



**EUROMATH & EUROSCIENCE  
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**ABSTRACTS BOOKLET**



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## **STUDENT PRESENTATIONS IN MATHEMATICS**

# **MPF0. PLACE BASED LEARNING IS THE FUTURE OF SCHOOLING: Design Principles for a Changing World**

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## **ABSTRACT**

In the future, the time and space-based model of education represented by tens of thousands of schools and universities worldwide will give way to a more distributed place-based learning model. Despite the enormous benefits it offers, place-based learning remains a fringe movement today. This presentation will show how fledgling place-based education movements are already leading the way towards a system of education that is more equitable, humane, economically viable and socially essential. In fact, we predict that place-based education will become the dominant model of learning in as little as 15 to 20 years and will have fully replaced schools as we know them by the middle of the 21<sup>st</sup> century.

## **MPF1. Monty Hall**

**Marko Pracek, Skofijska klasicna gimnazija, Slovenia**

### **ABSTRACT**

The Monty Hall problem appeared in 1990, in Parade Magazine.

It reads as follows: Suppose you participate in a prize game where you have three doors to choose from. There is a car behind one door and a goat behind the others. You choose door no. 1, then the show host opens door no. 2, behind which is the goat, it is important to know that the show host knows which door the car is behind. The show host then offers you to switch the doors or stay with the doors you chose. The question of the problem is, what is more worth it to replace or stay at the same door?

On the Monty Hall problem, I made a problem experiment in the classroom. Whole prize game was staged 60 times. The result was divided into four groups, depend on what did the player choose and what was the result that he got. The results were similar to prediction of conditional probability. If we wanted more accurate answers we should did more attempts.

Monty Hall problem falls within the field of mathematics called conditional probability. Conditional probability is a measure of the probability of an event occurring given that another event has occurred. So if at first probability that the car is behind chosen door is one third, than when we know new fact the formula for probability shows us that the probability that the car is behind the door that has not yet been selected is two thirds.

## **MPF2. SELTEN TO THE RESCUE: KIDNAPPING 101**

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### **ABSTRACT**

Kidnapping is a serious and ongoing threat in some regions of the world, even though it is not a widespread crime. A victim is kidnapped, and a monetary demand is made for his or her release in a typical situation. Even though it appears to be a straightforward exchange of money for the release of a captive, dealing with the scenario necessitates extensive planning by the police. This is where game theory, a well-developed discipline of mathematics that simulates strategic scenarios, is required to explore all possible options for the outcome of the situation. Reinhard Justus Reginald Selten was a German economist and Nobel Laureate in Economic Sciences in 1994, together with John Nash and John Harsanyi. Selten was a pioneer in the study of the strategic interplay between fully rational players (game theory) and everyday-life rational individuals (bounded rationality). Nobody else has made such significant contributions to both research areas. Selten's game is a kidnapping model in which the likelihood of catching the kidnapper is unaffected by whether the captive has been released or executed. In most cases, authorities devote more attention and resources to apprehending the kidnapper after the hostage has been executed, not when a ransom is paid to ensure the hostage's release. In this presentation, we'll discuss the asymmetric game in which the chance of catching a kidnapper is decided irrespective of whether the hostage has been executed or not, and we'll identify a new perfect equilibrium point according to Selten's game theory.

## **MPF3. Breaking The Limits**

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### **ABSTRACT**

My presentation is based on a machine that has revolutionised our understanding of mathematics and has made our lives as students much easier, the calculator. At first glance, the calculator seems omniscient solving equations much faster than we can, however like any other machine the calculator has its limitations which will be the focus of my presentation. I plan to show the limits of the calculator by giving an answer to “what is the highest possible equation a calculator can calculate”, I will also show how I came to this conclusion and how a calculator calculates certain mathematical symbols so the future generation of mathematicians can also work on this question and possibly prove me wrong. This information can be used to increase the effectiveness of our calculators and deepen our understanding of mathematics since knowing the limits of our technology allows us to work around them and improve. Another bonus I may add to my presentation would be the easiest possible calculation to do on a calculator determining as what can a calculator calculate the fastest. This is an idea that I don't think has ever been presented in the Euromath competition and I hope to be the first to be given the opportunity to present it.

## **MPF4. Is this your lucky day?**

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### **ABSTRACT**

Ever wondered why you hear so many people losing their fortunes in casinos? If your answer is yes, then this paper is for you. In this paper we will give an explanation to certain popular casino games through a mathematical approach. More specifically we will present and analyze the rules and probabilities for winning in the games of roulette, blackjack and slot machines. Initially there will be a presentation on some basic theory on probabilities. In the beginning this paper will conclude the rules of each game specifically. Furthermore, we will be mentioning the chances of someone actually landing a jackpot, using mathematical theory. Moreover, we will showcase some extraordinary examples of people winning big time against some of the biggest casinos in the world. Specifically, we will examine and analyze some of the most common strategies that casuals will often use to play those games, as they know they are in a disadvantage against the casino. In addition, we will debunk the myth that casino games are purely based on luck and coincidence and that will always interfere with the results leading to the casinos always winning at the end of the day.

## **MPF5. FROM PAGE TO STAGE**

**Viktorija Kavain**

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### **ABSTRACT**

From time immemorial we have encountered mathematical, philosophical, psychological, social, and cultural issues and problems. Sages such as Aristotle, Sophocles, Eratosthenes, Pythagoras, and many others devoted themselves to these components and thus influenced a kind of the beginning of science. Mathematics and drama (theater) had a great influence on society and its progress. Mathematics has influenced the development of other sciences such as physics, chemistry, and biology, which we still learn about in modern times, and theater has entertained society, learning about history, events, societies, and literary works to this day. These two, at first glance, completely different concepts have a similar root and much mathematical knowledge can be applied in theater, as it includes not only actors, stage and "backstage" film crew, but a lot of all kinds of knowledge of geometry, measurement, counting rhythm/step, frequency, lighting at a certain angle, etc. Simply put, without mathematics, the theater as we know it today could not function. In this topic, I will look at the development of both mathematics and theater and how one has influenced and is influencing each other. What insights do screenwriters, costume designers, actors, directors need, and how does this ultimately lead to a play behind which many formulas and tasks are hidden behind the scenes?

