The IMU 2018 annual meeting @Technion-IIT

SCHEDULE

9-9:30 Business meeting [meeting room]

9:30-10 Gathering [Sego]

10-10:45 Plenary talk (Rudnik) [Sego]

11-11:45 Prizes and Erdös talk [Sego]

11:50-13:20 Sessions:
– Algebra (Neftin & Meiri) [619]
– Analysis (Band) [232]
– Dynamical systems (Kosloff) [719]
– Number theory (Baruch) [Sego]
– Probability theory (Louidor) [814]

13:20-14:30 Lunch

14:30-15:15 Plenary talk (Hart) [Sego]

15:30-17:00 Sessions:
– Applied mathematics (Almog) [lounge]
– Discrete mathematics (Filmus) [814]
– Education (Hazzan) [232]
– Game theory (Holzman) [619]
– Non-linear analysis and optimization (Reich & Zaslavski) [719]
– Operator algebras and operator theory (Shalit & Solel) [919]

17:00-18:30 Posters, pizzas and beers [2nd floor]

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all rooms are in Amado building
Sego and 232 are on 2nd floor
619 on 6th floor and 719 on 7th floor
814, meeting room and lounge on 8th floor
919 on 9th floor
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The IMU 2018 annual meeting @Technion-IIT

PLENARY TALKS

Quantum chaos, eigenvalue statistics and the Fibonacci sequence

Zeev Rudnick (TAU)

One of the outstanding insights obtained by physicists working on “Quantum Chaos” is a conjectural description of local statistics of the energy levels of simple quantum systems according to crude properties of the dynamics of classical limit, such as integrability, where one expects Poisson statistics, versus chaotic dynamics, where one expects Random Matrix Theory statistics. I will describe in general terms what these conjectures say and discuss recent joint work with Valentin Blomer, Jean Bourgain and Maksym Radziwill, in which we study the size of the minimal gap between the first N eigenvalues for one such simple integrable system, a rectangular billiard having irrational squared aspect ratio. For quadratic irrationalities, such as the golden ratio, we show that the minimal gap is about 1/N, consistent with Poisson statistics. In the case of the golden ratio, the problem involves some curious properties of the Fibonacci sequence.

Forecasting, Calibration, and Dynamics

Sergiu Hart (HUJI)

How good is a forecaster? Assume for concreteness that every day the forecaster issues a forecast of the type ”the chance of rain tomorrow is 30%.” A simple test one may conduct is to calculate the proportion of rainy days out of those days that the forecast was 30%, and compare it to 30%; and do the same for all other forecasts. A forecaster is said to be *calibrated* if, in the long run, the differences between the actual proportions of rainy days and the forecasts are small|no matter what the weather really was.

The talk will first present (and prove) the classical result of Foster and Vohra (1998) that calibration can always be guaranteed by randomized forecasting procedures.

Next, it is proposed to smooth out the calibration score by combining nearby forecasts. While regular calibration can be guaranteed *only* by randomized forecasting procedures, we show that *smooth calibration* can be guaranteed by *deterministic* procedures. As a consequence, it does not matter if the forecasts are leaked, i.e., made known in advance: smooth calibration can nevertheless be guaranteed (while regular calibration cannot).

We then consider the resulting *smooth calibrated learning* in n-person games, and show that in the long run it is close to Nash equilibria most of the time.

The talk is self-contained; no prior knowledge will be assumed.

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Erdös Prize Talk

The pathwise method: understanding the behavior of high-dimensional geometric objects using stochastic calculus

Ronen Eldan (Weizmann)

Introducing randomness in a problem which is not necessarily a-priori related to probability is often very fruitful in combinatorics, analysis and geometry (in particular, the probabilistic method, pioneered by Paul Erdös is an extremely powerful tool to prove existence of combinatorial objects). This approach is key to many proofs from asymptotic geometric analysis, as it allows us to have numerous tools and concepts from probability theory at our disposal. The objective of this talk is to introduce an emerging method which uses stochastic calculus and pathwise analysis to prove results of a geometric nature. We focus on two constructions of a stochastic processes driven by a Brownian motion, associated with a geometric object, and illustrate how these constructions allow us to make the object more tractable, for example, through differentiation with respect to time. To illustrate how this works, we will discuss applications of this method to the understanding of dimension-free behavior in high-dimensional space, and in particular to concentration inequalities on high dimensional convex sets.

