

In Memoriam Mark Semënovich Pinsker

Sasha Barg

Mark Semënovich Pinsker, an outstanding scholar in the fields of information theory, coding theory, probability and statistics and communication networks, passed away on December 23, 2003. Mark Pinsker's presence dominated the landscape of information and coding theory in the USSR and Russia for much of the second half of the last century. His fundamental contributions are widely known among researchers throughout the world. They are discussed in a detailed article [R1], and in a brief overview in this Newsletter, [R2]. However, M. S. Pinsker has influenced our area in many more ways than just through his own research. He was a member of the editorial board of



1925-2003

Problemy Peredachi Informatsii (Russian for Problems of Information Transmission) since its inception in 1965 to the last days of his life. Together with R. L. Dobrushin, for many years he organized an information theory seminar in IPPI which became world-famous for the detailed scrutiny of the results presented there, often benefiting the authors at least as much as the audience. But most importantly, Mark Pinsker influenced the development of our science through numerous interactions with younger colleagues, happily and selflessly sharing with them his ideas and insights.

Mark Pinsker was born in Moscow on April 24, 1925. In 1944, after graduating from high school and completing his military service, he entered the Moscow Electromechanical University of Railway Transport. A year later he transferred to the Department of Mathematics and Mechanics (Mekhmat) of the Moscow State University, graduating in 1949. At the outset of his career, for several years he taught mathematics in high school. In 1955 he joined the Laboratory of Scientific Problems of Wireline Communication of the USSR Academy of Sciences, renamed later the Laboratory of Information Transmission Systems, and reorganized in 1961 into the Institute for Information Transmission Problems, or IPPI. It was there that Mark Pinsker worked until his last days, first as Head of Laboratory, and since 1991 as Principal Research Fellow.

Mark Pinsker began his research as a member of the famous probability school of A. N. Kolmogorov, who was his scientific advisor while he wrote and defended his Ph. D. dissertation. Kolmogorov's diaries published in Russian in 2003 reveal his appreciation of M. Pinsker's research and results. M. Pinsker became a State Doctor in 1963 upon presenting a dissertation on "Main notions of information theory". During the 1950s and the beginning of 1960s, probabilistic foundations of information theory were a subject of intense reflections. Many of Mark's results of that period were published in book form [19] and remain to this day a classic exposition of main information

theoretic problems and results.

Throughout his life Mark Semënovich always enjoyed working with his students, devoting to these interactions a lot of his time and attention. Over 20 of his students defended their Ph.D. theses under his guidance, and 5 advanced to the State Doctor degree. Among his students are S. Efromovich, I. Dumer, A. Gorbunov, V. Koshelev and A. Sheverdiaev.

For researchers in our field throughout the world, Mark Pinsker's name became associated with information theory and the IPPI. Many information theorists and statisticians who worked next to Mark in IPPI or visited him in Moscow keep fond memories of encounters and conversations with him, his lightning-fast insights and advice, his light humor and delicate manners and his genuine interest in other people's research and willingness to help.

Our Society and the IEEE honored Prof. Pinsker with their highest awards, the Shannon award (1978) and the Hamming medal (1996). He was the first to receive both highest honors in the field of information theory.

We mourn the passing away of Mark Pinsker.

[R1] Review of scientific achievements of M. S. Pinsker, *Problems of Information Transmission*, vol. 32, no. 1, 1996, pp. 3-14.

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From the Editor

Lance C. Pérez



In this issue of the *IEEE Information Theory Society Newsletter* we honor Mark Semënovich Pinsker, the great Russian information theorist, who passed away last year. We are fortunate to have a memorial of Mark written, at my invitation, by Sasha Barg which includes the fond recollections of several member of the IT community who knew Mark. In addition, our Historian, Anthony Ephremides, has Mark featured prominently in his column.

Please help make the Newsletter as interesting and informative as possible by offering suggestions and contributing news. The deadlines for the upcoming issues of the newsletter are as follows:

<u>Issue</u>	<u>Deadline</u>
December 2004	October 15, 2004
March 2005	January 15, 2005
June 2005	April 15, 2005

Electronic submission, especially in ascii, LaTeX and Word formats, is encouraged. Please keep in mind that any electronic photographs should be high resolution.

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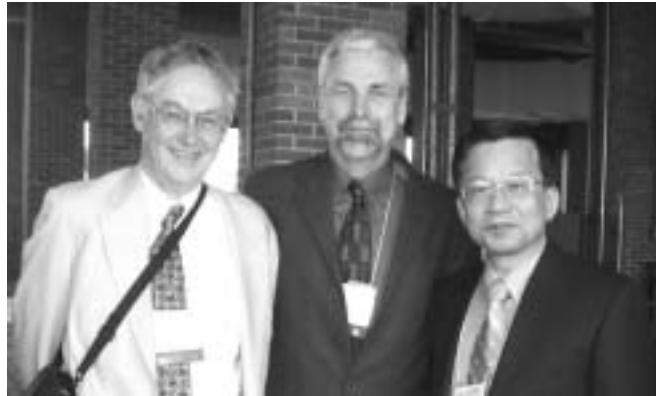
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President's Column

Hideki Imai

The 2004 IEEE International Symposium on Information Theory was held at the Chicago Downtown Marriott, USA from June 27 – July 2, 2004. I speak for all of those who attended in saying that this year's ISIT was another great success, thanks to the General Co-Chairs, Daniel J. Costello, Jr. and Bruce Hajek, who put considerable effort and energy into organizing this event. The accompanying picture of Dan, Bruce, and me was taken at the banquet held on July 1, at the Grand Ballroom in the auditorium at the end of Navy Pier. The hosts will give a detailed report of ISIT 2004 in a future issue of the Newsletter.



ISIT 2004 General Co-Chairs Daniel J. Costello, Jr. and Bruce Hajek with IT Society President Hideki Imai

I would like to mention the delightful Shannon Lecture given by Professor Robert J. McEliece, the recipient of the 2004 Claude E. Shannon Award. As is tradition, the lecture, entitled "Are there Turbo-Codes on Mars?", was the highlight of the Symposium. It consisted of three parts. Part 1 was beautifully constructed to guide us from the elementary levels of information theory to the latest, most advanced coding schemes, using animations that could be easily followed and appreciated by nonscholars as well. Part 2 was about space communications, a field in which Professor McEliece has been working for many years at the Jet Propulsion Laboratory (JPL) of the California Institute of Technology, and formed the core of the lecture. Professor McEliece seasoned his lecture with wit and humor. Moreover, he showed the application of information theory from a very refreshing point of view. Part 3 was a song performed by Professor McEliece, which unveiled his wonderful talent as an entertainer. The lecture not only charmed the audience, but also demonstrated that information theory is actually fun and useful to society. It thus revealed the significance of the Shannon Award in the Information Theory community.

As I wrote in the last "President's Column", the role of our Society in the fast-moving IT community will undergo drastic changes. In this transformation, our Society is taking on greater importance as an evaluator. The various awards that our Society offers have become, in fact, important assessment tools. The awards also stimulate Society members. At the same time, they are also reliable indicators of the achievements of the winners. In this perspective, let us consider the awards given by our Society for a moment. The Information Theory Society Board of Governors meeting was held from 13:00 to 18:30 on the first day, June 27, of ISIT 2004. (For details please see the minutes of the BoG meeting, which will appear in a future issue of the Newsletter.) The Board took three awards into consideration during this meeting.

The first was the 2004 IEEE Information Theory Society Distinguished Service Award. This is a new award that was created last year. The award is to honor outstanding leadership in- and providing long standing exceptional service to- the Information

Theory community. At the meeting, the Selection Committee announced Dr. James L. Massey as the first recipient of this award. Moreover, it was decided that the name of this award would be changed to the Aaron D. Wyner Award beginning next year. We believe that naming this newly-established award after Aaron Wyner would set the standard and the tone of the award and highlight the recipient's commitment to the IT Society. Aaron was President of the IT Society, Editor-in-Chief of the IT Transactions, a member of the Board of Governors for many years, a workshop organizer,

led the revision of the constitution of the Society, and was an ardent and indefatigable spokesman for the Society. Consequently, Dr. James L. Massey is the first and last recipient of the IEEE Information Theory Society Distinguished Service Award, but he is regarded as the first recipient of Aaron D. Wyner Award. Dr. Massey is also a past recipient of the Shannon Award, the highest honor of our Society. The Wyner Award and the Shannon Award reflect different achievements and Dr. Massey was chosen as the most suitable person for the Distinguished Service Award.