## **MPF6. MATHEMATICS IN COOKING**

**Lana Acinger and Andrea Hasančević**

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### **ABSTRACT**

We all cook every day, however, not all of us are aware that mathematics is a very important part of the dish quality and how much it affects the taste. For that reason, in this project we decided to connect something we both enjoy which is cooking with mathematics. Math participates in many dish components such as cutting the ingredients (shapes and geometry), the temperature used for cooking and baking but also in stacking the parts of, for example, a cake. In this project we will present a three course meal which will include an appetizer, main course and dessert. We will demonstrate how shapes, in which the ingredients are cut, can affect the dish, use ratios instead of units of measurement because we know how difficult it can be for us to understand the foreign ones (pounds, kilograms, ounces, litres, et cetera) and we will also show you the importance of math in cooking

# MPF7. ANALYZING AND OPTIMIZING FOOTBALL STRATEGIES USING MATHEMATICS

## Jure Jerneić

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## ABSTRACT

Football, the most famous sport in the world. How could mathematics have any type of relation to it? Most people would say none, but I don't think so. Every sport is based on mathematics. The first thing a coach must do before a football match is to choose a formation in which players will play in. For example, the most basic one; 4-4-2 is formation where there are 4 defensive players, 4 in the midfield and 2 in the attack. This formation was effective since the start of the sport, but in the early 2010s coaches started developing more advanced formations that would give them an advantage before the match even started. For example, 5-3-2, often used by Chelsea, where there are 3 center backs and 2 wingbacks which makes more solid defense, while counterattacks are the tactic for scoring goals. Nowadays, there are more than 25 tactics widely used in football. Apart from them, speed, path and rotation of a ball are heavily based on mathematics and physics too. Player's pace and position on the field also play a significant role in the strategy of a certain team. In my presentation, I would go deeply into how coaches can outsmart opponents by using strategies based on mathematics while visualizing everything for better understanding.

## **MPF8. Using Benford's Law as an epidemiological tool for COVID-19 pandemic data analysis in Greece**

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### **ABSTRACT**

Have you ever imagined that nature may not be as uniform as it looks? Or that may have a tendency toward smaller numbers? At the end of the 19th century, triggered by an observation that in logarithm tables the earlier pages (that started with 1) were much more worn than the other ones, the idea of Benford's law was born. According to the law, in collections of numbers from empirical data, the leading digit is likely to be small. In sets that obey Benford's law, for instance, the number 1 appears as the leading digit about 30% of the time, while the number 9 less than 5%. Hence, this paper aims to examine the peculiarity of Benford's law and to apply it in the context of the critical health situation we are experiencing today, the COVID-19 pandemic, as a way to verify the validity of case statistics with the criterion of whether they follow this natural anomaly. It is worth mentioning the fact that taking the cases at time intervals of one month do not significantly follow the law, while overall -when the sample size is large- at a satisfactory level. On top of that, as part of the research, we were faced with an illusion known to psychologists as "bias of equal probability" (Flehinger, 1966); in a nutshell, it is a human tendency to think that "real" probability implies uniformity. But is it?

## MPF9. HEALTH^2

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### ABSTRACT

Mathematics have always been actively involved in different aspects but also fields of medicine. From nurses measuring your blood pressure levels, to taking a prescription of a specific drug for a health issue. Nowadays, health care workers are lucky enough to be able to work with the correct medical equipment that involves the use of mathematics and allows them to make accurate results for the dosage of medicines in milligrams (mg). For example, in rehab centres, such medical equipment is essential as even the slightest inaccuracy of dosages can lead to severe results in the patient getting worse or leading to overdose or addiction. To be able to achieve the exact amount needed a specific mathematical formula must be used by the experts of the field. Also, to be able to understand the level of an infection/disease, it is essential to perform a mathematical equation to find out the incidence rate-number of new cases within a population. In conclusion, human beings' lives are involved every single day in medical centres, so it's crucial and essential for healthcare professionals to be absolutely accurate with their measurements, using mathematical equations, to ensure the safety of their patients. Our aim is to present and make our audience understand the importance of the role of mathematics, in the field of medicine. In order to achieve that, we will present different diseases and measurements of medicine that require maths and even show the importance of mathematical formulas in rehab centres.

## **MPF10.√MEDIA**

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### **ABSTRACT**

Have you ever felt like you're being watched while scrolling on social media? Well, you are, in a way and it all leads back to maths! Your every move is predicted through a mathematical formula: the algorithm. The algorithm, is a proprietary technology that helps make each social network unique, determining what content will reach your phone on multiple platforms, such as Instagram, TikTok, YouTube, Netflix – even Spotify! In recent times, social media has become a necessity; something embodied in our everyday lives. The algorithm allows for the maintenance of that fixation on social media platforms, since it helps provide the content that we seek to see. For instance, on TikTok, each person's For You Page is based on certain factors such as user interactions (likes, comments, shares), video information (hashtags, sounds), along with multiple others. Similarly, the Instagram algorithm takes into account your relationship with your followers, as well as the relevance of your content (whether or not it's trendy). Our team will graft towards displaying how maths is incorporated into the personalized content provided by several social media platforms.

## **MPF11. MATHS, A SUBJECT USED IN EVERY SPORT**

**Ioannis Ioannou, Louis Aristotelous**

### **ABSTRACT**

We will be talking about how we use math with sports. For example, in American football to throw the ball the furthest we aim at 45 degrees, so we have the biggest outcome. How we use it in other sports like football, basketball, tennis and water polo which are very challenging to master, but with these tips it will be easier to come close to mastering them. With that in mind maths can help you perform better in sports and analyse the results, so you don't make the same mistakes repeatedly. In soccer for example, when you hit the ball hard enough so the goalie can't get it in time, but low enough so it doesn't go over the goal, you are using maths without realizing it. If you hit the ball too high, you analyse what you did wrong, so you don't do it again. Also, some countries at the 2016 Olympics, brought mathematicians as part of their team to collect data and produce performance statistics to plan and optimise the future training for their athletes.

## **MPF12. MATHS IN MARKETING**

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### **ABSTRACT**

We recall coming home from the school– English school and telling our parents that we had decided on our subject for our euro math’s competition .Our parent’s expression of happiness at knowing their children were entering the corporate world transformed with one phrase, and we can still see it on their face. Confusion .They thought that maths and marketing were 2 unrelated subjects

They attempted to persuade us that Finance or Accounting would be better suited for our analytical and mathematical minds throughout the course of a long talk. Marketing? That is for dreamers and artists. It is very simple and not related . We resisted replying with all the love and respect we could muster, but within our thoughts, we chuckled.

We explained that Marketing is maths and advertising is a vital component of marketing. It’s not just about understanding your target audience and how to reach them. it’s about knowing how much money it takes to get your message out. It’s about data, formulas, statistics, analytics, correlations, patterns, \*predictive modelling and testing.The common denominator of all these elements is maths.We explain some of this subjects in our presentation we go through some of these topics.

If you want to understand the wide and varied secrets behind various marketing techniques and get informed on a subject that is very vital in our daily routine, please take in consideration our essay

# MPF13. HOW DID THE KONIGSBERG PROBLEM REVOLUTIONISE MATHEMATICS

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## ABSTRACT

In this presentation we will talk about the Konigsberg problem and how it has revolutionized mathematics. We will refer to how and why it impacted mathematics as much as it did, and explain which chapters were affected the most. We will elaborate what we have gained from Euler's negative resolution, and what this meant for mathematics. We hope to achieve this through showing the solution, and referring to pictures and papers written by mathematicians, in order to provide further understanding of the impact of this problem.