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PROGRAM 11:50-13:20

Algebra (Neftin & Meiri) [619]

Radii of Elements in Finite-Dimensional Power-Associative Algebras

Moshe Goldberg (Technion)

The purpose of this talk is to introduce a new concept, the radius of elements in arbitrary finite-dimensional power-associative algebras over the field of real or complex numbers. It is an extension of the well known notion of spectral radius. As examples, we shall discuss this new kind of radius in the setting of matrix algebras, where it indeed reduces to the spectral radius, and then in the Cayley-Dickson algebras, where it is something quite different. We shall also describe two applications of this new concept, which are related, respectively, to the Gelfand formula, and to the stability of norms and subnorms.

Invariably Generated Groups

Gil Goffer (Weizmann)

A group is said to be invariably generated (IG) by a set S, if any conjugation of elements of S still generates G, and topologically invariably generated (TIG) by S if every such conjugation generates G topologically. We will give a short review on this notion, and present new results, from a joint work with Gennady A. Noskov.

Does isomorphism over a field implies isomorphism over its valuation rings?

Uriya First (Haifa)

Let K be a field and let R be a discrete valuation ring in K. A classical result states that two nondegenerate quadratic forms defined over R which become isomorphic over K are already isomorphic over R. This phenomenon turns out to hold for other types of objects, e.g. hermitian forms and central simple algebras, and is in fact a special case of a far-reaching conjecture of Grothendieck and Serre (now a theorem if R contains a field thanks to Panin and Fedorov). I will discuss several natural situations not covered by the original conjecture, e.g. certain degenerate quadratic forms, presenting both positive results and counterexamples.

Twisted group ring isomorphism problem

Ofir Schnabel (Technion)

Abstract: We propose a variation of the classical isomorphism problem for group rings in the context of projective representations. We formulate several weaker conditions following from our notion and give all logical connections between these condition by studying concrete examples. We introduce methods to study the problem and provide results for various classes of groups, including abelian groups, groups of central type, p-groups of order p^4 and groups of order p^2q^2, where p and q denote different primes.

Joint work with Leo Margolis.

Analysis (Band) [232]

Spectral gap and sign-changes

Naomi Feldheim (Weizmann)

It is known that the Fourier transform of a measure which vanishes on $[-a, a]$ must have asymptotically at least a/π zeroes per unit interval. One way to quantify this further is using a probabilistic model: Let f be a Gaussian stationary process on R whose spectral measure vanishes on $[-a, a]$. What is the probability that it has no zeroes on an interval of length L?

Our main result shows that this probability is at most $e^{-ca^2L^2}$, where $c > 0$ is an absolute constant. This settles a question which was open for a while in the theory of Gaussian processes. I will explain how to translate the probabilistic problem to a problem of minimizing weighted L^2 norms of polynomials against the spectral measure, and how we solve it using tools from harmonic and complex analysis. Time permitting, I will discuss lower bounds.

Based on a joint work with Ohad Feldheim, Benjamin Jaye, Fedor Nazarov and Shahaf Nitzan (arXiv:1801.10392).

Geometric methods in regularity theory for partial differential equations

Edgard Pimentel (PUC-Rio)

In this talk, we examine the regularity theory of the solutions to a few examples of (nonlinear) PDEs. Arguing through a genuinely geometrical method, we produce regularity results in Sobolev and Holder spaces, including some borderline cases. Our techniques relate a problem of interest to another one - for which a richer theory is available - by means of a geometric structure, e.g., a path. Ideally, information is transported along such a path, providing access to finer properties of the original equation. Our examples include elliptic and parabolic fully nonlinear problems, the Isaacs equation, degenerate examples and a double divergence model. We close the talk with a discussion of open problems and further directions of work.

Dynamical systems (Kosloff) [719]

The conformal measures of a normal cover of a hyperbolic surface

Ofer Shwartz (Weizmann)

In this talk, we will discuss the relation between the conformal measures of a normal cover of a hyperbolic compact surface to the geometric structure of its symmetries via the examples $\mathbb{Z}^d$ and hyperbolic covers.

