Abstract approach; Order; Orality; Relation to all the other important issues of preschool time. The access of SEN people to education is today an inalienable right, advocated by several official international documents (Jomtien Declaration, 1990; Salamanca Statement, 1994) and Portuguese (Lei de Bases do S.E., 1986; D.L. n°3/2008). In this talk, we will present a joint project Associação Ludus - CED Jacob Rodrigues Pereira/Casa Pia de Lisboa, focusing in the preschool mathematics for deaf young children. Naturally, all the four principles are taken very seriously and the tools are made to be useful for deaf kids, educators and parents. We present some important feedback and some practical examples.

Mathematics and fiber arts: knitting, crochet and cross-stitch

MARIA DO CARMO MARTINS, University of Azores

HELENA MELO, University of Azores

SANDRA VINAGRE, University of Evora

Mathematics can be found all over the world, even in what could be consider an unrelated area like fiber arts. In knitting, crochet and counted-thread embroidery, we can study some concepts of algebra, graph theory, number theory, geometry of transformations and symmetry, as well as computer theory. For example, many fiber art pieces embody notions related with groups of symmetry.

In this work, we focus on two areas of Mathematics associated with knitting, crochet, and cross-stitch works - number theory and geometry of transformations - and show some curiosities connected with this subject.

Mathematics in the Making

MARIA DO CÉU SOARES, CMA & New University of Lisbon

MARIA DE FÁTIMA RODRIGUES, CMA & New University of Lisbon

GRACINDA GUERREIRO, CMA & New University of Lisbon

NELSON CHIBELES MARTINS, CMA & New University of Lisbon

SUSANA BAPTISTA, CMA & New University of Lisbon

“MiMa - Mathematics in the Making” is an European Commission’s COMENIUS project that brings together the experiences of partners in five European countries: Portugal, Italy, England, Hungary and Germany (see www.mathematicsinthemaking.eu). Five professors of NOVA’s mathematics department constitute MiMa’s Portuguese team. The project focuses on the awareness that mathematics can be taught in a non-conventional way, involving young students collaborating in thinking, creating and evaluating mathematics, in a ludic way.

The MiMa project aims to develop ten different highly engaging hands-on activities, two proposals from each country, to be developed by primary school students (from eight to ten years old) and their teachers. This talk will describe these activities, focusing in the two Portuguese activities: “Frieze patterns” and “Modelling the solar system”.

Playing serious. . . maths, arts and life

NOÉMIA MARIA SIMÕES, ISEL

In the actual geopolitical context that appears as a scaring stage and chaotic chess game, we’ll essay trans-disciplinary navigation clues which include

mathematics, game theory, arts and life.

After briefly referring to some theoretical perspectives on trans-disciplinarity and global education frameworks, we'll present some examples of the use of maths and game theory in relation with arts in different cultural scenarios, in order to motivate intercultural communication, conflict solving and peace building approaches.

The mathematical problems of Almada Negreiros

PEDRO FREITAS, CEAFFEL & University of Lisbon

Almada Negreiros was a very important Portuguese painter and writer of the 20th century. Towards the end of his life, he became increasingly interested in geometry, producing artworks with rich geometric content. Among these are constructions for the division of the circle in n parts and golden rectangles. These can be viewed as geometric problems: are Almada's constructions exact or approximations? We present a few examples.

On the relative value of chess pieces and their combinations

PEDRO PALHARES, CIEC, Institute of Education, University of Minho

The relative value of chess pieces and their combinations has been an important theme in recreational mathematics for a long time. Also it has clear intersections with chess playing where values can be estimated from its practice. In a recent article I have proposed a relative value for the combination of rook and Bishop versus queen. I propose to extend the method used for other confrontations of pieces.

Cards with Memory

RICARDO LOPES, University of Lisbon

CATARINA MARTINS, University of Lisbon

Would you believe, if there was a magician, who picked 4 volunteers and handed the 1st a regular deck of cards (without jokers) and told him to look at the deck, verify the cards, shuffle them and handle the shuffled deck to the 2nd volunteer, this one would pick (deliberately or randomly) 5 cards out of the deck, showing them to everyone except the magician, then place the deck on top of some table and leave it there.

After he'd given the 3rd volunteer the 5 picked cards, this one would now choose (again deliberately or randomly) 1 card out of the 5, then show the picked card to everyone, except the magician of course, and hide the card in his/her own pocket.

The rest of the cards, the 4 unchosen ones, would then be given to the 4 volunteer, who would shuffle these 4 cards form a pile and hand them to the magician. The magician would then look at the cards and after a while he'd name the picked card hidden in the pocket of the 3rd volunteer.

Would it amaze you?