## **MPF14. CAN MATHEMATICS WIN AT MONOPOLY ?**

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### **ABSTRACT**

We can all agree that there is nothing more magical than a full-blown family argument caused by a good old-fashioned game of Monopoly. Monopoly whose sole objective is to have your friends and family forced into poverty, also has mathematics involved. Here, we'll talk about how to increase your skill in Monopoly. The key to success in Monopoly is noticing that not all properties are created equal, knowing where to invest and which sets will give you better returns on your money is your ticket to board-game glory. Also, knowing when to stay in jail is very important. Hanging out in jail might not be such a bad idea, after all you never pay rent. Monopoly has an element of chance, but it can still be predicted. Probabilities appear in three elements of the game: the dice, Community Chest Cards and Chance Cards. Three things mess with the probabilities of the Monopoly board, and they are the Community Chest Cards, the Chance Cards and the Go to Jail space since specific spaces become more likely to get hit than others. Monopoly is a game of chance and luck, and mathematics just so happens to help you secure your victory.

## **MPF16. EGYPTIAN PYRAMIDS**

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### **ABSTRACT**

Egyptian pyramids are one of the most powerful and long-lasting symbols of old Egyptian civilization. During this presentation we will try to answer questions concerning how the pyramids were built, how the Egyptians measured angles, the amount of material needed and all of these done without using well-organized number system.

The ancient Egyptians were constantly using mathematics, mostly for calculating taxes, at the stores or measuring land. During frequent floods of the Nile river, the river banks were destroyed, so it was necessary for them to be measured again. This is how the new math word was born: geometry. It is a branch of mathematics which translated from Greek means "measuring land".

The Egyptians wrote their discoveries on papyrus, which have been destroyed over time. They contained many mathematical secrets. The only document that survived was the Rind papyrus, containing everyday mathematical problems of the ancient Egyptians.

Egyptian ability to generate new mathematics was astonishing. The ancient Egyptians were building pyramids in order to honour their dead pharaohs, thus giving them an eternal afterlife. Besides, owing to them, we were gifted with foundations of today's mathematics. The ancient Egyptians discovered the power of geometry, numbers and made the first steps for upcoming discoveries.

## **MPF17. Math in bacteria**

Marija Švegović

### **ABSTRACT**

At this time, everyone's thoughts are occupied with corona virus, nobody talks about bacteria. It is like they do not even exist. And only in human body there are about one hundred billion of them, which is ten times more bacteria than human cells. Of course, some of them are useful for our organism but there are some that can be very harmful for our health.

And in what way is Math connected to bacteria?

Firstly, when you look at their shape, you can see that it is connected with geometry and in this presentation, I will show you how. I will introduce you with the formations they can build and also with the ways they multiply in our body. In our intestines there are more than 500 types of bacteria which differ in their percentage of good and bad bacteria that live in human body and for the end, with the way in which Escherichia coli is multiplied in 24 hours.

## **MPF18. MATH IN ASTRONOMY**

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### **ABSTRACT**

Since I was a little girl, planets of Solar system always been point of interest to me and I had a lot of questions about space and planets.

Today, using math, I can get answers and calculate how far away planets and stars are, or how fast planets are moving in space. Some of themes that I will explain in this assignment are:

- 1. How we can calculate distance of each planet from Sun**
- 2. How planets are moving around the Sun**
- 3. How to calculate size of planets**
- 4. How spacecraft leave the Earth atmosphere**

Thanks to astrologist Keppler we know that planets are going around Sun in elliptical orbit, all due to gravity and planet weight.

When planets are closer to Sun they are moving faster and opposite, slower when they are far away from Sun.

Period (time it took planet to go around the Sun) of each planet is in correlation with its distance from Sun.

How spacecraft leave Earth? What is speed that satellite need to gain to circle around the Earth? Understanding of cosmic velocity will give us answers on those questions.

Math plays important role for understanding solar system. Without mathematics, people would not be able to build spacecrafts or calculate route for it, build telescopes and satellites. Math is essential in astronomy.

## **MPF19. DOES A “NATURAL ABILITY IN MATHEMATICS“ EXIST?**

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### **ABSTRACT**

I am going to talk about a „natural ability in mathematics“.

Scientists have located a part of our brain that helps with the understanding of mathematics. It's called the hippocampus. Students with a relatively large hippocampus generally learn more during a math lesson. Not only does the hippocampus matter. The connections between the hippocampus, the frontal lobe and basal ganglia also have a significant influence on someone's mathematical performance.

## MPF21.UNIVERSE INSIDE OF CALCULATOR

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### ABSTRACT

Look through the window. What do you see? You either see the Sun, or the Moon and the stars. At first, it seems as if the universe is just a space filled with celestial bodies, but we can make it a little more complicated and a little more fun just by using basic mathematical principles. Mathematics has always been a means of space exploration, from the time of ancient civilizations and Erathostenes' calculation of the Earth's circumference to the latest discoveries.

Every planet is also a geometric body. Each of these geometric bodies has its own surface and distance from the other bodies. The distances among the planets are large, so we present their values in the form of a scientific record with potentials. The whole universe is actually a set of subatomic particles that can be represented by a number. So basically, the universe is made up entirely of numbers and there is no problem in the universe that we can't solve with mathematics.

In our presentation, we will present the application of Newton's law of gravity, Einstein's general theory of relativity, but also other mathematical theories in space exploration. Come with us on a mathematical journey through space filled with Pythagorean teaching, trigonometry, and geometric bodies.

## **MPO15. MATHEMATICALLY DETERMINING THE TIME BY LOOKING AT THE SUN**

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### **ABSTRACT**

In this modern-day time, we heavily depend on our mobile phones or watches to know the time. It's important because we always have to be somewhere at some time or have a limit to do something, such as going to school, to work, going out... But what if you find yourself in a situation where you do not have any gadgets with you, for example on the beach or in the nature? How to know the time? You may not have a wristwatch or a phone with you, but there is a giant, flaming clock in the sky: the Sun. While it does not directly say the time, there is a way to approximately determine it in a few steps using mathematics. Don't be afraid, you need not know complicated equations for those steps. Just make sure you know where you are, and use your head!

## **MPO20. IS MATHEMATICS A LANGUAGE?**

**Aikaterini-Maria Boura\***

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### **ABSTRACT**

If you attempt to find a single definition about language you will come across various outcomes. Some people claim that language is a system of commonly spoken, manual (signed), or written symbols that humans use to express themselves as members of a social group and be able to coexist in societies. Language functions include communication, expression of oneself and one's imagination, reflect one's cheerful state and a tool of emotional release. A more established definition of language, according to Noam Chomsky, is the inherent ability of native speakers to understand and form grammatical sentences. It would be interesting to examine an alternative approach of what can be considered as language, and more specifically about the nature of Mathematics as a special kind of language. Mathematics can be fundamentally defined as the science of structure, order, and relationship that arose from the primitive practices of counting, measuring, and describing the shapes of objects. It can also be considered the fundamental science of number, quantity, and space. In this paper we will examine the similarities and differences between Mathematics and traditional forms of languages. Furthermore, we will analyze other factors of Mathematics and attempt to answer the scientific question: is truly Mathematics a language?