Counting independent sets in amenable virtually orderable groups in polynomial time

Raimundo Briceno (TAU)

Given a countable discrete amenable virtually orderable group G acting by translations on a G-subshift $X \subseteq A^G$ and an absolutely summable potential Φ, we present a set of conditions to obtain a special integral representation of pressure $P(\Phi)$. The approach is based on a Breiman type theorem for Gibbs measures due to Gurevich-Tempelman (2007), and generalizes results from Marcus-Pavlov (2015) by extending the setting to other groups besides $\mathbb{Z}^d$, by relaxing the assumptions on X and Φ, and by using sufficient convergence conditions in a mean –instead of a uniform– sense.

As an application of this result, we show that if G is generated by a finite set S (e.g., all groups of polynomial growth) and $\Gamma(G, S)$ is the corresponding Cayley graph, then the exponential growth rate of the number of independent sets weighted by $\lambda > 0$ –known as the pressure– has a special expression in terms of finitely many conditional probabilities and it is computable in polynomial time whenever $\lambda < \lambda_c(\mu(G, S))$, where $\lambda_c(\mu) = \frac{\mu^\mu}{(\mu-1)^{\mu+1}}$ and $\mu(G, S)$ is the connective constant of $\Gamma(G, S)$. In particular, this proves that the topological entropy of the associated G-subshift is computable in polynomial time for every 2-generated such group. This generalizes results from Gamarnik-Katz (2009), Pavlov (2012), and Wang-Yin-Zhong (2014), who proved similar results for particular Cayley graphs of $\mathbb{Z}^d$.

Kakutani's splitting procedure for multiscale substitution schemes

Yotam Smilansky (TAU)

In 1975, S. Kakutani introduced a splitting procedure which generates a sequence of partitions of the unit interval [0,1], and showed that this sequence is uniformly distributed in [0,1]. We present generalizations of this procedure in higher dimensions, which correspond to constructions used when defining substitution and multiscale substitution tilings of Euclidean space. We prove uniform distribution of these sequences of partitions using new path counting results on graphs and establish Kakutani's result as a special case.

Number theory (Baruch) [Sego]

Maps between Spaces of Nearly Holomorphic Modular Forms

Shaul Zemel (HUJI)

Modular Forms carry, via their Fourier expansions, a lot of interesting information about several elementary number-theoretic objects. There are also maps between spaces of (holomorphic) modular forms of half-integral weight and those of integral weight (in both directions), which can be realized using integrals with respect to a kernel function. We present an extension of one of these maps to the nearly holomorphic case.

Prime lattice points in ovals

Bingrong Huang (TAU)

We study the distribution of lattice points with prime coordinates lying in the dilate of a convex planar domain having smooth boundary, with nowhere vanishing curvature. Counting lattice points weighted by a von Mangoldt function gives an asymptotic formula, with the main term being the area of the dilated domain, and our goal is to study the remainder term. Assuming the Riemann Hypothesis, we give a sharp upper bound, and further assuming that the positive imaginary parts of the zeros of the Riemann zeta functions are linearly independent over the Rationals allows us to give a formula for the value distribution function of the properly normalized remainder term. This is joint work with Zeev Rudnick.

Irreducibility of integral polynomials with a large gap

Mark Shusterman (TAU)

Providing irreducibility criteria for integral polynomials is by now a classical topic. Yet, the irreducibility of "most" polynomials cannot be established using the existing techniques, and many problems remain open. For example, establishing the irreducibility of random polynomials, and the irreducibility of various trinomials. We will be interested in polynomials with only few nonzero coefficients, located "near the ends" (that is, a large gap in the middle). Focusing on a particular case, the family of polynomials $X^{2k+1} - 7X^2 + 1$, we show how work of Schinzel (and generalizations by Bombieri-Zannier using unlikely intersections) imply irreducibility for large enough k. We then discuss work by Filaseta-Ford-Konyagin which gives more effective bounds. At last, we present our improved bounds that allow to obtain irreducibility for every k. We finish with some applications and conjectures. This is a joint work with Will Sawin and Michael Stoll.