At the BoG meeting, we also discussed the possibility of creating an award for the outstanding Ph.D. dissertation. However, because it is difficult to evaluate what is the best dissertation, this discussion is still in progress. The Board also had a vigorous discussion about the process of evaluating and selecting the winner of the Best Paper Award.

As for the Shannon Award, it is selected by the Shannon Award Selection Committee, which is a different body than the Board of Governors. After the BoG meeting, the 2005 Shannon Award Selection Committee had its final meeting and selected Richard E. Blahut as the recipient of the 2005 Shannon Award. The decision was announced at the ISIT banquet. The Committee had kept the decision secret and the recipient was not informed in advance. Therefore, the announcement became an emotionally moving moment for both the winner and the audience. It was a wonderful experience to be among those who offered Professor Blahut their wholehearted congratulations. Professor Blahut is certainly a deserving recipient of the Shannon Award.

Any award is the result of a difficult evaluation process and it is challenging to do it so that all, or even most, of us are convinced of the decision. However, it is the mission of our Society to assess research and service achievements such that the decisions we make are consistent with the majority's views and withstand the test of time. If we fail in this mission, our Society will certainly suffer. We constantly strive to achieve this ideal. I welcome opinions from our members concerning the IT Society's awards and selections processes. Please send your candid opinion to the First Vice President Steven W. McLaughlin at swm@ece.gatech.edu and to me at imai@iis.u-tokyo.ac.jp.

The Historian's Column

A. Ephremides



Occasionally in the past, I have bestowed the coveted title of “honorary historian” to some of our colleagues who have provided exceptional and insightful historical tidbits that have adorned this column. The honor list includes Toby Berger, Jim Massey, and Rolf Johannesson. Today, I have the pleasure to augment the ranks of this select group by awarding the honorary title to; unfortunately I cannot disclose his name. The reason is that this individual wishes to remain anonymous. A variety of reasons (but especially a high sense of prudence, implanted in him by having grown up and worked in the former Soviet Union where anonymity was equivalent to life insurance) have made him opt for staying unidentified.

The information he has given me includes some fascinating details from the dark past concerning the relations between our Society and our colleagues in the Soviet Union. I have reported on this subject in the past, but all my reports were based on my own personal observations and documents of our Society. This time, however, the incremental information I have in store for our readers comes directly from the “other” side. And it is very timely since it concerns the travails of Mark Pinsker who is eulogized elsewhere in this issue and who has been not only a victim of the antics of the former “evil empire”, but also one of the luminaries of our field. So, here it goes.

Mark Pinsker was one of three delegates from the Soviet Union who came to the 1966 ISIT in Los Angeles. The other two included a Scientific Administrator and a KGB major, who had appropriate scientific “cover”. It was the first time that an official delegation from the Soviet Union included such a prominent scientist.

As it turned out, Mark had a great time at that symposium. He had lively discussions with many participants and his company was sought after very vigorously. Invitations to dinner, lengthy private discussions, unfettered attention to his person, and respect for his work and sparkling intellect were, apparently, the order of the day.

Well, all this did not sit well with one of the two chaperons. He was in charge of reporting back to the authorities a summary of Mark’s conduct. Although not negative, it was not positive either. It portrayed him as an unreliable and untrustworthy, absent-minded scientist who could inadvertently be duped by western agents and thus inflict harm to the interests of the proletariat back home. This report was duly filed. And thereupon commences a Kafkaesque odyssey.

Based on this report, Mark was banished from traveling abroad and he was blacklisted internally. His colleagues made valiant efforts to reverse the effects of the report. In fact, even one KGB officer felt strongly for Mark and tried to intercede on his behalf. In fact, even the author of the report felt bad about the consequences of the filing. No one was really against Mark, however, the report had been filed. This meant that there was no way of rescinding it, withdrawing it, or modifying it. It had become part

of the oppressive apparatus of the system. It had become impersonal and unmovable. So, here was a fine scientist receiving the ... “shaft”, because a stupid report had been filed, even though without malice or evil intent. Years went by. More Soviet scientists showed up at our symposia. People like Tsybakov, Zigangirov, Varshamov, and others were among the early visitors to Ellentown, Notre Dame, and elsewhere. But not Mark. In fact, he was even invited to give the Shannon lecture in 1979 in Grignano but was not allowed to come.

The notorious, by now, workshop between our Society and its Soviet counterpart that was supposed to take place in New York following the historic workshop in Moscow in 1975, and in which Mark was supposed to participate, was cancelled just hours before the Soviet delegation was about to depart for the United States because Mark was finally prevented from coming despite earlier assurances to the contrary. And all of this because of that stupid report.

I have reported before on the drama of these workshops. So I won’t repeat the facts surrounding them here. One new item is that the KGB officer who tried to help Mark on that fateful 1966 trip was actually the one who was instrumental in assuring that Adrian Segall received a visa for participating in the Moscow workshop. Nonetheless, he proved impotent in trying to undo the damage of the infamous report. As Sakharov said, the KGB was actually one of the less corrupt parts of the Soviet machinery.

In any event, despite this totally unjustified and unstoppable banishment of Mark Pinsker, contact between the two sides continued. In addition to Soviet delegates coming to subsequent ISITs, there were several information theorists from the United States who participated in Soviet IT meetings in Dubna (1969), Tsakhadzor (1971), Talinn (1973), Leningrad (1976), Tbilisi (1979), and Tashkent (1982). In fact, the idea of holding such symposia in the Soviet Union was Mark’s. His goal was to increase the contacts between the two sides. After that, the Soviet Symposia gave way to the Swedish-USSR bi-lateral meetings that took place in Sochi (1983), Granna (1985), Sochi (1987), Gottland (1989), Moscow (1991), Molle (1993), and St. Petersburg (1995).

As it turns out, the momentum of History undid the effects of the evil report. Eventually, Mark made it to the 1995 ISIT in Whistler, where he joined the ranks of the other Shannon Lecturers for the unforgettable ceremony on the banquet stage. And I recall his gracious hosting of a dinner at a fantastic Georgian restaurant in Moscow in January 1991, during the Swedish-USSR workshop. The power of a worthless report on a piece of paper dissolved gradually over time, but had a devastating effect on the brilliant mind and the fine human being that was Mark, but, most importantly, on the rest of us as well by depriving us of his company and advice. But it could not deprive us of his legacy, as a scientist as well as a towering human being.

GOLOMB'S PUZZLE COLUMN™

Countable or Uncountable

Solomon W. Golomb



A set S is *countably infinite* if its members can be put in 1-to-1 correspondence with the positive integers. If S is an infinite set whose members cannot be put in 1-to-1 correspondence with the positive integers, then S is *uncountably infinite*.

You may use each of the following well-known facts in solving the current set of problems.

- The set of real numbers on any interval (a, b) of the real line, with $a < b$, is uncountably infinite.
- The set of all k -tuples of the positive integers is countably infinite.
- The set of *all* subsets (or, all subsequences) of the positive integers is uncountably infinite.
- The set of all *finite* subsets of the positive integers is countably infinite.

In each of the following problems, S is a collection of infinite subsets (or, infinite subsequences) A_i of the positive integers. (The subscript “ i ” does not necessarily come from the set of positive integers. It can just as well come from an uncountably infinite set.) In each problem you are to indicate whether it is possible for S to be uncountably infinite. If so, you are to exhibit a construction for an uncountable set of A_i 's meeting the conditions for belonging to S . If S can be (at most) countably infinite, you must prove that S cannot be uncountably infinite.

