IEEE Information Theory Society Newsletter

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President's Column

Abbas El Gamal

The first Board of Governors (BoG) meeting this year was held at the ITA workshop in beautiful sunny San Diego. The BoG discussed some of the issues I mentioned in my March column and there have been some follow on actions that I would like to share with you.

The ad hoc committee on Information Theory Future Directions consisting of Jeff Andrews (chair), Alex Dimakis, Lara Dolocek, Michelle Effros, Olgica Milenkovic, Muriel Medard, Andrea Montanari, Sriram Vishwanath, and Edmund Yeh, gave a report to the BoG based on their discussions and input from leading researchers in genomics, biology, economics, and neuroscience, among other fields. The committee was charged with exploring the following questions: What are future directions for research in information theory? Where will information theory be having an impact in 10–20 years? Are there new and emerging areas where information theory can have a revolutionary impact, as it did on the telecommunications industry over the past 50 years? How should the IEEE Information Theory Society promote high-risk new research directions and broaden the reach of information theory, while continuing to be true to its ideals and insisting on the intellectual rigor that makes its breakthroughs so powerful?

The main message in the committee report is that much of the growth opportunities and high-impact future directions lie at the intersection of information theory with other disciplines. As a field dedicated to understanding the limits of the representation, communication, and processing of information and methods for achieving these limits, the scope for such intersections is immense and exciting. In addition to continuing to serve as the theoretical underpinning for communications and networking, and in cognate fields such as theoretical computer science, statistics, machine learning, signal processing, and control theory, the committee envisions a growing role for information theory in diverse fields, such as genomics, data processing, economics and finance, neuroscience, and physics. The report lays out concrete topics in which information theory is envisioned to become indispensible, for example, in the compression of genomics data, the application of learning algorithms to massive data sets, and understanding the value and role of information in economic decisions with limited information. Ultimately, as progress is made in neuroscience, it seems inevitable that information theory will also play an important role in understanding how the brain stores and processes information, and it can be expected that these pursuits will enrich the field of information theory as new tools and models are developed. The final report of this committee will be publicly available in the near future.

Frank Kschischang provided a report on the Transactions on Information Theory titled, "Transitions." The first transition he mentions is from Pareja to ScholarOne. Thanks to the efforts of Helmut Bolcskei, Lisa Jess from IEEE, and most importantly, to Michael Lerjen at ETH Zurich, this transition has been successfully completed. Another transition is to moderate editing, which is providing "moderate" but badly needed savings in editing costs. Frank's report discusses other ways to reduce editing costs, including imposing page charges for papers having a length exceeding some threshold or creating electronic-only Supplements to the Transactions to appear on IEEEXplore. He also outlines alternatives to transition to a new more "robust" editorial board structure.

The BoG seemed open to the idea of peer-reviewed supplements provided the saving in editing cost is significant and the technical quality is not sacrificed. Subsequent to the BoG meeting we found out from the IEEE that the

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From the Editor

Tara Javidi

Dear IT Society members,

In the second issue of 2014, in addition to our popular and regular contribution by our historian Tony Ephremides and our puzzle master Solomon Golomb, we congratulate Professors Candes, Poor, Verdu, and Yu for their elections the National Academy of Sciences and the Royal Society. I would also like to thank Bob Gray for preparing a tribute to our colleague and friend Thomas J. Goblick.

As a reminder, announcements, news and events intended for both the printed newsletter and the website, such as award announcements, calls for nominations and upcoming conferences, can be submitted jointly at the IT Society website http://www.itsoc.org/, using the quick links "Share News" and "Announce an Event." Articles and columns also can be e-mailed to me at ITsocietynewsletter@ece.ucsd.edu with a subject line that includes the words "IT newsletter." The next few deadlines are:

Issue	Deadline
September 2014	July 10, 2014
December 2014	October 10, 2014
March 2015	January 10, 2015

Please submit plain text, LaTeX or Word source files; do not worry about fonts or layout as this will be taken care of by IEEE layout specialists. Electronic photos and graphics should be in high resolution and sent as separate files. I look forward to hear your suggestions and contributions.