Prime and Mobius correlations for very short intervals in polynomials over finite fields

Lior Rosenzweig (Afeka)

We investigate function field analogs of the distribution of primes, and prime k-tuples, in "very short intervals", as well as cancellation in sums of function field analogs of the Mobius µ function and its correlations. When the characteristic of the field tends to infinity, we show that for" generic" polynomials the main term agrees with the expected results in the classical setting. We also give examples of polynomials for which there is no cancellation at all, and intervals where the heuristic "primes are independent" fails badly. This is joint work with Par Kurlberg.

Probability theory (Louidor) [814]

Stabilization of Diffusion Limited Aggregation in a Wedge

Ron Rosenthal (Technion)

We prove a discrete Beurling estimate for the harmonic measure in a wedge in $\mathbf{Z}^2$, and use it to show that Diffusion Limited Aggregation (DLA) in a wedge of angle smaller than $\pi/4$ stabilizes. This allows to consider the infinite DLA and ask questions about its growth, dimension and number of arms. Some conjectures and open problems will be discussed. Based on a joint work with Eviatar Procaccia and Yuan Zhang.

Convergence of a quantile admission processes

Ohad-Noy Feldheim (HUJI)

Consider the following stochastic model for a growing set. At time 0 the model consists of the singleton $S = \{0\}$. At every subsequent time, two i.i.d. samples, distributed according to some distribution D on R_+, are suggested as candidates for S. If the smaller among the two is closer to at least a fraction of r of the current elements of S (in comparison with the larger one), then it is admitted into S. How will the distribution of the members of S evolve over time as a function of r and D? This model was suggested by Alon, Feldman, Mansour, Oren and Tennenholtz as a model for the evolution of an exclusive social group. We'll show that the empirical distribution of the elements of S converges to a (not-necessarily deterministic) limit distribution for any r and D and discuss interesting phenomenon occurring in the model for large values of r. Our methods relate this problem to a certain type of random walk in changing environment and to a new general inequality concerning mean and minimum of independent random variables. Joint work with Naomi Feldheim.

When More Information Reduces the Speed of Learning

Matan Harel (TAU)

Consider two Bayesian agents attempting to estimate a random variable based on exogenous information, as well as each other's action. Our main finding is that increased interaction between the agents can dramatically increase the probability of estimating the variable incorrectly: when both agents observe each other, learning is significantly slower than it is when the observation is one-sided. This slowdown is driven by a process in which early consensus on the wrong action causes the agents to discount new contrary evidence. This is joint work with Elchanan Mossel, Phillippe Strack, and Omer Tamuz.

If you squint hard enough, Gibbs distributions behave like mixtures of product measures

Renan Gross (Weizmann)

Gibbs distributions are everywhere, whether you're Ising-modeling a magnet or fitting an exponential random graph to your social network. Alas, explicitly solving Gibbs distributions can sometimes be a bit hard, to put it mildly. In this talk, we'll discuss a mean-field condition on the Hamiltonian and how this condition decomposes the distribution into a mixture of product measures.

These product measures satisfy a vector equation which, if solved, can reveal some of the structure underlying the distribution (e.g. symmetry breaking in graphs with a small number of triangles).

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PROGRAM 15:30-17:00

Applied mathematics (Almog) [lounge]

Spline Functions, The Biharmonic Operator and Approximate Eigenvalues

Haggai Katriel

The biharmonic operator plays a central role in a wide array of physical models, notably in elasticity theory and the streamfunction formulation of the Navier-Stokes equations. The need for corresponding numerical simulations has led, in recent years, to the development of a discrete biharmonic calculus. The primary object of this calculus is a high-order compact discrete biharmonic operator (DBO). The numerical results have been remarkably accurate, and have been corroborated by some rigorous proofs. However, there remained the "mystery" of the "underlying reason" for this success. Our work is a contribution in this direction, showing the strong connection between cubic spline functions (on an interval) and the DBO. It is shown in particular that the (scaled) fourth-order distributional derivative of the cubic spline is identical to the action of the DBO on grid functions. A remarkable consequence is the fact is that the kernel of the inverse of the discrete operator is (up to scaling) equal to the grid evaluation of the Green's function of the biharmonic operator, providing an explicit expression for the matrix of the inverse of the DBO. We use these results to study the relation between the (infinite) set of eigenvalues of the fourth-order biharmonic operator on an interval and the finite set of eigenvalues of the discrete biharmonic operator. The discrete eigenvalues are proved to converge (at an "optimal" $O(h^4)$ rate) to the continuous ones.