- The subsets A_i in S are pairwise disjoint.
- The intersection of any two distinct subsets A_i and A_j in S is finite.
- The intersection of any two distinct subsets A_i and A_j in S contains at most m elements, for some positive integer m .

Yaacov Ziv Elected to National Academy of Sciences

On April 20, 2004, Yaacov Ziv was elected as a foreign associate to the U.S. National Academy of Sciences. Such an election is considered one of the highest honors that can be accorded to a scientist or an engineer in recognition of distinguished and continuing research achievements.

Yaacov Ziv is famous for his outstanding contributions to information theory and coding theory, particularly for his work on individual sequences which led to the well-known universal data compression algorithm. Yaacov Ziv has also been a foreign associate of the U.S. National Academy of Engineering since 1988.

The National Academy of Sciences was established in 1863 by a congressional act signed by Abraham Lincoln. The total number of active members in the National Academy is 1,949. Foreign associates have citizenship outside the United States and their total number, from all countries, is 351.

Jack K. Wolf Awarded IEEE Richard W. Hamming Medal



Jack K. Wolf at the IEEE award ceremony in Kansas City, June 2004.

1974 IT Society President Jack K. Wolf, the Stephen O. Rice Professor in the Department of Electrical and Computer Engineering at the University of California, San Diego, has been awarded the IEEE Richard W. Hamming Medal “For fundamental contributions to the theory and practice of information transmission and storage.” Jack was the recipient of the 2001 Claude E. Shannon Award. He is a member of the IEEE Computer, Communications, Information Theory and Magnetics Societies.

[R2] Mark Semenovich Pinsker. On his 70th birthday, *IEEE Information Theory Society Newsletter*, vol. 45 (3), 1995, pp. 1, 3.

A few of the people close to M. S. Pinsker share their recollections of encounters and friendship with him. These personal remembrances are followed by a complete bibliography of M. S. Pinsker's papers.

Kamil Zigangirov (University of Notre Dame and IPPI). I knew Mark Semënovich for almost 40 years. I joined his laboratory in IPPI in 1965 after defending a Ph.D. dissertation in the Kotel'nikov Institute. My knowledge of information and coding theory was close to nothing at that time. Having learned that my Master Thesis was in the area of sequential analysis and sequential detection, Mark Pinsker immediately suggested to me to work in the area of sequential decoding. An excellent suggestion indeed!

Mark had staggering intuition for which research areas had potential at any particular moment and which research problems would fit a particular individual. Later in my career he convinced me to switch to transmission over feedback channels. He also tried to convince me to study LDPC codes, codes on graphs, and iterative decoding algorithms. Unfortunately for me, he did not succeed. He had more luck with V. V. Zyablov and G. A. Margulis. Jointly with V. V. Zyablov, he published two well-known papers on LDPC codes. G. A. Margulis wrote a few papers on graph theory with applications to coding and concentrators including a famous construction of Ramanujan graphs that has since become a classic.

Prakash Narayan (University of Maryland). The genial man with a twinkle in his eye who beckoned me to his side at an Information Theory Workshop in Oberwolfach in 1989, and proceeded to pepper me with probing technical questions, finally introduced himself as Mark Pinsker. It was easy to take an instant liking to this great and playful scientist.

That meeting also marked the beginning of Mark's sustained and beneficial interest in my research, and of a cherished friendship. I was privileged to collaborate with him (and Volodia Blinovskiy) on the problem of list decoding for the arbitrarily varying channel. Much of the discussion took place during a long night in Mark's Moscow flat in the midst of a workshop in January 1991. My procrastination in furnishing my part of the resulting joint paper ended a few years later during another Moscow workshop with Mark sitting guard outside my hotel room for several days in order to prevent me enjoying the sights until I had completed writing. The gentle soul could turn stern when needed.

An unassuming person, Mark kept from all but a handful of his closest associates in Moscow the fact that he had received in 1978 a letter from the President of the IEEE Information Theory Group informing him of his selection as winner of the Shannon Award; unfortunate circumstances had prevented him from accepting the award. This fact was revealed during ISIT 95 in Whistler and Mark's 1978 award was formally recognized.

Several happy memories of Mark will endure: his wonderment at the variety of products on display in a Washington, D.C. grocery store during a visit to the U.S. in the Spring of 1990; his instructing me to remain mum if interrogated during a night-train journey in January 1991 from Moscow to Leningrad on a discounted-fare ticket provided by him for which only Soviet Union citizens were eligible; his fondness for pulling a leg; and, of course, the joy-

ful get-togethers and technical discussions at many a conference.

In Mark Pinsker's passing, we have lost a great information theorist, and a kind and generous man.

Ilya Dumer (University of California at Riverside). I first met Mark Pinsker in 1973 as an undergraduate, when my fellow students and I started choosing among research directions offered by the Laboratory Heads at the IPPI. Mark Pinsker – who headed the Laboratory of Information Theory since its inception – also gave a two-hour presentation. It was not that his talk was the most entertaining one, nor was it even easy to follow. However, there was something intriguing about this convoluted presentation, something that made you feel entirely connected to the subjects discussed. Mark showed us science in the making. I saw a man fully engaged in high-intensity research, a man ready to proceed from information theory to estimation to networks and back, with no end in sight.

However often I spoke with Mark after this talk – as an undergraduate trainee, as his doctoral student, as a co-worker, still later hosting him in California or visiting back in Moscow – I was always amazed at his never-ending engagement in research. I saw him come up with new ideas in places as unpredictable as a crowded subway car or in a local food market. Even in these unlikely locales, his brief remarks could often shed new light and render a problem from a totally different perspective. Mark enjoyed immensely the sharing of his insights with colleagues and – not surprisingly – for many people he was not only the Laboratory Head but also its magnet. He would often say, "People should help other people" – and was available to anybody who was ready to work with him.

Looking at his scientific achievements, it seemed that his mind always worked at ease, having more trouble resting than moving ahead. For me, however, it was also his perseverance that made Mark so special. I will always remember his two-week visit to Riverside, California, in early May of 2000. Having dismissed all arguments against such a move, Mark decided to fly to California only ten days after he had sustained an apparently quite serious head injury. Upon arrival, his walk was very shaky and he felt dizzy after even a 30-minute drive. However, he kept insisting on going to the Yosemite National Park, paying no heed to my arguments about the difficulty of a seven-hour drive. A few days later, I gave in but took him instead on a shorter trip to Big Bear Lake, a beautiful retreat hidden above winding mountain roads.

Two hours and three stops later, we finally arrived at the lake, whereupon Mark decided to swim in the 58°F water. When the dust settled after a long argument, I was left with no choice but to follow this 75-year old man into the lake. Naturally, I expected problems to ensue from this chilly medicine, but how wrong I was! The next morning Mark actually looked much better, claiming that water had always been good for him. Then, unexpectedly, the neglected and nagged-over trip to Yosemite was completely forgotten. "Epsilonentropy of ellipsoids" took over, and Mark was all business for the rest of his stay. Again, I would see a formula scribbled on a napkin accompanied by his typical remark: "This should be the right answer."

What is more surprising, he kept thinking about ellipsoids – his last scientific toy – even two years later – in the sunset of his life. As ill as he was at that time, some of his remarks would still remind me of the years when he was in his prime. Yet again I remembered the amazing intuitive gift that helped him find the correct answers

to so many conundrums, and then develop new mathematical concepts and techniques that paved the way for later researchers.

Along with many other people, I feel honored to have known him. It was this blend of strong character, a brilliant mind, and generosity of spirit that has made the memory of Mark so special for so many people.

Alexander Barg (University of Maryland and IPPI). When I first met Mark Pinsker in 1981, the distance between us seemed insurmountable. His comments at the seminar meetings, remarks made in our infrequent conversations mostly went by me leaving no trace. It took me a few years and quite some experience before I began to understand and appreciate his views of information theory and ideas behind his coding theory results. The ultimate truth about his mathematics was: he knew the answer, proofs came later. Although coding theory was only one of his areas, and arguably not the most important one, he provided deep insights that influenced coding theory in general and my scientific work in particular. One of M. Pinsker's deep ideas was coding with side information that now exists in many incarnations, from "dirty-paper" coding to correction of defects and localized errors. His paper [55] written jointly with my advisor, V. V. Zyablov, supplied deep insights into the list decoding behavior of the ensemble of linear codes. These ideas have had a strong influence on my work and on many other papers that I know of, emerging again and again as information theory takes new turns.

