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A complete classification of endomorphisms of Kiselman's semigroup

Predavatelj: Luka Andrenšek, *Univerza v Ljubljani, Fakulteta za matematiko in fiziko*

Kiselman's semigroup K_n was introduced in the context of convexity theory and later studied in algebraic combinatorics. Kudryavtseva and Mazorchuk posed the open problem of classifying all endomorphisms of K_n, which remained unresolved. We present a complete description of the endomorphism monoid $\mathrm{End}(K_n)$. We construct a Boolean matrix monoid $(D_n, \cdot)$, consisting of $n \times n$ matrices over $\{0, 1\}$ avoiding the 2×2 permutation matrix $P = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ as a submatrix, and show that $\mathrm{End}(K_n) \cong (D_n, \cdot)$. The classification proceeds via an intermediate monoid $(M_n, *)$ of so-called monotone sequences of subsets of $\{1, \ldots, n\}$, which captures the combinatorics of idempotents in K_n. These sequences are in bijection with Boolean matrices in D_n via characteristic vectors, preserving monoid structure. As corollaries, we recover the known result that $\mathrm{Aut}(K_n)$ is trivial, and compute the cardinality of $\mathrm{End}(K_n)$ for small n via existing results on pattern-avoiding matrices. This resolves an open problem and reveals a rich combinatorial structure underlying $\mathrm{End}(K_n)$.

Holomorphic symmetries of the Markov equation

Predavatelj: Rafael Andrist, *University of Ljubljana*

The Diophantine solutions of the so-called *Markov equation* $x^2 + y^2 + z^2 = 3xyz$ were originally considered by Markov in 1879. The solutions (x, y, z) in the natural numbers are called *Markov triples*. Later, this equation was studied over the complex numbers in algebraic geometry: The group of algebraic symmetries is discrete and acts transitively on the Markov triples. Research about the Markov equation has remained a very active area in both number theory and geometry until now. We describe the group of holomorphic symmetries. In contrast to the algebraic case, this group is infinite-dimensional and interpolates any permutation of (ordered) Markov triples.

Slovenian mathematicians / analysis of bibliographic networks from OpenAlex

Predavatelj: Vladimir Batagelj, *IMFM, Ljubljana, UP FAMNIT, Koper, UL FMF, Ljubljana*

OpenAlex (https://openalex.org/) is a newer and freely available bibliographic database that covers a much larger number of publications than similar paid services such as Web of Science and Scopus. It also provides programmatic access (API) to the data.

From the OpenAlexa data, we created bibliographic networks (citations, authorship, journals, keywords, countries, year of publication, etc.) for works with mathematical content and Slovenian co-authors. We will present some results of the analysis of these networks. More detailed results (and data) will be available at https://github.com/bavla/OpenAlex/tree/main/ex/SImat

From Passive Practice to Cognitive Activation: Fostering Deeper Mathematical Understanding

Predavatelj: András Bátkai, *PH Vorarlberg, Austria*

The goal of intelligent practice and cognitive activation in mathematics education is to move students beyond rote memorization and towards a genuine, deeper understanding of concepts. Modern educational theories, such as constructivism and constructionism, suggest that learning is most effective when students actively construct their own knowledge. Research shows that methods like "learning by explaining" can significantly enhance cognitive engagement, as they require learners to structure and articulate their understanding of complex topics.

This talk will first explore key findings from the educational literature on cognitive activation and self-determination theory, highlighting how student-centered approaches can foster motivation, self-confidence, and a more robust grasp of mathematical concepts. We will then present a case study from our recent research, which introduced

an innovative homework format for linear algebra students. Instead of traditional written submissions, our students were tasked with creating their own explainer videos to demonstrate their solutions.

The results of our mixed-methods study, featuring quantitative surveys and qualitative interviews, reveal that students found this video-based approach to be highly cognitively activating. The process not only improved their technical and media literacy skills but also positively impacted their self-perceived understanding and self-confidence in the subject. We will discuss the differences in perception between students and instructors regarding the benefits and challenges of this method, offering insights into its potential and areas for future optimization. We conclude by showing how this method can serve as a powerful tool to empower future educators and prepare them for the challenges of a digital world.