Joint work with Matania Ben-Artzi.

Loss of phase and universality of stochastic interactions between laser beams

Amir Sagiv (TAU)

The control and prediction of interactions between high-power, nonlinear laser beams is a longstanding open problem, studied by both the optics, engineering and mathematics communities. One of the traditional underlying assumptions in this field has been that these dynamics are governed by a deterministic model. Lately, however, we have shown that high-power laser beams lose their initial phase information in nonlinear propagation. Thus, even though the beam's profile appears to be stable, its phase dynamics are chaotic. Furthermore, long-range interactions between beams become chaotic too, contrary to the widespread belief. Not all is lost, however. Even though each interaction is unpredictable, the statistics of many interactions are predictable. Moreover, the above "loss of phase" result implies that these statistics, in fact, follow a universal model. With this universal model, and using a novel stochastic computational method we developed, we can accurately and efficiently compute the statistics of these chaotic laser interactions.

Vector-valued Phase-field Models of Obstacle Type

Orestis Vantzos (Technion)

We present a class of phase-field models based on the double- obstacle Ginzburg-Landau functional. They involve vector-valued potentials with values constrained on convex sets beyond the classic Gibbs complex, and are therefore suitable for the modeling of multi- phase problems with various complicated domain/junction arrangements. We discuss their efficient variational discretization, based on De Giorgi's minimizing movements, and certain interesting geometrical insights concerning their behavior in the sharp limit.

The Superheating Current for a Reduced Ginzburg-Landau Model

Yaniv Almog

We consider the time-dependent Ginzburg-Landau model in the absence of a magnetic field but in the presence of an electric current. In the large domain limit, for a general 2D setting we prove existence of perfectly conducting solutions for current below a certain threshold.

Discrete mathematics (Filmus) [814]

Property testing in ordered structures

Omri Ben-Eliezer (TAU)

Classical results in property testing, based on Szemerédi-regularity arguments, provide very strong characterizations of testability for graph properties. Graph properties are inherently symmetric (they are closed under relabeling of the vertices) and the proofs of these results rely heavily on this symmetry.

In recent years, we were able to prove order-preserving variants of these results that do not rely on the aforementioned symmetry, obtaining strong characterizations of testability in ordered structures such as images and vertex-ordered graphs. In this talk I will present these results, briefly describing how Szemeredi-regularity based tools can be used in an order-preserving manner.

Based on joint works with Noga Alon and Eldar Fischer.

Biased halfspaces, noise sensitivity, and relative Chernoff inequalities

Ohad Klein (BIU)

Let X be a random variable defined by $X = a_1x_1 + ... + a_nx_n$, where x_i are independent random variables uniformly distributed in $\{-1, 1\}$, and $a_1, ..., a_n$ are real numbers. We investigate the tail behavior of the variable X, and apply the results to study halfspace functions $f : \{-1, 1\}^n \to \{-1, 1\}$ defined by thresholding X. Specifically, we characterize the maximal influence, vertex boundary, noise sensitivity, and low-level Fourier weights of halfspaces in terms of $\Pr[f(x) = 1]$ and the coefficients $a_1, ..., a_n$.

List decoding using double samplers, application of high dimensional expanders

Inbal Livni (Weizmann)

List decoding is the algorithm task of retrieving all code words at a distance of about d from the input, for a given code C with distance d. In this talk I will present double samplers, which are an extension of the samplers graphs used in theoretical computer science. I will show how double samplers can be used to list decode the ABNNR code construction. Double samplers can be constructed from high dimensional expanders. Currently, it is not known if there is a random construction for double samplers.

Joint work with Irit Dinur, Prahladh Harsha, Tali Kaufman and Amnon Ta Shma.