IEEE Information Theory Society Newsletter

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Professors Elected to the US National Academy of Sciences and the Royal Society

As the issue was going to print, we heard that Professors Emmanuel Candès, Sergio Verdú, and Bin Yu have been elected members of the National Academy of Sciences. Furthermore, Professor Vincent Poor has been elected as a Foreign Member of the Royal Society. Professors Candes, Poor, Verdu, and Yu are distinguished members of the IT society.

The National Academy of Sciences is a private, nonprofit institution that was established under a congressional charter signed by President Abraham Lincoln in 1863. It recognizes achievement in science by election to membership, and—with the National Academy of Engineering, Institute of Medicine, and National Research Council—provides science, technology, and health policy advice to the federal government and other organizations. Election to the National Academy of Sciences is among the highest professional distinctions accorded to any scientist.

The Royal Society, the UK's national academy of science, is the oldest scientific academy in continuous existence. The Fellowship of the Royal Society is made up of the most eminent scientists, engineers and technologists from the UK and the Commonwealth as well as across the globe. Past Fellows and Foreign Members have included Newton, Darwin and Einstein.

Emmanuel Candès

Sergio Verdú

Bin Yu

Vincent Poor

President's Column *continued from page 1*

saving of online-only paper editing can be quite substantial. Subsequently, the BoG passed the resolution "To allow for peer-reviewed online-only supplementary material to be posted together on IEEExplore with each IT Transactions paper." An ad hoc committee chaired by Frank has been charged with working out the implementation details of this resolution. They are expected to report their recommendations at the Honolulu BoG meeting at the end of June.

In my previous column I mentioned the declining membership of our society. The society second Vice President, Alon Orlitsky, has been spearheading an effort to increase our membership to match the healthy growth in our publications, conferences, and schools. We are pursuing several approaches to increasing our membership:

1) Increasing awareness of the benefits of membership, such as the outreach and mentorship programs that are reserved only for members. Also, along with the IEEE, we are considering adding a website service providing career advancement opportunities for society members.

2) Offering lower costs to members. Starting this year, workshop, symposia, and school registration fees will be lower for members. We are also considering imposing Transactions page charges on non-member authors.

3) Inviting members of other IEEE societies (COMSOC, SP, CS) to join our society at reduced initial membership fee.

4) Articulating the importance of membership to the health of the society and to our field.

In closing, I look forward to seeing you at ISIT in Honolulu. This conference promises to be one of our best ever thanks to the exceptional efforts of the general chairs Anders Host-Madsen, Aleksandar Kavcic, and Venugopal Veeravalli and the technical program chairs Sae-Young Chung, Gerhard Kramer, Olgica Milenkovic, and Urbashi Mitra (not to mention the amazing venue).

Please feel free to email me your thoughts and suggestions at: abbas@ee.stanford.edu.

The Historian's Column

Anthony Ephremides

Many of our members often wonder how the venues of our workshops and symposia are chosen. For that matter one could wonder how any one of the multitude of scientific conferences in the world are decided. What criteria are used and who decides? I can offer today to the readers some enlightenment on this subject based on the accumulated wisdom from years in the trenches of the IEEE.

In our Society the decisions are made ultimately by the Board of Governors but mostly after the recommendations of the Committee on Conferences (in each Society this entity has a different name), which in our case is a rather recently created one. Usually there are formal or informal solicitations for proposals by interested volunteers, and, frequently, the Board and Committee members "shake the bushes" to encourage potential organizers to step forward with concrete suggestions, plans, and ideas.

The criteria vary but some of the ones we have used are (i) to rotate locations around the world, (ii) to secure venues with sufficient resources to accommodate the size of our meetings, and (iii) to select attractive, interesting, and "fun" places. Often, but not always, we pay attention to whether there is sufficient local activity on Information Theory and whether the location is easily accessible from around the world and whether the costs are manageable.