On chaotic planar attractors

Predavatelj: Jernej Činč, *University of Maribor & ICTP Trieste*

Soavtor: Piotr Oprocha, *University of Ostrava*

Dynamical systems theory provides a rigorous framework for studying complex phenomena arising in physics and engineering. A famous example is the Lorenz system, introduced in the 1960s as a simplified model of fluid convection derived from the Navier–Stokes equations. Its solutions, known as Lorenz attractors, became a paradigm of chaotic dynamics and inspired the notion of the "butterfly effect" —small changes in initial conditions can lead to drastically different long-term behavior. Since then, parameterized families of chaotic attractors have been one of the central topics in dynamical systems.

We are particularly interested in the study of planar attractors and the question: which attractors appear *typically* in certain systems and can they be discovered through physical experiments?

A surprising answer in a particular setting comes from the pseudo-arc. Together with the arc, it is the only planar continuum (that is, a compact connected metric space) in which every proper subcontinuum is homeomorphic to the whole continuum (Hoehn–Oversteegen, 2020). First described about a century ago, the pseudo-arc has remarkable structural properties and arises typically in several topological contexts. In this talk I will present a result which reveals that pseudo-arc is a generic object within natural families of attractors arising as extensions of dynamical systems on interval. This is joint work with Piotr Oprocha (University of Ostrava).

Prvih 25 let tekmovanja dijakov srednjih tehniških in strokovnih šol v znanju matematike in zanimanje dijakov za tekmovanje

Predavatelj: Lovro Dretnik, *Gimnazija Poljane*

Tekmovanja v znanju matematike imajo v Sloveniji dolgo tradicijo, saj je bilo prvo tekmovanje v znanju matematike izvedeno že leta 1950. Tekmovanje se je nenehno razvijalo in v letu 1985 doživelo korenite spremembe, saj je bilo v tem letu uvedeno šolsko tekmovanje tudi za učence, ki so obiskovali šole, kjer matematika ni bila tako poudarjena, ipd. Danes na tekmovanju sodelujejo učenci od 1. razreda osnovne šole, do 4. letnika srednje šole.

Ker se je v srednji šoli pojavila potreba po diferenciaciji tekmovanja zaradi različnih programov srednjega izobraževanja, je bilo v letu 2001 prvič izvedeno tekmovanje v znanju matematike v treh nivojih zahtevnosti. K že uveljavljenemu tekmovanju srednješolcev v znanju matematike za Vegova priznanja –kat A, je bilo uvedeno še tekmovanje dijakov srednjih tehniških in strokovnih šol v znanju matematike –kat B in tekmovanje dijakov srednjih poklicnih šol v znanju matematike –kat C.

V prispevku se bom osredotočil na tekmovanje dijakov srednjih tehniških in strokovnih šol v znanju matematike –kat B, katerega član sem že od leta 2008, od leta 2015 pa tudi njen predsednik. Povzel bom prvih 25 let obstoja tega tekmovanja, posegel z informacijami o zanimanju za tekmovanje in kako se je tekmovanje tekom let razvijalo, spreminjalo.

Raziskovanje lastnosti nitnega nihala

Predavateljica: Andreja Eršte, *Srednja šola Josipa Jurčiča Ivančna Gorica*

V prispevku je opisana raziskava, v kateri je 86 dijakov tretjih letnikov gimnazijskega programa pri pouku fizike spoznavalo lastnosti nitnega nihala s pomočjo izkustvenega učenja. V uvodu so predstavljene vsebine, ki jih pri nihanju obravnavamo v srednji šoli, ter motivacija za izbiro izkustvenega učenja ter učenja z raziskovanjem pri obravnavanju nove učne snovi. Nato je predstavljena odprta laboratorijska vaja, pri kateri so dijaki v parih raziskovali lastnosti nitnega nihala. Na podlagi svojega predznanja in predstav o nihanju so si zastavili več hipotez, ter zasnovali poskuse s katerimi so svoje hipoteze potrdili ali ovrgli. Zanimivo je, da se več kot tri četrtine parov pri postavljanju prve hipoteze osredotoča na napovedovanje funkcijske odvisnosti med fizikalnimi količinami ter analizo podatkov z grafom. Sledila bo analiza dela dijakov, laboranta in profesorice fizike pri celotnem učnem procesu, s poudarkom na vpliv raziskovanja na razumevanje učne snovi. Dijaki so imeli na odprto laboratorijsko vajo pozitiven odziv, večina se je s tem tipom dela srečala prvič; v njihovi samoevalvaciji prevladuje mnenje, da znanje pridobljeno z raziskovalnim in izkustvenim učenjem obdržijo dlje časa in pojav bolje razumejo. Na podlagi pridobljenih podatkov in odzivov, so v zaključku opisane možne izboljšave za prihodnjo uporabo izkustvenega učenja pri pouku fizike.