Gradually we became friends. I would always visit him during my summer visits to Moscow, we spoke a lot on the phone (the last time some 10 days before his demise). He was keenly interested in codes on bipartite graphs and understood their potential for decades before the community turned to their study in the 1990s. His 1975 paper [41] is now cited in most works on iterative decoding that include a historical overview. In later years he became interested in expander codes. In one of our conversations he said, "I mostly worked on ensemble-average properties rather than concrete constructions. Still it is a pity that I did not study expander codes in more detail." Asked why, he responded, "After all it was me who invented expanders" (truly so, in [35]).

In later years Mark's health began to decline. Still in each of our conversations in person or on the phone, he would ask what I was working on, comment on possible directions, and evaluate results and potential of the problem that I would mention. He never forgot to ask about my family and remembered much more than just the names. Apart from mathematics, it is perhaps his interest in other people and their lives that impressed me most about Mark. Moscow is emptier for me without him.

List of publications of M. S. Pinsker

Problems of Information Transmission is a cover-to-cover English translation of the Russian journal *Problemy Peredachi Informatsii*.

1953

1. "Random processes with stationary increments of order n ," *Dokl. Akad. Nauk SSSR, Novaya Ser.*, **90**, No. 5, 731–734 (with A. M. Yaglom).

1954

2. "On linear extrapolation of random processes with stationary increments of order n ," *Dokl. Akad. Nauk SSSR*, **94**, No. 3, 385–388 (with A. M. Yaglom).

3. "Information on a Gaussian random stationary process in a second process stationary related with the first," *Dokl. Akad. Nauk SSSR*, **99**, No. 2, 213–216.

1955

4. "Theory of curves in a Hilbert space with stationary n th increments," *Izv. Akad. Nauk SSSR, Ser. Mat.*, **19**, No. 5, 319–344.

1956

5. "Computation of the information rate of a stationary random process and of the capacity of a stationary channel," *Dokl. Akad. Nauk SSSR*, **111**, No. 4, 753–756.

6. "Information on a stationary random process in another stationary random process," in: *Proc. 3rd All-Union Math. Congress, 1 [in Russian]*, *Izd. Akad. Nauk SSSR, Moscow*, p. 125.

1957

7. "Extrapolation of homogeneous random fields and information on a Gaussian random field in another Gaussian random field," *Dokl. Akad. Nauk SSSR*, **112**, No. 5, 815–818.

1958

8. "Extrapolation of random vector processes and information on a stationary random vector process in another stationary random vector process related with it," *Dokl. Akad. Nauk SSSR*, **121**, No. 1, 49–51.

9. "Estimation of the capacity of a communication channel, the parameters of which are random functions of time," *Radiotekhnika*, **12**, No. 10, 40–46 (with I. A. Ovseevich).

10. "Estimation of the capacity of real communication channels," *Radiotekhnika*, **13**, No. 4, 15–25 (with I. A. Ovseevich).

1959

11. "On the capacity of a multipath information system," *Izv. Akad. Nauk SSSR, Energ. Avtom.*, No. 1, 133–135 (with I. A. Ovseevich).

12. "Optimal linear pre-emphasis and signal correction for transmission through a multipath system," *Izv. Akad. Nauk SSSR, Energ. Avtom.*, No. 2, 9–59 (with I. A. Ovseevich).

13. "Information rate, capacity of a multipath system, and reception by the method of linear-operator transformation," *Radiotekhnika*, **14**, No. 3, 9–21 (with I. A. Ovseevich).

1960

14. "Information stability of Gaussian random variables and processes," *Dokl. Akad. Nauk SSSR*, **133**, No. 1, 28–30.

15. "Entropy, entropy rate, and entropy stability of Gaussian random variables and processes," *Dokl. Akad. Nauk SSSR*, **133**, No. 3, 531–534.

16. "Dynamical systems with completely positive and zero entropy," *Dokl. Akad. Nauk SSSR*, **133**, No. 5, 1025–1026.

17. "Pre-emphasis and correction in a channel with fading," *Izv. Akad. Nauk SSSR, Energ. Avtom.*, No. 3, 145–156 (with I. A. Ovseevich).

18. "Capacity of channels with global and selective fading," *Radiotekhnika*, **15**, No. 12, 3–9 (with I. A. Ovseevich).

19. *Information and Information Stability of Random Variables and Processes [in Russian]*, *Probl. Peredachi Inf.*, **7**, *Izd. Akad. Nauk SSSR, Moscow*.

1961

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32. "Information in observations and asymptotically sufficient statistics," *Probl. Peredachi Inf.*, **8**, No. 1, 45–61).
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66. "Self-tuning algorithm for minimax nonparametric estimation of spectral density," *Probl. Inf. Trans.*, **22**, No. 3, 209–221 (with S. Yu. Efroimovich).
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82. “Binary constant-weight codes correcting localized errors and defects,” *Probl. Inf. Trans.*, **30**, No. 2, 102–104 (with R. Ahlswede and L. A. Bassalygo).
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87. “Asymptotically optimal binary codes of polynomial complexity correcting localized errors,” *Probl. Inf. Trans.*, **31**, No. 2, 162–168 (with R. Ahlswede and L. A. Bassalygo).
88. “Sensitivity of channel capacity,” *IEEE Trans. Inf. Theory*, **41**, No. 6 (with V. V. Prelov and S. Verdú).
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90. “Codes detecting localized errors,” *Probl. Peredachi Inf.*, vol. 32, no. 2, pp. 36–38 (with L. A. Bassalygo).
91. “Sharp-optimal and adaptive estimation for heteroscedastic nonparametric regression,” *Stat. Sinica*, vol. 6, pp. 925–942 (with S. Yu. Efroimovich).
92. “Constant-weight codes detecting localized errors,” in *Proc. 5th Int. Workshop on Algebraic and Combinatorial Coding Theory*, Sozopol, Bulgaria, June 1–7, pp. 25–26 (with L. A. Bassalygo).
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93. “On error-free filtering of some stationary processes,” *Usp. Mat. Nauk*, vol. 52, no. 2, pp. 109–118 [English translation in *Russian Math. Surveys*, vol. 52, no. 2, pp. 349–358] (with V. V. Prelov).
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95. “On codes correcting weakly localized errors,” *IEEE Trans. Inf. Theory*, vol. 43, no. 1, pp. 363–364 (with L. A. Bassalygo).
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96. “Information rates in certain stationary non-Gaussian channels in weak-signal transmission,” *Probl. Peredachi Inf.*, vol. 34, no. 1, pp. 3–17 (with V. V. Prelov and E.C. van der Meulen).
97. “Error-free filtering of an entropy-singular signal under independent distortions,” *Probl. Peredachi Inf.*, vol. 34, no. 3, pp. 3–6 (with V. V. Prelov).
98. “Upper and lower bounds and asymptotics of the optimal filtering error of a stationary process with a small information rate,” *Probl. Peredachi Inf.*, vol. 34, no. 4, pp. 23–38 (with V. V. Prelov).
99. “Information-theoretic methods in filtering problems,” in *Trans. 13th Prague Conf. on Information Theory, Statistical Decision Functions, and Random Processes*, Prague, pp. 465–468 (with V. V. Prelov).
- 1999**
100. “Stationary channels with a random parameter which is a completely singular process,” *Probl. Peredachi Inf.*, vol. 35, no. 1, pp. 3–12 (with V. V. Prelov and E.C. van der Meulen).
101. “Centered error-correcting codes,” *Probl. Peredachi Inf.*, vol. 35, no. 1, pp. 30–37 (with L. A. Bassalygo).
102. “On the Hamming bound for nonbinary localized-error-correcting codes,” *Probl. Peredachi Inf.*, vol. 35, no. 2, pp. 29–37 (with R. Ahlswede and L. A. Bassalygo).
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103. “Evaluation of the asymptotics of the summarized capacity of an M-frequency T-user noiseless multiple-access channel,” *Probl. Peredachi Inf.*, vol. 36, no. 2, pp. 3–9 (with L. A. Bassalygo).
104. “Information rate in memoryless channels for a slowly varying Markov signal,” *Probl. Peredachi Inf.*, vol. 36, no. 3, pp. 29–38 (with V. V. Prelov and E.C. van der Meulen).
105. “Entropy of an ellipsoid in a Hamming space,” *Probl. Peredachi Inf.*, vol. 36, no. 4, pp. 47–52.
106. “On error-free filtering of singular processes under nonstationary distortions,” *Probl. Peredachi Inf.*, vol. 36, no. 4, pp. 89–97 (with V. V. Prelov).
- 2001**
107. “Correction of ordinary and localized errors,” *Probl. Peredachi Inf.*, vol. 37, no. 4, pp. 56–59 (with L. A. Bassalygo).
108. “Asymptotic investigation of the information rates in certain stationary channels with and without memory,” *Amer. J. Math. Manag. Sci.*, vol. 21, no. 1–2, pp. 29–42 (with V. V. Prelov and E.C. van der Meulen).
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109. “Epsilon-entropy of an ellipsoid in a Hamming space,” *Probl. Peredachi Inf.*, vol. 38, no. 1, pp. 3–18 (with I. I. Dumer and V. V. Prelov).
110. “An optimization problem related to the computation of the epsilon-entropy of an ellipsoid in a Hamming space,” *Probl. Peredachi Inf.*, vol. 38, no. 2, pp. 3–18 (with I. I. Dumer and V. V. Prelov).
- 2004**
111. “On coverings of ellipsoids in Euclidean spaces,” *IEEE Trans. Inf. Theory*, to appear (with I. I. Dumer and V. V. Prelov).
112. “On the thinnest coverings of spheres and ellipsoids with balls in Hamming and Euclidean spaces,” in: *General Theory of Information Transfer and Combinatorics* (with I. I. Dumer and V. V. Prelov).