Our record, in comparison to other Societies, is excellent, in that we do come up with unusual, varied, and, generally, delightful destinations. The Communication Society, for example, usually rotates among well-established, predictable, accessible, and often pricey Convention cities like Chicago, London, Toronto, Sydney, Atlanta, Los Angeles, and similar towns in a few other countries. There has always been a concern about how a chosen venue will appear to employers and funding agencies. It shouldn't be a "boondoggle" (I love this word) or look like a vacation. In our case the prestige of our Society's name and the quality of our technical programs quickly absolves us from such considerations or suspicions. Thus, we have been to ski resorts (Les Arcs, St. Jovite), prime vacation lands (Sorrento, Hawaii), charming smaller towns (Ulm, Adelaide, Brighton, Trieste, Trondheim, Nice, Austin), exotic places (Svalbard, Kruger Park, Metsovo), and larger, more "predictable" cities (Seattle, San Diego, Yokohama, St. Petersburg, Budapest, etc.)

Our volunteers who undertake the daunting task of organizing a symposium or workshop are very imaginative and creative and sometimes come up with irresistible proposals. The choice of Svalbard, for example, in 1997 is a case in point. I bet most of our readers do not have any idea where that is. Well, it is located at 80 degrees of north latitude or, put in another way, two hours of flying time due north from the northern-most tip of Norway. The benefits from a sliver (or "tongue") of Gulf Stream waters that reaches Svalbard provides it with two months of (sometimes) ice-free water access and has permitted the development of an interesting little town (Longyearbyen) that boasts a small University campus (focusing on arctic research), lots of summer tourist activities and, even, a Michelin-rated one-star restaurant! It has a trade-free status that brings in cruise ships and a fine hotel that can accommodate a meeting with about one hundred participants easily. An interesting feature of the place is the preponderance of polar bears, so that when one ventures out of the town it is advised (if not required) to carry a rifle, so that he/she can handle effectively an unpleasant "glad-to-eat-you" encounter.

Similarly, in 1999, our members had the chance in Kruger Park of South Africa to come real close to wild animals like lions, elephants, rhinos, etc. The sightings were uneventful and more tranquil than the interactions inside the session rooms. What is actually totally unusual is that we had a second meeting right on the heels of the Kruger one in Metsovo, a small quaint village in the middle of northwestern Greece, which shares with Kruger Park only the fact that both locations are in the same time zone.

Looming in the horizon are symposia in Hong Kong (2015), Barcelona (2016), and Aachen (2017) and workshops in Tasmania (later this year) and Jerusalem (next year). Of course, the ITA, which has earned a permanent place in our calendar of meetings, remains steadily in its wonderful San Diego location, adding a sense of stable anchorage for our Society.

It used to be that, to gain the approval of suspicious watchdogs of virtuous living, one would have to choose places like Biloxi, Mississippi, in August or Manitoba in January. Not anymore. The reason is that there is no place on this earth that will satisfy the requirements of having no recourse other than penance during leisure time as our watchdogs would have us do. One can engage in prime large-mouth bass fishing in Biloxi and in dog-sledding or cross-country skiing in Manitoba. Our creativity can always lead us to fun activities even in the remotest places of the world.

So, please use your knowledge and imagination and propose innovative locals for our meetings in the future.

NSF Center for Science of Information

Wojciech Szpankowski
Center for Science of Information, Director
Purdue University, W. Lafayette, IN 47907, USA

A recent development in our field has been the establishment of the Center for Science of Information (CSoI) as one of the NSF Science and Technology Centers. The Center seeks to develop the fundamental principles underlying various aspects of information, along with their application to diverse scientific, engineering, social, and economic domains. Its mission is to advance science and technology through new paradigms in the quantitative understanding of the representation, communication, and processing of information in biological, physical, social, and engineering systems. It aims to use information theory and its tools as a basis for extending the scope of information science, beyond Shannon's original objective of laying the foundation for communication theory for reliably reproducing data.

Led by Purdue, Center member institutions include Bryn Mawr, Howard, MIT, Princeton, Stanford, Texas A&M, UIUC, UCSD, UC-Berkeley. Other institutions (e.g., Rutgers, University of Hawaii, LINCS, Paris, and ETH, Zurich) are affiliated with the Center in various roles. The Center team includes a Nobel laureate, several members of National Academies (NAS/NAE), a Turing award winner, Shannon award winners, Nevanlinna prize winners, a Humboldt prize winner, and a Swartz prize winner in neuroscience. The project team brings expertise in all essential areas of research, including Computer Science, Chemistry, Economics, Statistics, Information Theory, Life Sciences, Mathematics, and Physics. The Center has fostered a strong environment of collaborative research and education—crossing institutional and disciplinary boundaries.