## **MPO22. Online Presentation. Application of Boolean algebra in Coding and Cryptography and Design of Electrical Sensors**

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### **ABSTRACT**

Today, base two numbers- which are known Binary numbers- are used in computers and digital systems. Arithmetic and logic operations are performed on binary numbers. The mathematics governing logical operations is called Boolean algebra. In Boolean algebra and different digital systems, various codes are used for three major reasons: for enhancing network security, for making such codes user friendly for ordinary people and also for easy correction of occurred errors. In this article, the author researches the gray code in digital systems and investigates about the applications of this code in encoder shaft sensors. It should be noted that the use of shaft encoder sensor is in determining the position of rotational motion and estimating the moving speed in such movements.

## **MPO23. Online Presentation - Application of the pigeonhole principle in solving intelligence problems**

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### **ABSTRACT**

The pigeonhole principle is one of the most important principles in solving mathematical problems. The authors of this article try to use this important mathematical principle to solve problems related to finding maximum and minimum values. This principle is also used in matters related to the counting principle as well as the calculation of probabilities. Today, these issues are mostly used in university entrance exams as well as corporate recruitment exams. This article tries to categorize these issues that are solved with the dovecote principle so that volunteers can use them easily

## **MPO24.Online Presentation - Novel and Classified Method for Solving Problems Related to Cubes and Dice Funds**

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### **ABSTRACT**

Nowadays, one of the most important issues which is raised in intelligence and aptitude tests of entrance exams of universities and industrial centers, as well as in employment tests, is the visual issues related to the funds of expanded cubes and dice. For example, in such examinations, it is asked what image is located in front of this fund in the cube, according to the different situations which is presented in the question. Or which three sides of the cube can form a corner according to the problem conditions. Or as another example we are asked what the opposite number of this number is, in a non-standard dice according to the conditions. The author of this article has tried to present a novel and scientific method for solving these problems scientifically and easily. This developed method will be able to solve problems in a simple way

## **MPO25. ONLINE - RATIONAL KNOTS AND RATIONAL NUMBERS: ARE THEY RELATED?**

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### **ABSTRACT**

Knot Theory is a very exciting branch of modern mathematics and, more precisely, of low-dimensional topology. The set of knots is infinite and discrete, but they exhibit exponentially increasing complexity and their classification is still a big open problem of Mathematics. Mathematicians try to tackle this problem by constructing the so-called knot invariants. For example, tricolorability proves that the trefoil is not the trivial knot. Yet, there are some families of knots that are completely classified. One of them is the rational knots. These knots are obtained by closing rational tangles. And rational tangles are, in turn, classified by the rational numbers, through their continued fraction expansion. In this talk we will present the classification of rational tangles and rational knots, that is, the theorems of Conway and Shubert.

# MPO26.FIXED SYSTEMS UNDER THE SHAPLEY-SHUBIK AND BANZHAF INDICES WITH ONE OR TWO PRESIDENTS

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## **ABSTRACT**

We introduce the Banzhaf and Shapley-Shubik power indices for voting systems, with definitions, properties and the vote donation paradox by Felsenthal and Machover. Then we give particular attention to the *fixed systems* – those for which the index of every player equals the proportion of votes which he/she owns in the system. We work with the requirements that not all players have equal proportions of votes and all players have a non-zero proportion. We investigate the types  $(a, b, b, \dots, b)$  (systems with *one president*) and  $(a, a, b, b, \dots, b)$  (systems with *two presidents*). For the first type we derive for Shapley-Shubik, by means of a combinatorial counting approach, an auxiliary equation of the form  $f\left(\left\lfloor \frac{1}{2x} \right\rfloor\right) = x$ , where  $\lfloor z \rfloor$  is the integer part of  $z$  and  $f$  is a linear function; analogously for the second type we derive three possible equations, but with quadratic functions  $f$ . By transforming these equations into inequalities without the integer part function and solving them in integers via tricky bounding techniques, we describe all Shapley-Shubik fixed systems of these two types. Moreover, these turn out to be enough to give a proof that at least one fixed system with  $n$  players exists if and only if  $n \geq 4$ . For the Banzhaf index fixed systems of the type  $(a, b, b, \dots, b)$ , we derive an auxiliary equation and describe almost all fixed systems with an even number of players.

## MPO27. NEWTON'S SHELL & SUPERB THEOREMS

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### **ABSTRACT**

In the first volume of his book "*Philosophiae Naturalis Principia Mathematica*" Newton includes a theorem which states that *if to every point of a spherical surface there tend equal centripetal forces decreasing as the square of the distances from those points, a corpuscule placed within that surface will not be attracted by those forces any way*. And another which, based on the previous, concludes that *a spherically symmetric mass distribution attracts a body outside as if the entire mass were concentrated at the center*. These are the shell (theorem 70) and the superb (theorem 71) theorems and they are what we will cover in our work. We will prove these theorems based on contemporary mathematical approaches and we will also present some of the implementations of these two theorems in mathematics, physics and astronomy.

## **MPO28. Mathematics in architecture**

Author: Amadea Filipović

Mentor: Mara Grašić

### **ABSTRACT**

I always wanted to be an architect. But everyone told me that I couldn't handle math. I think that they're wrong. To be honest, I love math and I am always curious where math is in different things around me. So, I am going to talk about math in architecture. A lot of famous buildings use math and the principals of the Golden Section in their design. For example: Parthenon. A bunch of constructions are calculated by certain calculation methods. Their stability and load-bearing capacity are calculated. Foundations bearing columns, beams and lattice girders are studied. The resistance of the structure to various loads and wind, snow, earthquake and its own weight is studied. All in voices are expressed through formulas or aesthetic calculations.

## **STUDENT PRESENTATIONS IN SCIENCE**

## **SPF1. WIM HOF METHOD**

**Jost Lombardo**

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### **ABSTRACT**

Wim Hof is a Dutchman, known for his incredible endurance stunts and world records. He developed a method, consisting of breathing exercises, cold exposure and meditation, which allows him to withstand extreme temperatures, control his heart rate, raise his body temperature and even influence his immune system with his conscious mind to defend against illnesses. The method is practiced by many world class athletes to increase energy levels and endurance.

I took the method up for a few months, to see, how it would influence my health and overall well-being and it was a very positive experience. In my presentation I go into detail about the science behind the major benefits and why performing these seemingly odd practices can have such a huge effect on the human physiology.

In the first part I will talk about the breathing aspect of the method, how it affects the oxygen to carbon dioxide ratio, blood alkalinity, hormone excretion and inflammation and why it is a beneficial practice.

In the second part I will explain the benefits of gradual and controlled cold exposure. Cold water helps with blood ventilation, increases the number of white blood cells and makes us more alert.

Lastly, I will present the various studies that have proven Wim's claims to be true and how the method can be applied to help patients with various auto-immune diseases.