Surfaces in the d-Cube

Predavatelj: Dejan Govc, *Faculty of Mathematics and Physics, University of Ljubljana*

Soavtorja: Andrea Aveni, *University of Copenhagen*; Erika Roldan Roa, *Max Planck Institute for Mathematics in the Sciences, Leipzig*

Triangulating a surface means finding a subcomplex of a simplex that is homeomorphic to the surface. Vertex-minimal triangulations of closed surfaces have been characterized in classical work of Jungerman and Ringel.

The corresponding problem for cubes has been much less studied. Notably, Coxeter found surfaces in the d-cube of maximal possible genus and Schulz gave bounds on the dimension of the cube required to realize a particular surface as a subcomplex. These latter bounds are tight for orientable surfaces and nonorientable surfaces of even demigenus $k \geq 12$, while for surfaces of odd demigenus they may be off by one.

In the cubical case, minimizing the embedding dimension is not equivalent to minimizing the number of vertices, and finding vertex-minimal cubical realizations of surfaces remains poorly understood. We provide new theoretical bounds for this problem and, using computational methods, give a complete enumeration of connected closed surfaces in the 5-cube. We find that there are 2690 isomorphism classes of such surfaces. As a consequence, we obtain the minimal f-vectors of these surfaces in the 5-cube and complete Schulz's characterization for the even demigenus case, while discovering some new examples in the process.

Bézier diagonals

Predavatelj: Domen Gradišek

The topic of the lecture is Bézier curves and surfaces. The main goal is to determine the diagonals on Bézier surfaces in the following sense: it will be shown that diagonals are Bézier curves, and the relationship between their control points and the control points of the surfaces will be established. Furthermore, conditions are derived under which two arbitrary curves are diagonals of a Bézier surface. Finally, a class of surfaces with identical diagonals is determined, and how this class changes when, in addition to conditions on the diagonals, further constraints on the boundary of the surface are imposed.

Kalejdoskopi in dualnost poliedrov

Predavatelj: Izidor Hafner, *upokojenec*

Poliedrski kalejdoskopi omogočajo predstavitev poliedra z izdelavo le manjšega dela poliedra. Oglišča dualnega poliedra dobimo tako, da na sredino ustreznega kalejdoskopa vstavimo kroglico. Z vstavitvijo kroglic si lahko predstavljamo tudi molekule. Lahko si pomagamo tudi z risbo. Izdelava kalejdoskopov je tudi zanimiv eksperiment za učence.

Biholomorphic Invariants and Jet Determination/Parameterization in CR Geometry

Predavatelj: Ahmad Hussein, *Inštitut za matematiko, fiziko in mehaniko*

A very brief motivation for a problem of interest in CR Geometry: the finite jet determination/parameterization of automorphisms of real, smooth, strongly pseudoconvex hypersurfaces in $\mathbb{C}^n$, approached via stationary disks. In as much as time allows, I will mention some methods I am currently exploring to further our understanding of this problem. Due to time constraints, the discussion will remain informal

On Pythagorean-hodograph curves and their applications

Predavateljica: Marjetka Knez, *University of Ljubljana, Faculty of Mathematics and Physics*

Polynomial Pythagorean-hodograph (PH) curves, characterized by the property that their unit tangent is rational, have many important features for practical applications. Planar PH curves are important since they admit rational offset curves, which are useful in computer-aided design and manufacturing. Spatial PH curves are especially interesting because their construction from a quaternion preimage curve allows one to equip the curve with a rational orthonormal adapted frame which makes these curves an efficient tool for motion design applications. Another key advantage of the polynomial PH curve is that its arc length function is also a polynomial. This property significantly simplifies the computation of PH curves with prescribed length and allows simple real-time interpolator algorithms, making PH curves useful in robotics as well. In the talk we give an overview of various PH construction algorithms and methods, supported by numerical examples that illustrate their efficiency, present some recent developments and future challenges.