Center Overview

Claude Shannon laid the foundation of information theory, demonstrating that problems of information communication can be precisely modeled, formulated, and analyzed. He also provided basic mathematical tools for addressing these problems. Shannon's focus on what is fundamental, and his precise quantitative analysis, continues to motivate and inspire. In the current world, however, information is not merely communicated; it is also acquired, represented, inferred, processed, aggregated, managed, valued, secured, and used. A comprehensive science of information must address all of these aspects of information. The Center aspires to do fundamental research in the science of information with high and direct impact.

Following the principles of Shannon and Turing—who engaged themselves with practical systems before arriving at their theoretical abstractions, the Center focuses on specific applications with the goal of obtaining a broader and more general understanding of information. For instance, timeliness of information is extremely important when information is used in cyber-physical systems—leading one to investigate the issue of delay, which Shannon's theory largely ignored. The use of information also brings to focus the issue of semantics. The meaning of the message is integral to performance of the consequent task, leading one to investigate goal-oriented communication and control under constrained

communication. These problems are helping define information-semantics in fundamentally new and relevant ways by the Center scientists. Cyber-physical systems bring together processing and communication of information which is explored in the context of various applications ranging from vehicle information systems to sensor networks.

Investigation of biological systems at the Center motivates understanding of representation, inference, and aggregation of data. Since the time of Shannon, biology has undergone a major revolution, giving rise to significant challenges in interpreting data and understanding biological mechanisms. From a historical perspective (see L. E. Kay, "Who Wrote the Book of Life", 2000), Henry Quastler first introduced information theory in biology in 1949, just a year after the landmark paper of Shannon, and four years before the inception of molecular biology (shaped by the work of Crick and Watson). Continuing this effort, Quastler organized two symposia on "Information Theory in Biology". These attempts were rather unsuccessful, as argued by Henry Linschitz who pointed out that there are "difficulties in defining information of a system composed of functionally interdependent units and channel information (entropy) 'to produce a functioning cell'". The advent of high-throughput technologies for data collection from living systems, coupled with our refined understanding of biological processes provides new impetus for efforts aimed at understanding how biological systems (from biomolecules to tissues) represent and communicate information. How can one infer this information optimally (from genome sequencing to functional image analysis)? How can one control specific functional and structural aspects of processes based on this understanding?

In yet other applications such as economics, questions of how information is valued are important. Flow of Information in economic systems and associated control problems are vitally important, and have been recognized through recent Nobel Prizes. More recently, with the ability to collect large amounts of data from diverse systems such as sensed environments and business processes, problems in 'big and small data' have gained importance. Data analytics at scale is critically reliant on models and methods whose performance can be quantified. Issues of privacy and security pose problems for data management, obfuscation, querying, and secure computations. The Center is at the cutting edge of research in knowledge extraction from massive and structural data.

With respect to education and diversity, the Center aims to define a complete program at the Undergraduate level in the Science of Information. This program consists of a sequence of courses covering topics ranging from core theoretical foundations, to applications of the science of information in various disciplines. Students are exposed to research topics at annual summer schools. Graduate students are presented unprecedented opportunities to work across disciplines and institutions, and are strongly encouraged to seek joint advisors across universities. Postdoctoral researchers and CSoI Fellows at the center are funded with the explicit expectation that they are supervised by faculty at multiple institutions, and are expected to spend significant time at these institutions. We are in the third year of our prestigious Center Fellowship program with the first graduated Fellow joining the University of California at Berkeley. The diversity mission of the Center focuses on enhancing the representation of women and minorities in various disciplines associated with the Center. A number of programs identify promising students from underrepresented groups and recruit them to the Center.