Follow me, as I explain why I believe this method could change the way we look at our own health, strength and happiness forever.

## **SPF2.SEARCHING FOR A NEEDLE IN A HAYSTACK – GENE EDITING WITH CRISPR CAS9**

**\*Eva Deftera; \*\*Angelos Koutentakis; \*\*\*Daniella Metaxa; \*\*\*\*Nestoras Panayiotou – Ioannou; \*\*\*\*\* Iliana Skordi**

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### **ABSTRACT**

We have crossed a new threshold into a whole new age, perhaps a brave new world, like when Adam and Eve bit into the apple, or Prometheus snatched fire from the Gods. After more than three billion years of evolution of life on this planet, one species (us) has developed the talent and temerity to grab control of its own genetic future. The new Nobel-prize winning “CRISPR Cas9” genetic scissors, are a revolutionary, yet intriguing technology, which will change the face of science, and specifically medicine, and public health as we know it. This new means of editing the DNA of any living being, was adapted from clever DNA sequences found in bacteria and archaea, which ‘snip’ a piece of DNA from invading viruses. Humanity’s eyes have now been opened to a third, momentous era: a life science revolution, a horizon of opportunity to edit DNA sequences, and effectively giving us the power to rewrite the source of life itself.

But what does this truly entail? Are we playing God? What might that do to the diversity of our societies? A few decades from now, if it becomes possible, should we allow parents to make decisions on the appearance of their children – their IQ and muscle strength? Should we let them decide eye colour, skin colour, height? Whoah! Let’s stop for a moment before we slide down this slippery slope. Perhaps we should develop some rules. What if this powerful remedy turns into a lethal weapon that marks the beginning of the end?

## SPF3. NUCLEAR ENERGY

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### ABSTRACT

Energy is abstractly defined by scientists as “the ability to produce work”, meaning the capacity to generate force. Nuclear energy comes from splitting atoms in a reactor to heat water into steam, turn a turbine and generate electricity. Uses of nuclear technology include Agriculture and Food, Medicine, Space Exploration, Water Desalination. In many parts of the world, agricultural workers use radiation to prevent harmful insects from reproducing. When insects cannot have offspring, there are fewer of them. Reducing the numbers of pests and bugs protects crops, providing the world with more food. Nuclear technologies provide images inside the human body and can help to treat disease. For example, nuclear research has allowed doctors to predict precisely the amount of radiation required to kill cancer tumors without damaging healthy cells. Nuclear technology makes deep space exploration possible. The generators in unmanned spacecraft use the heat from plutonium to generate electricity and can operate unattended for years. This reliable, long-term source of electricity powers these spacecrafts, even as they venture deep into space. The World Nuclear Association notes that one-fifth of the world’s population does not have access to safe drinking water and overcoming this challenge. Nuclear energy originates from the splitting of uranium atoms, a process called fission. Nuclear reactors and power plants have complex safety and security features and they produce radioactive waste. Moreover, they do not produce direct carbon dioxide, they are one of the most low-carbon energy sources and they have one of the smallest carbon footprints. Additionally, it's one of the solutions to the energy gap and essential to our response to climate change and greenhouse gas emissions, whilst being reliable and cost-effective.

## **SPF4. CRYONICS: A WAY OUT TO ETERNAL LIFE**

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### **ABSTRACT**

Cryonics is a medical field referring to the practice of freezing cells, tissues or human organs at extremely cold temperatures with the aim of reviving them in the future. The word "cryonics" is derived from the Greek term for "cold". The modern era of cryonics began in 1962 at Michigan college. Physics teacher Robert Ettinger proposed that freezing people may be a way to reach future medical technology. J. H. Bedford was an American psychology professor at the University of California and was the first person whose body was cryopreserved after legal death (1967). In 1991, when removed from storage to be evaluated, his body was found to be preserved but damaged. Many biological specimens have been cryopreserved and revived; these include whole insects, vinegar eels, many types of human tissues (e.g., brain tissue) and a few small mammalian organs. Increasingly more cells, organs and tissues are being reversibly cryopreserved. However, there are three challenges for this future technology to overcome. It'll need to repair the damage done by freezing, cure whatever ailment originally killed the subject, and reverse the ageing process so that the subject has a young, healthy body. The current study will focus on the past, modern and future applications of cryonics, the fundamental processes and ethical aspects.

## **SPF5. TOWARDS A NEW ERA IN MEDICINE: 3D PRINTING OF HUMAN ORGANS**

**Karali Ioanna\*, Psarogiorgou Vasiliki\*\*, Vonatsou Evangelia\*\*\***

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### **ABSTRACT**

3D printing is the process of converting digital files into three dimensional objects. It was invented in Japan in the early 1980s and recently has deemed to be of vital essence in the medical world. Some of the first attempts of 3D printing in healthcare were dental implants and custom prosthetics in the 1990s. However, the first ever 3D printed limb was made and implanted in 2008. Since then, 3D printing has been involved in the bioprinting of tissue as well as both the production of external and internal prosthetics. Such examples are the novel 3D printable blood plasma bio-ink, by the Irish RCSI university or the first human prosthetic eye by the Moorfields eye hospital in Finsbury, London. It is further envisioned that soon this revolutionary technology will be able to print high precision, patient-oriented organs and maybe even cure common diseases, like diabetes or cancer. Therefore, organ transplants will become way more accessible and neither shortage nor incompatibility will pose further issues as well as death and rejection rates, which will decrease significantly. These will consequently diminish associated costs and surgeries will become easier as so to reduce time, effort, and hands in need. Despite the advantages, the materials used for this purpose are a major obstacle, as they are very limited and cannot fulfill all requirements. Some of those include their form, their biocompatibility, or their sterilization stability. Additionally, there are some moral and legal issues that need to be considered, that are mostly associated with the donor's consent and rights, along with the use of human embryonic stem cells. In conclusion, it is believed that in several years from now, this exciting new era of medicine will enable us to regenerate damaged or failing organ systems causing people to live longer and improve the quality of life.

## **SPF20. CONCENTRATED SOLAR ENERGY**

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### **ABSTRACT**

The Concentrated Solar Energy (CSE) technology uses the Sun's energy to generate electricity. Its main advantage is sustainability, as well as environmental friendliness thanks to its low CO<sub>2</sub> emissions. It also presents a higher ratio of solar to electrical energy produced, compared to producing electricity via photovoltaic panels. On the other hand, concentrated solar energy plants are more complex and require more maintenance than solar panel systems.

The CSE concept involves focusing solar energy through mirrors, and producing heat that is then used to heat up a fluid, transform it to steam and drive turbines that produce electricity.

In our presentation we strive to describe the general principles, and highlight the method's advantages, for countries with a high percentage of sunny days over the year. We also present the various set ups and forms, as well as the uses, applications and combinations of CSE systems proposed and applied in several areas of the world.