Explicit geometric construction of triangle-free Ramsey graphs

Predavatelj: Matija Kocbek, *Fakulteta za matematiko in fiziko, Univerza v Ljubljani*

We describe an explicit geometric construction of a vast parametrized family of graphs without k-cliques with bounded independence number generalizing triangle-free Ramsey graphs described by Codenotti, Pudlák and Resta and provide a new combinatorial proof for the upper bound on the independence number of the latter. We focus on triangle-free graphs and describe some families of such graphs with n vertices and independence number $O(n^{\frac{2}{3}})$ which give us a constructive asymptotic lower bound $\Omega(t^{\frac{3}{2}})$ for Ramsey numbers $R(3,t)$ which achieves the best known constructive lower bound. We describe an additional family of graphs that don't match the best known bound but still have a polynomial independence number with regards to the number of vertices and are based on Euclidean geometry. We determine a necessary condition for parameters for which this family of graphs could yield better constructive asymptotic lower bounds on $R(s,t)$ than those currently known, again focusing on $R(3,t)$. We also present a linear approximation algorithm for finding the largest independent set in this parametrized family of graphs which is a $\frac{1}{2}$-approximation algorithm for a significant subfamily.

Self separating properties of sets

Predavateljica: Maruša Lekše, *Institute of Mathematics, Physics and Mechanics, Ljubljana*

Soavtorji: Kamilla Rekvényi; Marco Barbieri; Primož Potočnik

Let G be a transitive permutation group of degree n. Let $\mathbf{m}(G)$ be the largest integer such that, for every set A of this size, we are guaranteed the existence of a permutation $g \in G$ such that $A \cap A^g$ is empty. By Neumann's Separation Lemma, we know that $\mathbf{m}(G) \geq \sqrt{n}$. Experimental evidence suggests that, unless G contains a large alternating subgroup, $\mathbf{m}(G)$ grows asymptotically as $\mathcal{O}(\sqrt{n})$. We discuss for which families of permutation groups we can currently establish this expected bound.

This is joint work with Marco Barbieri, Kamilla Rekvényi and Primož Potočnik.

Prenova učnega načrta za matematiko: teoretična ozadja in didaktične usmeritve

Predavateljica: Vida Manfreda Kolar, *University of Ljubljana, Faculty of Education*

Predavanje obravnava teoretična izhodišča in didaktične smernice prenovljenega učnega načrta za matematiko v osnovni šoli, s poudarkom na postopnem oblikovanju abstraktnih matematičnih pojmov ter na vlogi reprezentacij pri razvijanju razumevanja in prenosu znanja. Temeljna izhodišča črpamo iz operativno- strukturnega pojmovanja abstraktnih matematičnih konceptov, Sfardine teorije reifikacije ter Tall in Vinnerjeve teorije konceptne slike.

Na treh vsebinskih sklopih –funkcije, cela števila in racionalna števila –so predstavljeni izzivi, ki jih imajo učenci pri prehodu od konkretnih izkušenj k formalnim definicijam, ter strategije, ki podpirajo fleksibilno prehajanje med različnimi reprezentacijami (konkretno, grafično, simbolno) in interpretacijami istega koncepta. Poseben poudarek je namenjen prepoznavanju napačnih in pomanjkljivih predstav, načrtovanju dejavnosti za njihovo odpravljanje ter uravnoteženemu razvoju konceptualnega in proceduralnega znanja.

Analizirani so tudi rezultati raziskav, ki kažejo na pogoste težave učencev in študentov pri razumevanju negativnih števil in ulomkov, kar potrjuje pomen usklajenega uvajanja matematičnih konceptov s stopnjami kognitivnega razvoja in pomen premišljene rabe modelov. Prispevek tako povezuje teoretične koncepte z empiričnimi ugotovitvami ter jih umešča v sodobne didaktične pristope, ki jih spodbuja prenovljeni učni načrt.

Kako merimo prepletenost? / How to measure linking?

Predavatelj: Luka Marčič, *Fakulteta za matematiko in fiziko, Univerza v Ljubljani*

Prispevek obravnava prepletenost spletov v kontekstu spletne homotopije. Predstavljene so osnovne definicije in invariante ter relativno preprosti klasifikaciji spletno homotopskih tipov spletov s tremi ali manj komponentami in skoraj preprostih spletov s poljubnim številom komponent v evklidskem prostoru. Prispevek se konča z razpravo o sodobnejših rezultatih ter bodočem delu na področju raziskovanja spletne homotopije.

The presentation discusses linking in the context of link homotopy. It presents the basic definitions and invariants, along with the relatively simple classifications of link homotopy types of links with three or fewer components and almost simple links with an arbitrary number of components in Euclidean space. The presentation concludes with a discussion of contemporary results and future work in researching link homotopy.