Kindergarten Activities for Early Mathematics

RICARDO TEIXEIRA, University of Azores

CARLOS PEREIRA DOS SANTOS, CEAFFEL

Singapore Math, which refers to the instruction and curriculum for teaching mathematics in the small island country, has become popular due to its top rankings on the international assessment of student math achievement TIMSS (Trends in International Mathematics and Science Study). Singapore has been among the top ranking countries in that assessment since 1995.

The Kindergarten's Singapore math is based on four principles: mathematical concepts are systematically introduced and reinforced using de Concrete → Pictorial → Abstract approach; the order in which the concepts are introduced is carefully planned; the practice of orality is taken very seriously; the subjects are framed in the light of all the other important issues of preschool time (e.g. trace and draw training).

This presentation will focus on activities and games for Kindergarten that follows the Singapore approach. The major themes of preschool mathematics will be explored.

Why can't we visualize beyond three dimensions?

ROGÉRIO MARTINS, New University of Lisbon

This is probably a philosophical question rather than a mathematical one, nevertheless, who said that philosophy doesn't have a recreational and fun side?

As a philosophical question, we don't expect to give a full answer, even though we hope to clarify some ideas and maybe give a new perspective on the subject.

We will find some curious analogies with the way we perceive color and make some imaginary experiments.

Street Maths: What's the chance of that?

STEVE HUMBLE, Newcastle University

The activities described show how order can be found in seemingly random actions. The author has found that by using playing cards and other recreational mathematics activities can help in taking the “maths beyond the classroom” and onto the “streets”. Activities such as these illustrate the connections between the real world and what students are (or have) studied in school. In so doing students and adults alike are enthused by the wealth of resources they have all around them in their own environments.

Then information on a couple of activities, if you want to have handouts.

Edwinn Abbott Abbott and the fourth-dimensional world

TEREZA BÁRTLOVÁ, Charles University

It is the general impression that Jules Verne and Herbert George Wells should be considered as the principal founders of the science fiction. But only few people are aware of the fact that almost at the same time another authors also published books in the very same genre. One of them was Edwin Abbott Abbott.

He is known mainly as a schoolmaster and theologian. In his literary and theological pursuits he tried to raise interest in Gospels reading. But even if we haven't heard about his contributions to theological discussions, he would for sure be remembered as an ingenious teacher and an excellent headmaster of the Great City of London School. Within the time, as a teacher, he became a famous and celebrated person because he had inspired many students and followers who became later known in a broad range of subjects and professions. The questions that interest us are: How much was he interested in mathematics? How did he influence mathematicians and how did mathematicians influence him?

In our contribution we shall recall his celebrated book entitled “Flatland”. We shall discuss various issues concerning this book including the questions of inspiration, its consequences in education, mathematics, geometry and history, and its moral impact. We shall also focus on its influence of further fiction writers and mathematicians.

A look at De Viribus Quantitatis and its author Luca Pacioli

TIAGO HIRTH, Ludus

As the field grows, History of Science has been more embracive than a purely advance oriented view of the history of Science. The History of Mathematics,

even though more resilient, has shown to accompany such developments. In the spirit of a more encompassing study, this presentation intends to share the findings from a book which has been belittled, misinterpreted or ignored altogether. *De Viribus Quantitatis*, one of the major historical recreational mathematics books, and its author Luca Pacioli. We will start by taking a brief look on the life and work of Luca Pacioli. This will be followed by a closer look at the 500-year-old manuscript. Some considerations on the book and its context will be explored as well as several examples of its sections. The mathematical content of these sections will briefly be exposed and a modern counterpart of the effects and puzzles given when possible.

2-player Tower of Hanoi

URBAN LARSSON, Dalhousie University

We discuss 2-player variations of the classical 1-player Tower of Hanoi game. The first player can control all moves and since the number of moves can be odd, it is easy to see that she wins in normal play. When we play a weighted variant, the first player can win, by obtaining a positive score, if all move-edges have positive weight. If she cannot win she secures a draw game, by infinite play; never put the smallest disc on top of the rest of the tower.

Speedcubing: Taking the Rubik's Cube to the next level

VASCO VASCONCELOS, University of Lisbon

A brief history of the sport that has gradually become the hobby of thousands of people all over the world.

Unusual problems that can be solved using chess pieces and a chessboard

YOSSI ELRAN, Weizmann Institute of Science

The game of chess is intriguing. The unusual setup of the different pieces and their legal moves on the board leads to the complex and much enjoyable game of chess. The chessboard and its pieces, however, can also be used for other purposes, such as solving arithmetic problems and algorithmic puzzles, or providing proofs for mathematical theorems. In the talk, we will show some examples of some unusual and even bizarre uses of the chess board and chess pieces. These include using the chessboard as a calculator, proving a theorem in number theory and solving some problems that have their roots in cellular automata, specifically, John Conway's Game of Life.

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