The current, worldwide energy crisis provides an extra incentive for such alternative, sustainable and environmentally friendly options to be developed and exploited

## **SPO6. CREATING AN EARTH-LIKE ATMOSPHERE ON MARS**

**Kaloudis Aristomenis \*, Kaloudis Sevastianos \*\*, Koutsoumpas Markos \*\*\*,**

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### **ABSTRACT**

Creating an atmosphere on Mars, an ambitious dream or a feasible mission?

During the late 20<sup>th</sup> and 21<sup>st</sup> century, people are witnessing the earth's gradual demise. Unfortunately, for the sake of humanity's survival, we might have to consider other planets for establishing a living settlement. For this purpose, we could possibly examine other planets in our solar system, such as Mars, as the best candidates for human colonization. However, even if we are able find safe ways to reach these planets, in order to survive, two critical factors are required, water and an oxygen rich atmosphere. The main function of an atmosphere is to keep the water and oxygen accessible for living organisms habiting on the planet. In order to recreate an atmosphere with an oxygen rich structure, we need to overcome some basic obstacles. First of all, loads of oxygen and water would be required in gaseous state. This task could be accomplished by turning solid fine regolith found in the surface of Mars, also known as Martian soil, into breathable air or water combined with hydrogen. There is hard evidence that Martian soil can be turned into oxygen and other byproducts through a chemical process called electrolysis. This is the initial step towards human colonization of other planets, where experimental colonies could be settled, offering an alternative for the survival of human race in the case of earth's irreversible ecocide.

## **SPO7. OXYGEN GAS-FILLED MICROPARTICLES**

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### **ABSTRACT**

Is it possible for humans to stay underwater for long time periods without breathing equipment? It is widely known that the majority of living organisms demand oxygen in order to continue to exist. The oxygen enters the lungs and settles inside the air sacs. Afterwards it moves across paper-thin walls to tiny blood vessels, capillaries, and into the blood stream where the veins carry it around the body. In many cases, organisms do not have direct access to oxygen and thus their life is put at risk. Science and technology could offer a possible solution. Scientists have developed a microparticle intravenous injection, foam suspension, which is a lipid based Microparticle encapsulating a core of pure oxygen gas. This injection delivers the oxygen directly into the bloodstream. Once the Microparticles are injected into the blood, the living organisms are in no need of oxygen for at least 15 minutes as the oxygen is already in the organism's veins. The impact of this discovery can shape the scientific field of human physiology and more importantly save lives in life-threatening situations. Underwater breathing for a longer period of time can make some peoples' dreams come true by exploring freely the seabed of the ocean without having to worry about oxygen. However, the main question still remains, will human kind be able to safely utilize this breakthrough and why haven't we heard about it yet, does the use of it involve any unknown risks for the human respiratory system?

## SPO8. PROSTHETIC LIMBS IN SPORTS

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### **ABSTRACT**

Have you ever imagined the possibility of athletes with prosthetic limbs to be able to surpass the able-bodied ones? A prosthetic limb is not only a technical aid for people with a part loss or congenital limb absence but can also be a mean to perform at top level athletic events. The technological improvements in the scientific fields of mechanical engineering, material science and physics have made possible the construction of prosthetic limbs that enable amputee athletes to compete in athletic events, even against able bodied ones. Prosthetics have come a long way since the "Cairo Toe", the earliest known prosthetic, dating possibly around 950 B.C. It was discovered in Cairo on the mummified body of an ancient Egyptian noblewoman. The first prosthetics were mainly made of wood and its components were bound together with leather thread. The technological improvements lead to dramatically improving the prosthesis' construction materials. Nowadays, almost all types of prosthesis are constructed out of carbon fiber and are composed of three main components: suspension, pylon and socket. The main purpose of this focused review is to improve the reader's knowledge on the advancement of constructing methods of athletic prosthetic limbs and the possibilities they offer to amputee athletes to improve their performance, even beyond able-bodied ones.

## **SPO9. THE EFFECTS OF MUSIC IN THE HUMAN ORGANISM**

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### **ABSTRACT**

Can music improve our everyday life, beyond just mood changing?

The vast majority of people believe that music can only make you happier or more depressed, depending on the genre or the tune, you are listening to. According to multiple scientific studies, it has been proven that a wide variety of music genres can influence your body functions and brain activity in multiple ways. For example, 9 out of 10 people's heart rates are increasing when listening to pop music without doing any other activity. Furthermore, listening to music can enhance memory, decrease stress levels, decrease fatigue and even reduce anxiety levels. Listening to specific music genres can also result in the avoidance of superficial mistakes, make working process more productive and enhance sports performance. However, is there hard scientific evidence to support those claims? In this paper we attempt to examine the physical properties of sound waves and how combining them can create music tunes. Moreover, listening to specific sound frequencies, relating to different music genres, can activate brain functions responsible for producing certain neurotransmitters and hormones, regulating our mood and behavior. Ultimately, our goal is to determine how much can music possibly affect aspects of our lives and how we can incorporate it in order to become the best version of ourselves.

## **SP10. ONLINE - INVESTIGATING THE ROLE OF THE COSMIC RAYS ON AEROSOLS AND CLOUDS, AND THEIR IMPACT ON CLIMATE**

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### **ABSTRACT**

Nowadays, we observe a significant change in the global temperatures, climate, weather patterns, and prolonged atmospheric conditions. Those circumstances impact not only the environment but also the economy, social relations, demographics, and migration in certain regions. An aspect that is not yet fully understood is specifically the effect of cosmic rays on the formation of clouds and consequently the climate. The CLOUD experiment conducted at CERN is an experiment working on better comprehending this situation. In our research, we will be making a review of the papers based on the result of the CLOUD experiment. Furthermore, using other sources we will try to answer the question of whether the cosmic rays really do have a significant impact on climate change.

## **SPO11. ONLINE LIVESTOCK ODOR PROBLEM IN JEJU ISLAND**

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### **ABSTRACT**

Jeju is the largest island in South Korea that manages to have the best quality of the natural environment. Its ocean is so clean that the bottom of the beach can be observed easily. Unfortunately, the strength of this island has been losing its power. The livestock living in Jeju, such as pigs, horses, and cows, are causing terrible odor problems. Thousands of tons of livestock manure and waste are left unattended even though those should be properly disposed of in excreta treatment facilities. The various harmful components of the manure are absorbed into the ground, eventually reaching the underground water. The bacteria in their manure can cause health problems when the underground water is consumed by people. For example, giardia in animal waste can be spread through water and cause stomach ache and dehydration. The chemical components in the manure can also cause another problem. The underground water does eventually reach the beach after all and the components, such as ammonia, hydrogen sulfate, and methane, generate stinky odors in the beach. In an attempt to solve these problems, researchers have developed a “flushing” system which pumps up the unpolluted water from deeper parts of the underground and mixes two chunks, resulting in a tolerable level of chemical concentration.