Two results on union-closed sets

Ilan Karpas (HUJI)

We show that there is some absolute constant $c > 0$ such that for any union-closed family F on n points, if $|F| \geq (1/2 - c)2^n$ then some element appears in at least half of the sets of F. We also show that for any union-closed family

F on n points, the number of sets which are not in F that cover a set in F is at most 2^{n-1}, and provide examples where the inequality is tight.

Education (Hazzan) [232]

למידה פעילה בשיעורי סטטיסטיקה בתואר ראשון
דר ג׳קלין אשר (הטכניון ומכללת כנרת)

In this session we will experience a number of active learning exercises, from the simple to the complex, consider their advantages and address the challenges of introducing them in statistics lectures to supplement our traditional teaching methods. You will find this session valuable if you want to improve the quality of your teaching and to make your lectures more enjoyable for yourself and your students.

קורס הכנה במתמטיקה או טיול למזרח הרחוק?
ד״ר אביב צנזור (הטכניון)

סטודנטים רבים מתחילים את לימודי המתמטיקה בטכניון ברמת מוכנות בלתי מספיקה. זהו ניסוח עדין לאמירה בעייתית מאוד - אנחנו מנסים ללמד מתמטיקה ברמה אקדמית גבוהה, כולל אפסילון-דלתא, לתלמידים שטועים בכללי היסק פשוטים, שתועים בין נוסחאות מסתוריות של לוגריתמים וטריגו, שתוהים לגבי המשמעות של נגזרת. זוהי בעיה מוכרת שאינה ייחודית לטכניון, ופתרונה מחייב הכרעה לא פשוטה: האם הטכניון מסתפק בהצעת דרכים להתכונן, ומטיל את האחריות לכך על הסטודנטים? או שהטכניון לוקח את האחריות על עצמו, ויוצר מנגנון שיחייב את כל הסטודנטים להתכונן? נדבר על המשמעויות המורכבות של כל גישה, ונתלבט מהו המתווה הנכון עבור הטכניון.

K-12 Mathematics education in Israel – Issues and innovations
פרופ׳ נצה מובשוביץ הדר, הטכניון

הכותרת היא שמו של ספר שיצא לאור לקראת יום העצמאות ה-70 למדינת ישראל בהוצאת $World\ Scientific$, ככרך מס. 13 בסדרת ספרים על החינוך המתמטי במדינות העולם. הוא פרי עיטם של 86 אנשי חינוך מתמטי בישראל שחברו אלי למשימה בקיץ 2016 ובמאמץ משותף וממוקד יצרו 44 פרקים קצרים, למעלה מ-400 עמודים, המכסים מגוון עשיר של סוגיות במערכת החינוך המתמטי בישראל, החל מהגיל הרך ובית הספר היסודי, עבור דרך חטיבת הביניים והחטיבה העליונה ועד להכשרה של פרחי הוראה והתפתחות מקצועית של המורים המקצועיים למתמטיקה. הספר כולל בין היתר פרק על התפתחות השפה העברית המתמטית, על מדיניות החינוך המתמטי הנהוגה כיום, על אתגרים שעומדים בפנינו לעתיד, על יוזמות חדשניות הנמצאות בניסוי ועוד. הספר מהווה ״חלון ראווה״ המשקף את העשייה

הרבה המתרחשת בישראל בתחום החינוך המתמטי, ומצביע באורח אמין הן על ההצלחות, האתגרים וההתלבטויות, והן על מגמות לעתיד. בכנס תוצג יריעה רחבה ככל האפשר של התכנים הכלולים בו.

מתמטיקה, הוראה וחינוך - דברים שרואים מכאן

אבי נתן (מורה מתמטיקה בחט״ב קרית טבעון)

חלק מהמשתתפים בכנס השנתי של האיגוד המתמטי הישראלי שיתקיים בשנת 2038 לומדים היום מתמטיקה בחטיבת הביניים: מספרים מכוונים, משפט פיתגורס, פרבולה.

האם אנחנו זורעים היום את הזרעים שיצמיחו את המתמטיקאים של המחר? מה חווים ילדי ישראל בשיעורי המתמטיקה? מהו האתגר המוטל על כתפי המורה?