IEEE Information Theory Society Board of Governors Meeting

Allerton Conference Center, Monticello, IL USA

October 1, 2003

Mehul Motani

Attendees: Alexander Barg, Thomas Cover, Michelle Effros, Anthony Ephremides, Tom Fuja, Marc Fossorier, Andrea Goldsmith, Torleiv Kløve, Ralf Koetter, Ryuji Kohno, Steven W. McLaughlin, Muriel Medard, Urbashi Mitra, Mehul Motani, David L. Neuhoff, Lance C. Pérez, Bixio Rimoldi, Joseph A. O'Sullivan, Alexander Vardy, Sergio Verdu, Han Vinck.

The meeting was called to order at 19:30 by Society President Han Vinck. The members of the Board were welcomed and introduced themselves.

1. The agenda was approved and distributed.
2. The minutes of the previous meeting in Yokohama, Japan on June 29, 2003 were approved as distributed.

The following action items from the previous meeting in Yokohama, Japan were reviewed.

→ **Action Item** It was agreed by the Board that the Joint IT/ComSoc Paper Award procedures be added to the Bylaws. This needs to be in conjunction with ComSoc.

→ **Action Item** The Board voted unanimously to revisit the Bylaws with respect to voting for the IT Paper Award at the BOG meeting.

→ **Action Item** The Board requested that the ad hoc committee looking at publications issues write a detailed task description and report at the next meeting in October.

→ **Action Item** The Board requested that the Education committee present a more detailed report on their activities at the next meeting in October.

→ **Action Item** The Board requested that the ad hoc committee tasked to liaison with the NSF report on their activities at the next meeting in October.

Steven McLaughlin reported on the reorganization at NSF. He commented that Venu Veeravalli is now the program director responsible for communications funding at NSF.

Anthony Ephremides discussed his experience as a member of the NSF Visiting Committee and expressed some concern about leadership at NSF.

→ **Action Item** The President requested that the NSF ad hoc committee submit a report of their findings.

→ **Action Item** It was also agreed that the remaining action items from the previous meeting stated above be revisited.

3. The President began by thanking the organizers of ISIT'03.

Regarding the Society BOG elections, the President explained the circumstances of Hideki Imai's name appearing on the ballot.

The President commented on the need for a new webmaster for the Society web pages.

It was noted that Muriel Medard would be replacing Marc Fossorier as Treasurer of the Society.

The President announced the results of the elections for presidents of the Society: Hideki Imai as President, Steven McLaughlin as 1st Vice President, and David Neuhoff as 2nd Vice President.

By a clear majority of votes, the following paper was selected for the IT Society Paper Award:

Lizhong Zheng and David N. C. Tse, "Communication on the Grassmann manifold: A geometric approach to the noncoherent multiple-antenna channel", *IEEE Trans. Info. Theory*, vol. IT-48, pp. 359 - 383, February 2002.

It was noted that Robert Gallager was the recipient of the 2003 Marconi Award.

It was noted that the Germany chapter was selected as the Best Chapter for 2003.

The President discussed the meeting with the Japanese society SITA. It was noted that SITA is organizing ISITA'04 to be held in Italy next year. The abstracts for ISITA are to appear in *IEEE Xplore*.

The President discussed a proposal for a joint workshop with SITA in 2005 and to use the IEICE Meeting as a joint meeting. Marc Fossorier and Ryuji Kohno are coordinating this effort.

→ **Action Item** The Board supports this and encourages a detailed proposal.

The President discussed reciprocity of fees for ISIT and ISITA. He suggested a meeting in Chicago to discuss a formal agreement.

→ **Action Item** The Board unanimously supported the President in investigating this matter with IEEE.

4. Steven McLaughlin reported on membership development. He noted a 12% IT Society membership and a 6% drop in IEEE membership. He also reported a positive reaction in the IEEE-wide membership survey.

The Chapter Chairs meeting attracted the participation of 20 chairs. It was announced that the German chapter was selected as the Best Chapter for 2003. There were also two new chapters in 2003, Bangalore and Beijing.

The following ideas were suggested: (a) mentoring program, (b) Best Student Paper Award (Michelle Effros), and (c) Social event with students and BOG (Andrea Goldsmith).

→ **Action Item** The Board requested that David Neuhoff, along with Michelle Effros and Andrea Goldsmith, follow up on the ideas suggested above.

5. Marc Fossorier presented the Treasurer's report. It was noted that the IEEE is changing policies, resulting in less freedom for individual societies to develop their own finances.

It was commented that IEEE charges are based on services not on account balance.

Things are on target for 2003. The Society gets money returned over a two year period for having made its digital library available to IEEE. The IT Society benefits are based on these criteria.

It was reported that the Society will get \$10,000 over a two year period for the digital library.

ISIT 2002 reported a surplus of \$64,000. There was a suggestion to return the surplus to the chapter to use for activities (both local and society wide). There was a suggestion to revisit a proposal made by Jim Massey, a proposal for which more information is needed.

→ **Action Item** The Board requested Anthony Ephremides to develop a proposal for dealing with the surplus.

6. The President reviewed the report of the IT Transactions Editor-in-Chief.

The Board unanimously approved the following Associate Editor appointments: Galen Sasaki, Bruce Hajek, Ralf Müller, and Xiaodong Wang.

7. There was nothing to report with respect to the ad-hoc committee on publication issues.
8. Lance C. Pérez reported on the IT Society Newsletter. He noted problems with delivery outside the USA as IEEE is using a third-party vendor.

There was a suggestion to go fully electronic with the Society Newsletter. Several board members expressed strong interest in keeping the paper version.

There was a suggestion for the Society to assume responsibility for layout and distribution of the Society Newsletter.

→ **Action Item** The Board requested Lance C. Pérez to look into this matter and report back to the Board.

The idea of a digital archive of the Newsletter was proposed and the Board fully supported Lance's effort in pursuing this course of action.