## **SPO12. ONLINE - BENEFICIAL INSECTS**

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### **ABSTRACT**

We have had many misunderstandings about insects. We often think all insects are filthy, harmful, and not likable to humans. Indeed, there are quite many insects on Earth, like mosquitos and grain beetles, which can cause disease and harm to people, plants, and animals. However, there are also numerous insects which can be useful, beneficial, and even indispensable for many aspects of our lives. They can serve as bug predators and natural pesticides, which are not as toxic as chemical pesticides. Therefore, they can be used in the farms and gardens to protect crops and plants. Insects, such as ladybug, praying mantis, ground beetles, green lacewings, and many more are well known for natural pest control. Moreover, insects are the greatest pollinators who are responsible for about 80% of pollination of the flowering plants on Earth. Among those insect pollinators, the honey bees alone are in charge of 80% of pollination. Now these honey bees are disappearing due to pests and diseases, habitat loss, climate change, and many more threats caused by humans. In this paper, I present my investigation about how insects can be beneficial and our efforts to bring the honey bees back.

# **SPO13. ONLINE - HOW CAN WE SOLVE A CRIME USING FORENSIC SCIENCE?**

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## **ABSTRACT**

9.11 Terror. The Night Stalker. Jack the Ripper. These are some examples that used forensic science to crack the crime and find the criminal. Forensic science is the application of scientific principles and techniques to matters of criminal justice by collecting, examining, and investigating physical evidence left at the crime scene. It can be widely used to solve serious crimes by detectives, police officers, and forensic scientists working in crime labs. It can also be used by students like us to solve petty crimes. We have researched how forensic scientists collect and analyse several pieces of physical evidence including hair, bloodstains, fingerprints, DNA, and digital data in an attempt to solve crimes and we have created imaginary crime scene scenarios. For instance, you find that there is a big mess and something from your living room is missing when you get home. There are unusual footsteps on the floor and fingerprints on the glass coffee table. Who's done this? You can start to investigate the scene by using the fingerprints which can be gathered and examined by a fingerprint identification database to look for culprits. In our presentation, we are going to use another story involving an idiotic old man and a car to entertain and explain the world of forensic science to our audience.

# **SPO14 ONLINE - ADVANTAGES & DISADVANTAGES AND THE FUTURE OF GENETICALLY MODIFIED CROPS (GM CROPS)**

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## **ABSTRACT**

Genetically modified organisms (GMOs) are organisms that have been modified and remodeled in heritable genetic material by genetic engineering methods. For several decades, genetically modified animals and plants have been widely developed and used for research purposes and food production, respectively. There are several benefits of creating GMOs, especially crops (GM crops): Producing GM crops can lead to a more efficient way of farming and consistent standard qualities of crops. GM crops do not require many resources, such as water, land and fertilizer, and therefore, there is less destruction of the environment and reduced emission of carbon dioxide. In addition, GM crops can be disease- and pest-resistant, so the use of pesticides, vital for farming to keep the crops safe from the pests, can be minimized. However, some GM crops have disadvantages: They can cause harm to humans by triggering allergic reactions, changing the nutritional contents in the food, and increasing chances of getting diseases such as cancer. In this presentation, we investigate the advantages and disadvantages, as well as the potential future impact of GM crops.

# **SPO15. ONLINE - THE EFFECTS AND SIGNIFICANCE OF L-DOPA IN PARKINSON'S DISEASE**

**Sion Park<sup>\*</sup>, Chaeyoung Sohn<sup>\*\*</sup>, Joonhee Kim<sup>\*\*\*</sup>, Minjae Lee<sup>\*\*\*\*</sup>, Gyeongrok Hwangbo<sup>\*\*\*\*\*</sup>**

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## **ABSTRACT**

Parkinson's Disease is one of the common neurodegenerative disorders first described by James Parkinson in Essay on the Shaking Palsy in 1817. This slowly progressive disease is known to occur due to a low level or a lack of dopamine, a neurotransmitter in the brain, which plays an essential role in motor control. Parkinson's disease is caused by a combination of genetics, aging, and environmental conditions. A number of genes have been identified to be connected to Parkinson's disease. Environmental factors including traumatic head injuries, pesticides, rural living, dairy products intake and heavy metal exposures are also known to increase the risk of the disease. Parkinson's disease causes both motor and nonmotor symptoms and some of the typical clinical features include bradykinesia (slowness of movement), resting tremor, rigidity, and postural instability. Diagnosis of the disease is mainly based on history and physical examination. There is no cure for the disease, and therefore, the goal of the treatment is to slow or stop the neurodegenerative process. Some of the medications have been developed to improve patients' quality of life. L-dopa, also known as levodopa or 4-dihydroxyphenylalanine, is the main drug that is used to treat symptoms of Parkinson's disease. L-dopa is used to improve the movements of patients; by replacing dopamines with themselves, L-dopa effectively controls dopamine-induced bradykinesia, a common symptom of Parkinson's disease. In this presentation, we closely investigate the effects and significance of L-dopa and its usage to treat Parkinson's disease.

## **SPO16. ONLINE - CURRENT ADDRESS OF MEDICINE FOR VARIANTS OF TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHY**

**Byungjun Kwon\***, **Doyoon Lee\*\***, **Hosung Lee\*\*\***, **Kijoo Yoon\*\*\*\*** Cornerstone Collegiate Academy of Seoul

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### **ABSTRACT**

Encephalopathy, a type of certain disease that affects the function and structure of the brain, was once a rising issue as being one of the deadliest illnesses that humans can obtain. Bovine Spongiform Encephalopathy (BSE), widely known as mad cow disease, is a type of encephalopathy that has affected numerous people: it had its epidemic peak in 1993 with 100,000 confirmed cases, especially in Great Britain. Mad cow disease is known to be caused by contaminated cow meat which contains prion, an abnormally folded protein. This misfolded protein, prion, shortened for proteinaceous infectious particle, spreads like a virus and demolishes normal brain proteins which later worsens to tissue damage and cell apoptosis. Similarly, Creutzfeldt-Jakob disease (CJD), a neurodegenerative disorder leading to dementia in humans, has been believed to be caused by prion protein. Therefore, both diseases BSE and CJD are grouped as Transmissible Spongiform Encephalopathy, TSE. Furthermore, the fatality rate for both BSE and CJD is 100% with no medicine available that can cure the underlying condition. Therefore, in our presentation, we will mainly discuss the current address of curing the TSE and the possible treatments.

## **SPO17. Science and the environment**

Group members: Hong Ji Eon, Kim Yu Gong, Kuk Seo Jin, Kim Min Seok

Singapore International School

### **ABSTRACT**

The purpose of our topic was to improve awareness of bees. To a lot of people bees are just seen as another insect flying around, but they do so much more than just flap their wing and smell flowers.

Bees play an important role in our environment. We need bees. Bees are perfectly adapted to pollinate, helping plants grow, breed and produce food. They do so by transferring pollen between flowering plants and therefore keeping the cycle of life turning. But bees are in trouble. There's growing public and political concern at bee decline across the world. This decline is caused by a combination of different factors from the loss of habitat and food sources, exposure to pesticides and the effects of climate breakdown.