Lie algebra diameters

Predavatelj: Matevž Miščič, *IMFM, FMF*

We prove diameter bounds for finite simple Lie algebras that parallel Babai's conjecture for finite simple groups. Specifically, we show that any nonabelian finite simple Lie algebra g over F_p has diameter $O((\log |g|)^D)$ for $D \approx 3.21$ with respect to any generating set.

The Four-Color Theorem and its generalizations

Predavatelj: Bojan Mohar, *IMFM*

The Four-Color Theorem had profound influence on the developments of graph theory. It was proved 49 years ago by Appel and Haken. However, its proof left many questions unanswered. Is this result just a coincidence, or are there deeper reasons behind it? We try to provide deeper understanding why the 4CT is true. The speaker will give an overview of recent breakthrough results obtained in collaboration with Ken-ichi Kawarabayashi, Carsten Thomassen, Mikkel Thorup, Yuta Inoue, Atsuyuki Miyashita, and Tomohiro Sonobe.

The main results are based on a strengthening of the 4CT that includes the "flat curvature" analysis, which in particular leads to optimized algorithms for 4-coloring planar graphs. Moreover, it gives way towards resolutions of old conjectures of Grunbaum (1969), Albertson (1981), and Robertson (1994), and also gives a strong version of the Tutte 4-flow conjecture for graphs of small Euler genus.

Characterizations of minimally tough graphs in some graph classes

Predavateljica: Laura Ogrin, *UP FAMNIT*

Soavtorja: J. Pascal Gollin, *UP FAMNIT*; Martin Milanič, *UP FAMNIT, UP IAM*

For a non-negative real number t, a graph G is called t-tough if for every vertex set $S \subseteq V(G)$ that separates G, we have $t \cdot c(G-S) \leq |S|$, where $c(G-S)$ is the number of components of $G-S$. The toughness of a non-complete graph is the largest t for which the graph is t-tough, while the toughness of complete graphs is infinity. The concept of toughness was introduced and studied in connection with Hamiltonicity, as every Hamiltonian graph is 1-tough.

A graph G is minimally t-tough if the toughness of G is t and the removal of any edge from G decreases the toughness. A graph is minimally tough if it is complete or minimally t-tough for some real number t. Although deciding if a graph is minimally tough is a difficult problem in general, minimally tough graphs have been characterized in some graph classes. We characterize minimally tough graphs in the classes of P_4-free graphs, complete multipartite graphs, and complements of forests. We also characterize minimally tough co-chordal graphs whose complement has diameter at least 3.

Infinitely connected Fatou components in a family of numerical methods

Predavatelj: Dan Paraschiv, *IMFM Ljubljana*

We study the family of Chevushev-Halley family of numerical methods, previously introduced and studied by Campos, Canela, and Vindel. We prove the existence of parameters for which all Fatou components are infinitely connected, while components of the Julia sets are quasiconformal deformations of the Newton-type Julia set.

An explicit form of Ingham's zero density estimate

Predavatelj: Aleksander Simonič, *UP FAMNIT*

Soavtor: Shashi Chourasiya, *UNSW Canberra*

Ingham (1940) proved that $N(\sigma,T) \ll T^{3(1-\sigma)/(2-\sigma)} \log^5 T$, where $N(\sigma,T)$ counts the number of the non-trivial zeros ρ of the Riemann zeta-function with $\Re\{\rho\} \geq \sigma \geq 1/2$ and $0 < \Im\{\rho\} \leq T$. Such estimates are often valuable in the distribution theory of prime numbers. In this talk I will present an explicit version of this result with the exponent $(7-5\sigma)/(2-\sigma)$ of the logarithmic factor. The crucial ingredient in the proof is an explicit estimate with asymptotically correct main term for the fourth power moment of the Riemann zeta-function on the critical line, a result which is of independent interest.

This is joint work with Shashi Chourasiya (UNSW Canberra).

Izzivi poučevanja finančne matematike v angleščini

Predavatelj: Aleš Toman, *Univerza v Ljubljani, Ekonomska fakulteta*

Ko pri matematiki govorimo o finančni matematiki, govorimo o podpoglavjih zaporedij in vrst, v katerih obravnavamo obrestni račun, anuitete in amortizacijski načrt. Dijaki ali študenti pri tem spoznajo različne tipe obrestovanj (navadno, obrestno) in obrestnih mer (relativna, konformna), na koncu pa s pomočjo redukcijskega termina in načela ekvivalence glavnic vrednotijo periodične denarne tokove, npr. določijo anuiteto kredita. Obravnava finančne matematike v slovenščini je terminološko standardizirana (glede oznak to sicer ne drži) in reševanje nalog hitro postane rutinska uporaba matematičnih orodij v različnih ekonomskih kontekstih.