Lance announced that the deadline for the December 2003 Newsletter was October 15, 2003.

9. There was nothing to report with respect to the IT Society Website.

10. Matters related to Symposia and Workshops

- (a) The Board heard two proposals for ISIT 2006. Jody O'Sullivan made a proposal for ISIT 2006 in Seattle, Washington, USA. Andrea Goldsmith made a proposal for ISIT 2006 in San Francisco, California, USA.

The Board approved a motion to vote on ISIT 2006 at this current BOG meeting.

The Board then voted and selected Seattle as the location of ISIT 2006.

- (b) The Board unanimously approved the Information Theory Workshop to be held in New Zealand in August 2005.

- (c) Ryuju Kohno presented an update on ISIT 2003.

- (d) Sergio Verdu reported on the ITW Workshop in San Antonio, to be held from October 24-29, 2004.

- (e) Ralf Koetter reported that all was on track for ISIT 2004 to be held in Chicago.

- (f) There was nothing new to report regarding ISIT 2005.

11. There was nothing to report with respect to the Education Committee.

12. Steven McLaughlin commented on the new CD/DVD initiative. It was agreed to postpone the discussion and decision until we have information of the total costs involved.

→ **Action Item** The Board requested Steven McLaughlin to make another proposal once all the information is available.

→ **Action Item** The Board requests Lance C. Pérez, Steven McLaughlin, and Alexander Vardy to form an ad-hoc committee to look at the digital library issue.

13. The President led a discussion on the outcome of the IEEE questionnaire.

14. The floor was then opened up for all other business

The Board thanked Han Vinck for his service as President of the Society.

The Board also thanked Marc Fossorier and Michelle Effros for their contribution to the Society.

It was announced that the 2004 BOG meetings will be held in conjunction with CISS in Princeton, ISIT in Chicago, and ISITA. Further details will be provided at a later date.

15. The meeting was adjourned at 23:10.

SOME PRIME NUMBER PROPERTIES—Solutions

Solomon W. Golomb

Here $p_n = n^{\text{th}}$ prime number, and $\pi(x) =$ number of primes $\leq x$, for positive real x .

1. "Prove that the ratio $\frac{n}{\pi(n)}$, for $n \geq 2$, takes every integer value > 1 at least once."

Proof. It was given in the Puzzle Column that

$$\lim_{x \rightarrow \infty} \frac{\pi(x)}{x} = 0 \text{ and } \lim_{n \rightarrow \infty} p_n = \infty. \text{ Thus the ratio } \frac{\pi(x)}{x}$$

ultimately becomes and remains less than any assigned $\epsilon > 0$, as $x \rightarrow \infty$. It starts at $\frac{\pi(2)}{2} = \frac{1}{2}$.

For any $m \geq 2$, there is a *unique largest prime*

$p_k = p_{k(m)}$ for which $\pi(p_k) = k \geq \frac{p_k}{m}$. Thus,

$m\pi(p_k) = mk \geq p_k$. Either $mk < p_{k+1}$ or $mk \geq p_{k+1}$.

If $mk < p_{k+1}$, and since

$p_k \leq mk$, $\pi(p_k) \leq \pi(mk) < \pi(p_{k+1})$, from which

$\pi(mk) = k$, and $\frac{mk}{\pi(mk)} = m$, so that $n = mk$ is an integer for which $\frac{n}{\pi(n)} = m$.

If $mk \geq p_{k+1}$, then $\pi(p_{k+1}) = k + 1 > k = \frac{mk}{m} \geq \frac{p_{k+1}}{m}$,

which contradicts the choice of p_k as the *largest prime* for which $\pi(p) \geq \frac{p}{m}$. \square

2. "Every positive integer belongs to exactly one of the two sequences $\{s_n\} = \{n + \pi(n)\}$ and $\{t_n\} = \{n + p_n - 1\}$."

Proof. In the land of Primordia, the sequence $\{p_n\}$ is used as a "tax table", in the sense that the sales tax increases by one cent at every term of the sequence $\{p_n\}$ (and at no other values). Thus the sales tax on the price p_k is exactly k . More generally, the sales tax on the price m is $\pi(m)$, the number of terms of $\{p_n\}$ not exceeding m .

From this point of view, the "total price" (including tax) on an item with a net price of n is $n + \pi(n)$. The sequence $\{n + \pi(n)\}$ thus consists of all numbers which can occur as "total prices". What numbers cannot occur as "total prices"? As the net price increases through one of the terms of $\{p_n\}$, say from $p_n - 1$ to p_n , the total price increases from $(p_n - 1) + (n - 1)$ to $p_n + n$, thus skipping the value $p_n + n - 1$. If m is not of the form p_n , then the total price goes from $(m - 1) + \pi(m - 1)$ to $m + \pi(m)$, increasing by only one cent, because in this case

$\pi(m - 1) = \pi(m)$. Thus the integers skipped in the sequence $\{n + \pi(n)\}$ are precisely the terms of the sequence $\{n + p_n - 1\}$. \square

Note that in problems 1 and 2, the fact that $\{p_n\}$ is the sequence of the prime numbers (rather than some other subsequence of the positive integers that becomes less dense) plays almost no role.

3. "Given positive integers a and b , there exists a positive integer c such that infinitely many numbers of the form $an + b$ (n a positive integer) have all their prime factors $\leq c$."

Proof. All numbers in the sequence

$\{b(a + 1)^k, k = 1, 2, 3, \dots\}$ are distinct and of the form $an + b$. Thus $c = \max(b, a + 1)$ satisfies the condition of the problem. \square

4. (a) "What is the largest integer N such that, if $1 < k < N$ and k has no prime factor in common with N , then k is prime?"

Answer. $N = 30$. Since

$30 = 2 \times 3 \times 5 = p_1 \times p_2 \times p_3$, the product of the first three primes, every k relatively prime to 30 cannot be divisible by 2 or 3 or 5, and the smallest $k > 1$ divisible by none of these and *not* prime is $p_4^2 = 7^2 = 49$, which is bigger than 30.

- (b) "What is the largest *odd* integer N such that, if $1 < k < N$ and k has no prime factor in common with $2N$, then k is prime?"

Answer. $N = 105$. Since

$105 = 3 \times 5 \times 7 = p_2 \times p_3 \times p_4$, the product of the first three *odd* primes, every *odd* k relatively prime to 105 (i.e. every k relatively prime to $2 \times 105 = 210$) cannot be divisible by 2 or 3 or 5 or 7, and the smallest k divisible by none of these and *not* prime is $p_5^2 = 11^2 = 121$, which is bigger than 105.

(Known results on the distribution of the primes prevent larger solutions than 30 and 105 to these problems.)

5. "For what positive integers n is it true that $\sum_{p \leq \pi(n)} p = n$?"

$$\sum_{p \leq \pi(n)} p = n$$

Answer. $n = \{5, 17, 41, 77, 100\}$. For "large" n , $\sum_{p \leq \pi(n)} p > n$, and $n = 100$ is the last value for which equality holds. \square

(For a more detailed solution, see the Solution to Problem E3385 (**American Math. Monthly**) listed as Reference 5 at the end of these Solutions.)

6. Let $a_1 < a_2 < a_3 < \dots$ be an increasing, infinite sequence of positive integers."

(a) "Construct such a sequence $\{a_k\}$ having the property that, for every integer n (positive, negative, or zero) the sequence $\{a_k + n\}$ contains only finitely many prime numbers."
 Construction. Let $\{a_k\} = \{(2k)!\}^3$ for $k = 1, 2, 3, \dots$. For $A_n = \{a_k + n\}$, if $|n| \geq 2$ then all terms of A_n with $k \geq n$ are divisible by n , and hence not prime. For $n = 0$, $A_n = \{a_k\}$ is clearly composite for all $k \geq 1$. Finally, using $x^3 + 1 = (x + 1)(x^2 - x + 1)$ and $x^3 - 1 = (x - 1)(x^2 + x + 1)$, the values of A_n for $n = \pm 1$ are composite for all $k \geq 2$. (Many other constructions are possible.)