אבי נתן, מורה למתמטיקה, לאחר 30 שנים בהיי-טק, משתף את אתגרי היומיום במקצוע ההוראה, החופש להניע יוזמות מקומיות ומחשבות על שינוי אפשרי.

Game theory (Holzman) [619]

Communication Complexity of Local Search

Yakov Babichenko (Technion)

Local search over a graph $G = (V, E)$ is the problem of finding a local (with respect to G) maximum of a real valued function f over the vertices. We show that the following communication variant of the local search problem requires a large amount of communication: Alice holds a function f, Bob holds a function g, and their goal is to compute a local maximum of $f + g$.

Another variant of a local search problem is to find a pure Nash equilibrium in an exact potential game. In these settings, a much more natural distribution of information is that of uncoupledness ([Hart and Mas-Colell, 2003]). Each player holds his own utility function and their goal is to compute a pure Nash equilibrium of the game. We show that for exact potential games this problem requires a large amount of communication. This extends the result of [Hart and Mansour, 2008] who have proved the same result for ordinal potential games.

Agnostic Sequential Rationality

Igal Milchtaich (Bar Ilan)

An agnostic sequential equilibrium is a refinement of sequential equilibrium that does not force on the players a single, arbitrary belief system. In fact, a strategy profile in an extensive-form game with perfect recall is an ASE if and only if it is sequential equilibrium with every fully consistent belief system.

However, ASE is not defined in terms of full consistency (which uses perturbations of strategies) but it is based on a simpler, novel notion of consistency between strategy profiles and off-equilibrium beliefs that is applicable to a large class of dynamic games, including games with a continuum of actions. ASE is generalized by the set-valued solution concept of agnostic sequential polyequilibrium, which allows leaving the players' actions unspecified in some (possibly, many) information sets.

Quitting Games

Eilon Solan (Tel Aviv)

In this talk I will survey the current state of the art regarding the question of existence of uniform equilibrium in quitting games, and mention a few of the mathematical tools that are used to study this problem.

Non-linear analysis and optimization (Reich & Zaslavski) [719]

Physically Feasible Decomposition of Engino Toy Models: A Graph Theoretic Approach

Aviv Gibali (Braude)

During the 125th European Study Group with Industry held in Limassol, Cyprus, 5-9 December 2016, one of the participating companies, Engino.net Ltd, posed a very interesting challenge to the members of the study group. Engino.net Ltd is a Cypriot company, founded in 2004, that produces a series of toy sets – the Engino toy sets – consisting of a number of building blocks which can be assembled by pupils to compose toy models. Depending on the contents of a particular toy set, the company has developed a number of models that can be built utilizing the blocks present in the set, however the production of a step-by-step assembly manual for each model could only be done manually. The goal of the challenge posed by the company was to implement a procedure to automatically generate the assembly instructions for a given toy. In the present paper we propose a graph-theoretic approach to model the problem and provide a series of results to solve it by employing modified versions of well-established algorithms in graph theory. An algorithmic procedure to obtain a hierarchical, physically feasible decomposition of a given toy model, from which the assembly instructions can be recovered, is proposed. This is a joint work with E. N. Antoniou (Thessaloniki, Greece), A. Araujo (Coimbra, Portugal) and M. D. Bustamante (Dublin, Ireland).

BISTA: A Bregmanian Proximal Gradient Method without the Global Lipschitz Continuity Assumption

Daniel Reem (Technion)

The problem of minimization of a separable convex objective function has various theoretical and real-world applications. One of the popular methods for solving this problem is the proximal gradient method (proximal forward-backward algorithm). A very common assumption in the use of this method is that the gradient of the smooth term in the objective function is globally Lipschitz continuous. However, this assumption is not always satisfied in practice, thus casting a limitation on the method. We discuss, in a wide class of finite and infinite-dimensional spaces, a new variant (BISTA) of the proximal gradient method which does not impose the above-mentioned global Lipschitz continuity assumption. A key contribution of the method is the dependence of the iterative steps on a certain decomposition of the objective set into subsets. Moreover, we use a Bregman divergence in the proximal forward-backward operation. Under certain practical conditions, a non-asymptotic rate of convergence (that is, in the function values) is established, as well as the weak convergence of the whole sequence to a minimizer. We also obtain a few auxiliary results of independent interest, among them a general and useful stability principle which, roughly speaking, says that given a uniformly continuous function in an arbitrary metric space, if we slightly change the objective set over which the optimal (extreme) values are computed, then these values vary slightly. This principle suggests a general scheme to tackle a wide class of non-convex and non-smooth optimization problems. This is a joint work with Alvaro De Pierro and Simeon Reich.