Situacija se hitro spremeni, ko želimo iste vsebine poučevati v angleščini (avtor prispevka poučuje v mednarodnih programih in vodi priprave slovenske ekipe na Mednarodno ekonomsko olimpijado). V angleški literaturi zaman iščemo ustreznike relativne in konformne obrestne mere ali redukcijskega termina; po drugi strani pa

so nekateri izrazi (npr. *annuity*) standardizirani in jih moramo v slovenščini opisati z več besedami. Seštevanje številskih vrst v finančnih učbenikih hitro nadomestijo standardne formule in učenje njihove uporabe.

V prispevku opišemo slovensko in angleško finančno terminologijo, poiščemo njune sorodnosti in izpostavimo razlike. Mladi se pri vodenju osebnih financ ne ozirajo na meje Slovenije. Učitelje matematike zato spodbudimo, da zaradi izjemnega pomena finančne pismenosti v pouk dodajo še izbrane angleške izraze.

Carlemanova aproksimacija brez kritičnih točk / Carleman approximation without critical points

Predavatelj: Beno Učakar, *UL FMF, IMFM*

Carlemanov aproksimacijski izrek pravi, da za vsaki zvezni funkciji $f : \mathbb{R} \to \mathbb{C}$ in $\varepsilon : \mathbb{R} \to (0, \infty)$ obstaja cela holomorfna funkcija $F : \mathbb{C} \to \mathbb{C}$ tako da velja $|F(x) - f(x)| < \varepsilon(x)$ za vsak $x \in \mathbb{R}$. Rezultat velja tudi za bolj splošne množice kot realno os in je bil posplošen tudi na odprte Riemannove ploskve. V nadaljevanju si bomo ogledali razred **skoraj dopustnih množic** *(ang. semi-admissible sets)* na katerih velja analog Carlemanovega aproksimacijskega izreka za funkcije brez kritičnih točk.

The Carleman appoxiamtion theorem states that for any continuous functions $f : \mathbb{R} \to \mathbb{C}$ and $\varepsilon : \mathbb{R} \to (0, \infty)$ there exists an entire holomorphic function $F : \mathbb{C} \to \mathbb{C}$ such that $|F(x) - f(x)| < \varepsilon(x)$ holds for all $x \in \mathbb{R}$. This result holds for more general sets than the real line and it has been generalised to open Riemann surfaces as well. We shall discuss the class of **semi-admissible sets** for which an analogue of Carleman's approximation theorem for non-critical functions holds.

You can count with poset topology

Predavatelj: Russ Woodroofe, *University of Primorska*

How many ways are there to sort the numbers 1, ..., *n* so that the number *i* is not in the *i*-th place? How many ordered pairs from the integers are coprime? How many proper colorings are there of a graph that use only red, green, blue? I will explain how to view these and similar questions from the point of view of partially ordered sets and of topology.

Applied Mathematics in Generic Pharma Development

Predavatelj: Dejan Velušček, *Sandoz*

Sandoz, a global leader in generic pharmaceuticals and biosimilars, is deeply invested in leveraging advanced mathematical and data-driven methodologies to enhance drug development, manufacturing efficiency, and patient access. With operations spanning over 100 countries, Sandoz integrates applied mathematics across diverse domains - from predictive modelling of physico-chemical processes, optimisation in supply chains, bioinformatics, to digital twin construction. This commitment to scientific rigour and innovation supports its mission to deliver high-quality, affordable medicines worldwide, while fostering collaboration between industry and academia in the pursuit of impactful healthcare solutions.

The lecture will showcase several real-world applications of mathematical techniques - ranging from statistical analysis/modelling and machine learning to numerical methods and optimisation - within the context of generic pharmaceutical development. Case studies will illustrate how these approaches contribute to solving complex challenges such as bioequivalence assessment, similarity/sameness assessment and process optimisation. By highlighting interdisciplinary collaborations and practical outcomes, the talk aims to demonstrate the tangible impact of applied mathematics on accelerating development timelines, improving product quality, and supporting regulatory decision-making.