(b) "Is there such a sequence $\{a_k\}$ and a constant $B > 0$ such that, for every integer n (positive, negative, or zero) the sequence $A_n = \{a_k + n\}$ contains no more than B prime numbers?"

The answer to this is unknown. A "yes" answer would contradict the "prime k -tuples" conjecture, which the late Paul Erdős was convinced had to be true. However, at least two other plausible conjectures in prime number theory also contradict the "prime k -tuples" conjecture.

On the model of the construction given in 6.(a) above, let $\{a_k\} = \{(2k)!\}^{3F(k)}$, where $F(k)$ can be an integer-valued function that grows uncomputably fast. Then each translate sequence $A_n = \{a_k + n\}$ will be "expected" (by the thinning

density of the sequence of prime numbers) to contain only a *small* finite number of prime numbers, whereas our uniform bound B can be chosen arbitrarily large (e.g. $B = 10^{10^{100}}$). Anyone who can exhibit a *specific* sequence $\{a_k\}$ such that all its translates *provably* contain no more than B primes each (for a specific B , however large) will earn a permanent place in the history of prime number theory.

All the problems in this set are based on articles or problems which I published (over several decades) in either the **American Mathematical Monthly (AMM)** or in **Mathematics Magazine (Math. Mag.)**.

1. "On the ratio of N to $\pi(N)$ ", **AMM**, vol. 69, no. 1, Jan. 1962, 36-37.
2. "The 'Sales Tax' Theorem", **Math. Mag.**, vol. 49, no. 4, Sep.-Oct. 1976, 187-189.
3. Problem E2725, **AMM**, vol. 85, no. 7, Aug.-Sep., 1978, p. 593. Solution, vol. 86, no. 9, November, 1979, p. 790.
4. Problem E3137, **AMM**, vol. 93, no. 3, March, 1986, p. 215. Solution, vol. 94, no. 9, November, 1987, p. 883.
5. Problem E3385, **AMM**, vol. 97, no. 5, May, 1990, p. 427. Solution, vol. 98, no. 9, November, 1991, pp. 858-859.
6. Problem 10208, **AMM**, vol. 99, no. 3, March, 1992, p. 266. Solution, vol. 102, no. 4, April, 1995, pp. 361-362.

For further information about Problem 6.(b) and its relation to the "prime k -tuples conjecture", see Paolo Ribenboim, *The Little Book of Bigger Primes*, Second Edition, Springer, New York, 2004, pp. 201-204, where the existence of a solution to 6.(b) is called "Golomb's Conjecture".

Workshop Report: DIMACS Algebraic Coding Theory and Information Theory

Sasha Barg

The workshop was held at and sponsored by DIMACS (Center for Discrete Mathematics and Theoretical Computer Science of Rutgers, The State University of New Jersey) as a part of its Special Focus program in Computational Information Theory and Coding. The workshop was organized by Alexander Barg (University of Maryland), Alexei Ashikhmin (Bell Labs), and Iwan Duursma (University of Illinois at Urbana-Champaign).

Discoveries made in coding theory in the 1990s brought forward a number of new topics that presently attract attention of specialists. Present day developments in coding theory are concentrated around low-complexity code families, algebraic and lattice decoding, code design for multiple access channels, interplay with the theory of random matrices, quantum error correction, quantization, nontraditional applications of coding theory such as alternatives to routing in networks, coding with side information, problems in theoretical computer science. Expanding into these areas enriched coding theory research with new problems and ideas.

On the other hand, a number of recent studies in information theory attempt at developing structured code families as an alternative to random coding arguments usually employed to establish performance limits.

The overall purpose of the workshop was to establish and further links between algebraic coding and information/communications theory. The workshop featured theoretical contributions in some of the named areas, both new results and tutorial presentations. It also had a substantial educational component, exposing coding theorists to a new range of problems and presenting constructive methods to the information theory community. The workshop was designed to promote cross-proliferation of ideas, identify problems of information theory that can be addressed by coding theory methods, and familiarize information theorists with methods used for code construction.

A tightly packed scientific program consisted of 35 talks in three and a half days. Among the topics covered were recent developments in source coding, space-time coding, compression, iterative decoding of codes and lattices, side information problems, matrix integration, combinatorial problems in coding and cryptography. The full program is available at the web site <http://dimacs.rutgers.edu/Workshops/CodingTheory>.

The site also contains viewgraphs of many workshop talks.



**XXVIIIth General Assembly
New Delhi, India
23-29 October, 2005**



Announcement and Call for Papers Now Available

The announcement and call for papers for the XXVIIIth General Assembly of the International Union of Radio Science is now available on the Web. This includes the topics and schedule for the sessions of the 10 URSI Commissions, as well as the instructions and format for submitting papers. *Web-based submission is mandatory.* An abstract must be submitted first, followed by a full paper after acceptance. There is also information on the **Young Scientists Program**. The information in this announcement is *essential* for anyone wishing to submit a paper at the General Assembly. The deadline for *receipt* of abstracts is **February 1, 2005**.

<http://www.ursiga2005.org>

URSI GA 2005 Secretariat, National Physical Laboratory
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Workshop Report: SPWC 2004

London, England
June 2-4, 2004

Mohammad Shikh-Bahaei

The second international workshop on signal processing for wireless communication (SPWC 2004), yet another highly successful event in the series, was organised and chaired by Dr. Mohammad Shikh-Bahaei, and hosted by the Centre for DSP Research at King's College London, and was held in the heart of London between June 2-4, 2004.

During the two-day workshop some of the foremost experts in the fields of wireless communications and signal processing shared their highly respected views with the audience about the latest advances in those fields. Just to name two, the father of space-time coding and the inventor of turbo codes were among the keynote speakers. The workshop also featured two panel sessions that discussed the present techniques and the future trends in signal processing for wireless communications.

Professor Claude Berrou, whose name is associated with invention of turbo codes, presented at the workshop, for the first time, his latest findings on a smart technique to improve turbo codes. Professor Vincent Poor presented a unified approach to power control for multiuser detectors, and Professor Vahid Tarokh

spoke on collaborative wireless networks. Professor Sergio Verdu elaborated on his recent work (jointly with Guo and Shamai) on connections between information theory and estimation theory. Professor Bruce Sutter presented his paper about his recent findings on the applications of Hub matrix theory in wireless communication.

Professor Biglieri gave a talk on iterative processing in wireless communications. He provided a tutorial on the fundamentals of iterative processing, and elaborated on iterative interfaces for coded multiple-antenna signaling. One more talk related to coding theory was by Professor Bahram Honary, in which he presented new results on LDPC codes. Professor Hanzo gave an invited talk on adaptive OFDM and MC-CDMA versus space-time coding. Finally, Professor Paulraj presented his comparative results on wireless systems invoking space-time coding and those that feature beamforming.

The workshop also featured poster sessions during which the papers accepted by the workshop were presented by their authors.



Sergio Verdu and Mohammad Shikh-Bahaei at SPWC 2004.



Professors Shikh-Bahaei, Paulraj, Biglieri and Sutter during a panel session at SPWC 2004.