Although they're little, bees are important, and many other species depend on them for survival. Put simply, we cannot live without bees.

Bee nice and to care of the bees.

## **SPO18. Bernoulli principle**

Group members: Su-ho Jang, Hyeon-woo Gil

### **ABSTRACT**

One day, while playing with a friend, I found a balloon floating in the air. There was an air purifier under the balloon. We thought that the wind of air purifier had caused the balloon to float in the air. We used a hair dryer to inflate a balloon and it floated in the air. It was a due to Bernoulli's theorem.

The purpose of our presentation is to introduce the "Bernoulli principle" using an easy to understand example from everyday life. The Bernoulli principle states that an increase in the speed of a fluid occurs at the same time along with a decrease in pressure of that fluid. This principle is named after Daniel Bernoulli who published this idea in a book called "hydrodynamica" in the year 1738.

The Bernoulli principle is an important concept that can be observed in nature around us and is very useful for people to apply to technologies in everyday life.

For example, the Bernoulli principle is the key that allows airplanes to fly. The top of an airplane wing is curved and the bottom of an airplane wing is flat. The air on the top of the wing and the air on the bottom of the wing take the same time to move from the front of the wing to the back of the wing. This means that the air on the top of the wing has to travel faster to go to the back of the wing than the air on the bottom of the wing. The faster moving air creates a lower pressure on the top of the wing. The higher pressure on the bottom of the wing pushes the plane up, up, up, into the sky and the plane can fly.

## **SPO19. All about clocks**

Group members: Yoon-seo Kwon, Ju-ha Park

### **ABSTRACT**

How could we know the time in the ancient times when there were no clocks as in the present? We found watches had used in the past.

It's called a "Sundial" that uses shadows to measure time. The sundial cannot be used in the evening when there is no shadow.

There was another kind of clock in the ancient. It's called a "Water clock"

The water clock can tell the time even in the evening. The water clock counts time by the amount of flowing water.

We did our rearch on the watches the principles of the sundial and water clock used in the past.

## **EUROMATH & EUROSCIENCE WORKSHOPS**

## **WSF1. WHAT ARE TV-SHOW MATH TASKS?**

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### **ABSTRACT**

The educational scientific entertaining TV-show “Rocket 69” has been airing in Estonia for 10 years. It has continued to grow in popularity over the years, attracting young people (15 years and up) to science, technology, engineering, and mathematics (STEM). TV-show contestants need to solve tasks in groups or individually, and all tasks require creativity, theoretical scientific knowledge, and ability to use it in practice.

Tasks from this TV-show are used more and more on a school level. Also, STEM-subject teachers generate their own ideas to create team-tasks for their classes in the “Rocket 69”-format.

During the workshop, a group of teachers from Estonia will first present the format of this TV-show, which was elected the best educational TV-contest in Europe in 2012, and analyze with the workshop participants some examples of “Rocket 69” tasks. The math problems that were created by one of the workshop teachers and used in “Rocket 69” show will also be presented.

Then the attributes of suitable TV-show tasks will be discussed. For example, during the solving of the task the contestants need to apply integrated skills, a group task should be solved faster in a team, there should be several possible ways for solving the task and for evaluating the result, the solution process should have a visual effect that is understandable to the viewers and so on.

In the last part of the workshop, participants will be able to try their hand at solving some math “Rocket 69”-format tasks in groups.

## **WSF2. ESCAPE (CLASS)ROOM**

**\*Mara Grašić, \*\*Ksenija Varović**

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### **ABSTRACT**

Students learn best when they invest themselves in the lesson at hand. What is the better way to break away from the classic learning environment than with a escape (class)room?

Escape (class)room is a thematically assigned mission in which a group of students in a certain period of time must solve a series of unusual tasks, puzzles and logic tasks. The game will allow them to experience a unique, mysterious challenge and fun with the impression that they have entered another world.

The emphasis will be on the adoption of cooperative learning strategies or teamwork. Through this workshop, students will learn how to unite the individual potentials of students into a collective whole.

## **WSF3. A mission to Mars!**

**Eleni Papageorgiou, Ph.D., Teacher Trainer in Mathematics, Cyprus Pedagogical Institute**

**Giorgos Tsalakou, Ph.D., Teacher Trainer in Science, Cyprus Pedagogical Institute**

### **ABSTRACT**

The purpose of this workshop is to encourage students to participate in a set of exciting STEAME hands-on activities, in order to organize a space mission to Mars. Students will have the opportunity to investigate and study the potentials for Mars to host life, so that the possibility of building a new human community there can be established. Furthermore, they will design and test parachute landing systems to successfully land a probe on target and study parachute's motion by the use of a specific software. In addition, they will create their own coded message on their parachute, like NASA's Jet Propulsion Laboratory (JPL) designers did. Finally, they will build a paper helicopter, like the one NASA's Perseverance Mars rover carried to the surface of Mars, and they will create a video game that will enable players to explore the Red Planet with the helicopter.

## **WSF4. Ε Π Ι – STEAME**

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### **ABSTRACT**

This Workshop, focusing on Mathematics, refers to Pythagoras methodology, where Science, Technology, Engineering, Arts, Maths and Entrepreneurship (STEAME) but also Logistics, Ethics, Environmental Studies, History were taught in his School, leading students to Philosophy.

Using alternative teaching and learning methods and also gamefication, during the workshop, results are expected to be even better.

The term "ΕΠΙ-STEAME" is suggested, which adds to the Latin name "STEAME", the greek letters: Ε [ ΕΠΙΜΕΛΕΙΑ (Logistics) ], then three consecutive Πs [ ΠΕΡΙΒΑΛΛΟΝ (Environment), ΠΑΙΧΝΙΔΙ (Game), ΠΑΙΔΕΙΑ (Education, which is offered by the family environment, in other words ΕΝΤΙΜΟΤΗΤΑ (Ethics) ] and the letter "Ι" [ ΙΣΤΟΡΙΑ (History)]. The acronym "ΕΠΙ-STEAME" (combination of greek and latin letters) can be pronounced as "ΕΠΙ-STIMI" ("ΕΠΙΣΤΗΜΗ"), meaning "SCIENCE", in Greek.

I apply "ΕΠΙ-STEAME" approach for about four decades. A relevant project is "MOSSAiC" ("Mathesis (Learning) On Saturday (and) Sunday, Arts, imagination, Creativity"). Meetings with students anywhere discussing and exchanging ideas on various themes related to: Ethics, Arithmetic, Geometry, Stereometry, Astronomy, Physics, Chemistry, New Technologies, Environment, Mythology, History, Geography, Arts (Playing music and singing, drawing, painting, poetry, theatre etc.), History of Philosophy, More positive verbal communication, time management, the importance of Logistics in everyday life plus more, without the children having any sort of homework. We also use geometric instruments and some engineering and/ or agriculture tools during practical sessions. Visiting places of importance, meeting remarkable people and participating in public events is a must.

All "MOSSAiC" members love each other, truth, happiness and optimism.