Nonconvex Lagrangian-Based Optimization: Monitoring Schemes and Global Convergence

Shoham Sabach (Technion)

We introduce a novel approach addressing global analysis of a difficult class of nonlinearly composite nonconvex optimization problems. This genuine nonlinear class captures many problems in modern disparate fields of applications. We develop an original general Lagrangian methodology relying on the idea of turning an arbitrary descent method into a multiplier method. We derive a generic Adaptive Lagrangian Based mUltiplier Method (ALBUM) for tackling the general nonconvex nonlinear composite model which encompasses fundamental Lagrangian methods. This paves the way to prove global convergence

results to a critical point of the problem in the broad semialgebraic setting. The potential of our results is demonstrated through the study of two major Lagrangian schemes whose convergence was never analyzed in the proposed general setting: the proximal multiplier method and the proximal alternating direction of multipliers scheme. This is joint Joint work with Jerome Bolte (Toulouse 1 Capitole University) and Marc Teboulle (Tel Aviv University).

Regular Operators in Feasibility

Rafal Zalas (Technion)

In this talk we present a systematic study of regular quasi-nonexpansive operators in Hilbert space. We are interested, in particular, in weakly, boundedly and linearly regular operators. We show that the type of the regularity is preserved under relaxations, convex combinations and products of operators. Moreover, in this connection, we show that weak, bounded and linear regularity lead to weak, strong and linear convergence, respectively, of various iterative methods. This applies, in particular, to projection methods, which oftentimes are based on the above-mentioned algebraic operations applied to projections. This is a joint work with Andrzej Cegielski and Simeon Reich.

Operator algebras and operator theory (Shalit & Solel) [919]

TBA

Daniel Markiewicz (BGU)

Compactness and Minimality

Benjamin Passer (Technion)

Given a tuple T of operators, there is an associated matrix convex set W(T), called the matrix range of T, which consists of all images of T under UCP maps into matrix algebras. We consider the question, ”to what extent does W(T) determine T?” Following work in the literature, we are led to consider tuples which are minimal for their matrix ranges. I will give a class of examples demonstrating that even if T is compact, T is minimal for its matrix range W(T), and W(T) is a particularly nice matrix convex set (the minimal matrix convex set Wmin(K) over a scalar set K), T need not be determined up to unitary equivalence by its matrix range. On the other hand, the shape of the set K is quite rigid. Extending the scope of the search to non-compact operators shows it is also possible to find irreducible tuples T which are not uniquely determined by W(T). Time permitting, I will discuss related dilation-scale problems for compact and non-compact operators.

Positivstellensatz for free noncommutative functions

Gregory Marx (BGU)

We begin by introducing free noncommutative (nc) functions and talking a little bit about motivations for their study and special cases. We present a Positivstellensatz for this setting (i.e. we obtain a certificate for those free nc functions satisfying an appropriate positivity condition) and discuss connections with other Positivstellensatze in the literature. This talk is based on joint work (in progress) with J.A. Ball and V. Vinnikov.

Algebras of bounded noncommutative functions on noncommutative varieties

Guy Salomon (Technion)

The algebra of bounded noncommutative (nc) functions over a nc subvariety of the nc ball can be identified as the multiplier algebra of a certain reproducing kernel Hilbert space consisting of nc functions on the subvariety. In this talk I will try to answer the following question: in terms of the underlying varieties, when are two such algebras isomorphic? (The word "isomorphic" will be considered in at least four different categories.) Along the way, I will show that while in some aspects the nc and the classical commutative settings share a similar behavior, the first enjoys – and also suffers from – some unique nc phenomenons.

The talk is based on a joint work with Orr Shalit and Eli Shamovich.