CALL FOR PAPERS

2004 IEEE Information Theory Workshop

Marriot Riverwalk, San Antonio, Texas
October 24-29, 2004



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Paul Colac
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Sonny Matous

The 2004 IEEE Information Theory Workshop (ITW 2004) will take place on October 24-29 in San Antonio, Texas, USA. All areas of information theory will be represented, with special emphasis on new applications of information theory within biology, computer science, and networking. Technical sessions will include:

- Emerging Applications of Information Theory
- Information Theory and Computer Science
- Information Theory and Networks
- Wireless Systems and Space-Time Signal Processing
- Source and Channel Coding Techniques
- Data Compression
- Graphs, Codes and Iterative Decoding
- Algebraic Codes, Cryptography and Cryptanalysis

Contributions by authors new to the information theory community are particularly encouraged. Abstracts of up to 5 pages should be submitted electronically to itw2004@ee.tamu.edu by **May 31, 2004** following the guidelines on the workshop web page. Authors will be notified of acceptance decisions by **July 16, 2004**. The final version, to be published in the workshop proceedings, will be due by **September 3, 2004**. Information on the final manuscript format can be found on the workshop web page. Those unable to submit manuscripts electronically should send two copies of the manuscript by the deadline to:

Costas N. Georghiadis
c/o Ms. Sonny Matous
Electrical Engineering Department
Texas A&M University
College Station, Texas 77843-3128
USA

Information regarding the technical and social programs, final manuscript format, workshop registration, and hotel accommodations will be posted on the workshop website at:

<http://ee-wcl.tamu.edu/itw2004/>

Inquiries on general matters related to the workshop should be addressed to:

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Phone: 979-862-8657
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SPAWC 2005, the sixth IEEE International Workshop on Signal Processing Advances for Wireless Communications is devoted to recent advances in signal processing for wireless and mobile communications. For the first time in its series, SPAWC 2005 will also focus on selected emerging areas in wired-lines. This workshop brings together members of the signal processing, communications and information theory communities, working in universities, research centers and telecommunications companies. The meeting will feature keynote addresses by leading researchers, as well as invited and contributed papers. SPAWC 2005 will be held June 5, 2005 - June 8, 2005 at The Italian Academy for Advance Studies in America at Columbia University, New York, NY.

Prospective authors are invited to submit papers in the following areas:

- Source-channel coding
- Iterative (turbo) decoding, Monte Carlo signal processing
- Smart antennas, MIMO systems, and space-time coding
- Modeling, estimation and equalization of time-varying channels
- Signal separation, and interference rejection
- Acquisition, synchronization, and tracking (data aided or blind)
- Fundamental limits on capacity and performance analysis
- Single-carrier, multi-carrier, and multi-rate systems
- Multiple access and broadcast channels, multi-user receivers
- Mobile location
- Cross-layer issues: from physical to networking layers
- Signal processing tools for ad hoc, multi-hop, and sensor networks
- Cooperative transmission and reception schemes
- Spread-spectrum systems
- Time, frequency, multi-user diversity in fading channels
- Ultra-wideband radio
- Topics in wired-line: signal processing for power-line communications, digital subscriber loops and cable modems

Conference URL <http://spawc.ece.cornell.edu/>

Important Dates

- | | |
|------------------|----------------------------|
| January 15, 2005 | Submission deadline |
| March 15, 2005 | Notification of acceptance |
| April 15, 2005 | Submission of final paper |



IEEE
Signal Processing Society



Call for Papers CISS '05

39th Annual Conference

on Information Sciences and Systems

The Johns Hopkins University
 Department of Electrical and Computer Engineering
 Baltimore, Maryland, March 16, 17, and 18, 2005

<http://www.ece.jhu.edu/ciss/>

Authors are invited to submit papers describing theoretical advances, applications, and ideas in the fields of Information Sciences and Systems including signal processing and analysis, systems biology and control, communication and information theory, computer engineering, and photonics.

Two types of contributed papers are solicited:

- **Regular papers**, requiring approximately 30 minutes for presentation; these will be reproduced in full (up to six pages) in the conference proceedings.
- **Short papers**, suitable for presentation in approximately 15 minutes; one-page summaries of these papers will be published in the proceedings.

Electronic summaries in Adobe PDF format, together with a "regular" or "short" designation and 2-3 keywords must be submitted by **January 3, 2005** via the conference website: <http://www.ece.jhu.edu/ciss/> Summaries should be of sufficient detail and length to permit careful reviewing. Authors will be notified of acceptance no later than **January 31, 2005**. Final manuscripts of accepted papers are to be submitted in PDF format no later than **February 21, 2005**. These are firm deadlines that will permit the distribution of the Proceedings at the Conference.

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IMPORTANT DATES:

Submission deadline:

January 3, 2005

Notification of acceptance:

January 31, 2005

Final manuscript and
author registration:

Before February 21, 2005

Conference Dates:

March 16, 17, 18, 2005



CALL FOR PAPERS

2005 IEEE International Symposium on Information Theory

Adelaide Convention Centre, Adelaide, Australia
September 4 – 9, 2005



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The 2005 IEEE International Symposium on Information Theory will be held at the Adelaide Convention Centre in Adelaide, Australia from Sunday, September 4 through Friday September 9, 2005.

Previously unpublished contributions to the following areas will be solicited:

Coded modulation	Information theory and statistics
Coding theory and practice	Multiuser detection
Communication complexity	Multiuser information theory
Communication systems	Pattern recognition and learning
Cryptography and data security	Quantum information processing
Data compression	Shannon theory
Data networks	Signal processing
Detection and estimation	Source coding

Papers will be reviewed on the basis of an extended abstract (not exceeding six pages) of sufficient detail to permit reasonable evaluation. The deadline for submission is **January 30, 2005**, with notification of decisions by May 15, 2005. The deadline will be strictly enforced. In view of the large number of submissions expected, multiple submissions by the same author will receive especially stringent scrutiny. All accepted papers will be allowed twenty minutes for presentation, and one-page abstracts will be printed in the conference proceedings. Authors are strongly encouraged to submit electronic versions of their extended abstracts in the form of Portable Document Format (PDF) files.

Detailed information on paper submission, technical program, accommodation, travel, and excursions will be posted on the Symposium web site

<http://www.isit2005.org>

Inquiries on general matters related to the Symposium should be directed to

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Conference Calendar

DATE	CONFERENCE	LOCATION	CONTACT/INFORMATION	DUE DATE
September 15-16, 2004	InOWo '04 - 9th International OFDM Workshop	Dresden, Germany	http://ofdm.tu-harburg.de Prof. Herman Rohling, TU Hamburg-Harburg, Eissendorfer Str. 40, D-21073 Hamburg, Germany, ofdm@tu-harburg.de	April 30, 2004
September 29-October 1, 2004	42nd Annual Allerton Conference on Communication, Control and Computing	Monticello, IL	http://www.comm.csl.uiuc.edu/allerton	July 1, 2004
October 6-8, 2004	2004 Asia-Europe Workshop on Information Theory (AEW4)	Viareggio, Italy	http://www.exp-math.uni-essen.de/~vinck/aew4/aew4.html	May 1, 2004
October 10-12, 2004	2004 International Symposium on Information Theory and its Applications (ISITA 2004)	Parma, Italy	isita2004@sita.gr.jp http://www.sita.gr.jp/ISITA2004/new.htm	March 26, 2004
October 24-29, 2004	2004 IEEE Information Theory Workshop (ITW)	San Antonio Marriot Riverwalk Hotel San Antonio, Texas, USA	See CFP in this issue. http://ee-wcl.tamu.edu/itw2004 Ms. Sonny Matous Electrical Engineering Department Texas A&M University Room 237 WERC	May 31, 2004
November 29-December 3, 2004	GLOBECOM 2004	Hyatt Regency Dallas at Reunion Hotel Dallas, Texas, USA	http://www.globecom2004.org	March 1, 2004
April 3-7, 2005	WiOpt 2005	Trento, Italy	http://www.wiopt.org/	Oct. 5, 2004
TBA (before ISIT 2005)	2005 Information Theory Workshop (ITW)	New Zealand	TBA	TBA
September 4-9, 2005	2005 IEEE International Symposium on Information Theory (ISIT)	Adelaide Convention Center Adelaide, AUSTRALIA	See CFP in this issue. http://www.isit2005.org Dr. Alex Grant Institute for Telecommunications Research University of South Australia SA 5095 Australia Prof. Rodney A. Kennedy Research School of Information Sciences and Engineering Australian National University ACT 0200 Australia rodney.kennedy@anu.edu.au	January 30, 2005
April 3-7, 2006	4th International Symposium on Turbo Codes and Related Topics	Munich, Germany	http://www-turbo.enst-bretagne.fr/	Oct. 15, 2005
TBA	2006 IEEE International Symposium on Information Theory (ISIT)	Seattle, Washington, USA	TBA	TBA