Predstavitev tabora MaRS in njegove zgodovine

Predavatelj: Nejc Zajc, *Magistrski študent Fakultete za matematiko in fiziko, Univerze v Ljubljani*

Matematično raziskovalno srečanje (MaRS) je poletni matematični tabor za srednješolke in srednješolce, ki združuje bogat strokovni in pester družabni program. V letošnjem letu smo izvedli jubilejni dvajseti MaRS zapored. Na konferenci bomo predstavili program našega tabora in se dotaknili njegove bogate zgodovine.

Urnik tabora je vsako leto zelo pester. Strokovni del tabora je razdeljen na tri sklope. V osrednji delavnici udeleženci poglobljeno spoznajo izbrano matematično temo. Na večernih predavanjih gostje tabora predstavijo krajše, a zanimive matematične vsebine. Osrednja dejavnost pa je delo na projektih, kjer skupine treh udeležencev pod mentorstvom člana organizacijske ekipe raziskujejo pripravljen matematični problem. Reševanje nalog, preučevanje matematičnega ozadja in priprava končnega članka potekajo cel teden. Družabni del tabora ponuja številne priložnosti za sproščeno druženje in zabavo. Udeleženci na igriv način preizkusijo svoje spretnosti, ob večerih pa druženje ob družabnih igrah v skupnih prostorih pogosto traja pozno v noč. Tabor tradicionalno zaključimo z Veliko MaRSovsko pustolovščino - orientacijskim pohodom po naravi v okolici doma, na katerem udeleženci rešujejo zabavne, spretnostne in miselne naloge. Pustolovščini sledita piknik in sproščeno druženje do jutranjih ur zadnjega dneva tabora.

V zgodovini našega tabora se je v organizacijski ekipi zamenjalo že več kot 60 članov, med udeleženci pa smo imeli več sto dijakinj in dijakov iz cele Slovenije. Predstavili bomo vodje tabora skozi leta in člane več posadk. Spomnili se bomo mnogih nepozabnih in lepih trenutkov, ki smo jih doživeli na taboru.

Izzivi učenja in poučevanja matematike –včeraj, danes, jutri

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Didaktika matematike je znanost, ki si prizadeva metodično priti do sistematično izpeljanih, urejenih in dokazljivih spoznanj na področju učenja in poučevanja matematike.

Izhajajoč iz številnih izsledkov nacionalnih in mednarodnih raziskav učenja in poučevanja matematike, ob upoštevanju tehnološkega napredka, razvoja izobraževalne tehnologije, se vedno znova zastavlja vprašanje, kakšen naj bo proces izobraževanja, zlasti proces izobraževanja matematike, da bo čim bolj kakovostno prispeval k razvoju matematike in posameznika.

V prvem delu prispevka obravnavamo učenje in poučevanje matematike skozi zgodovino in predstavimo teorije učenja in poučevanja (matematike). V 20. stoletju so se na osnovi teoretičnih izhodišč kognitivne in konstruktivistične teorije poučevanja in učenja uvedle pomembne novosti in zelo spremenile pouk matematike: Brunerjev model usvajanja matematičnih pojmov; taksonomije matematičnih vsebin po Gagneju; raziskovalni in problemski pouk idr. Na podlagi teh spoznanj se je sredi 20. stoletja v kurikularnih dokumentih začel pojavljati pojem matematične pismenosti kot analogija bralne pismenosti. Ena pomembnejših zahtev matematične pismenosti v 21. stoletju pa je zmožnost matematičnega modeliranja ter uporaba izobraževalne tehnologije.

V povezavi z omenjenimi poudarki razvoja pouka matematike v drugem delu prispevka predstavljamo rezultate empirične raziskave, katere cilj je bil na izbrani temi iz aritmetike raziskati (1) dosežke učencev pri osnovnem in konceptualnem, proceduralnem in problemskem znanju in (2) ali dosežki na posamezni kognitivni ravni napovedujejo dosežke na drugi kognitivni ravni. Izpostavljamo dosežke in nevralgične točke učencev pri vseh treh kognitivnih ravneh in posebej pri reševanju besedilnih matematičnih problemov (BMP). Pri kvantitativni in kvalitativni analizi dosežkov pri BMP smo se usmerili na tri faze: prevajanje besedila v matematični zapis, izvajanje postopka ter oblikovanje in utemeljevanje odgovora. Pri tem se navežemo na izsledke predhodnih raziskav, ki povezujejo bralno in matematično pismenost.