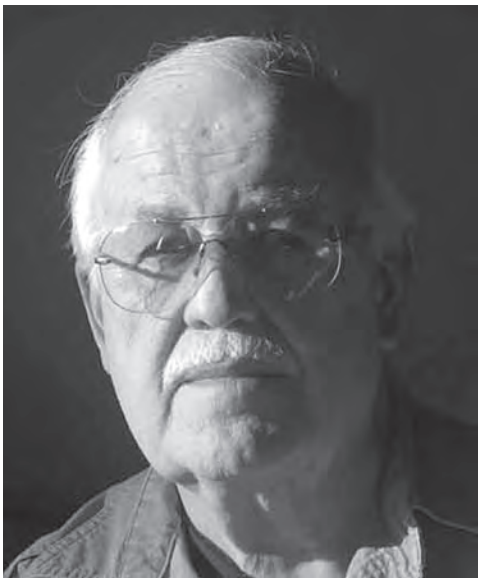
The knowledge transfer mission of the Center focuses both on delivering Center products to the broader community, and on engaging with industry partners to adapt solutions to real-world problems. To achieve these goals, the Center hosts periodic workshops and meetings with the scientific community. The Center has developed a significant web-based curricula, which is currently used at a large number of institutions worldwide. It has also formed strategic international partnerships (e.g., LINCS, Paris and ETH, Zurich). Beyond this, Center researchers engage closely with a number of companies on a variety of problems—ranging from genome sequencing to vehicular networks.

We invite all members of our Society, and other interested readers, to the Center portal—http://www.soihub.org, and to engage with us in new joint initiatives to promote our shared interest in extending the scope of information sciences.

In Memoriam: Thomas J. Goblick, Jr.

Robert Gray
Stanford University

Thomas J. Goblick, Jr, died at age 79 at home in Wayland, Massachussetts, on March 30, 2014. Tom was an early and important participant in the development of Shannon information theory, especially in source coding—a mix of quantization, data compression, analog-to-digital conversion, and rate-distortion theory. His work during the 1960s produced several classic results and conjectures which are still heavily cited. In later years he moved on to numerous other technical domains, including speech coding, spread spectrum, GPS, parallel computing, image understanding architectures, artificial neural networks, and optical interconnection networks for parallel computers. The focus here will be on information theory.



Tom entered the field almost 60 years ago as Bob Gallager's first PhD student. His dissertation committee included Claude Shannon, Peter Elias, and Irwin Jacobs. The acknowledgements in his 1962 dissertation "Coding for a discrete information source with a distortion measure" include thanks to fellow graduate students Robert Kennedy, James Massey, and Jacob Ziv. Tom received his B.S. at Bucknell University in 1956 and was working at MIT Lincoln Laboratory when Paul Green and Robert Price encouraged him to pursue graduate studies at MIT as a Lincoln Staff Associate, funded by Lincoln. He received from MIT his S.M. in 1958, his E.E. in 1960, and his Ph.D. in 1963. He was a Fulbright Scholar in 1958 at Imperial College of Science and Technology at the University of London.

Following his graduation, with the exception of sabbaticals at Washington University of St Louis (1967) and MIT (1983), Tom spent his entire career of roughly half a century at Lincoln, where he held a high reputation as engineer, leader, and mentor. While at Washington University he worked with Russell Pfeiffer developing models for the auditory system and he taught classes on information theory and linear systems. At MIT he worked on computer technology and artificial intelligence.

In his dissertation, Tom was the first to propose the use of tree codes for source coding. For IID sources and a Hamming distortion, Tom showed by simulation that randomly generated tree-structured decoders with matched sequential encoding—the reverse structure of that used for coding for noisy channels— could provide performance approaching the Shannon rate-distortion function and conjectured that the approach provided nearly optimal performance under suitable assumptions, a conjecture later proved by Fred Jelinek.

Arguably Tom's most famous work was his "1/4 bit" 1967 correspondence in the *IEEE Transactions on Information Theory* with Jerry Holsinger. They demonstrated that for an IID Gaussian source with a high bit rate, the simple combination of uniform scalar quantization combined with entropy coding achieved

performance within approximately .25 bits per sample (or about 1.5 dB) of the Shannon optimal performance. The good news of the result was that simple techniques were shown (under certain conditions) to provide nearly optimal performance. An unfortunate side effect was the subsequent common interpretation of the result to imply that it was never worth the effort to consider more sophisticated source coding methods since there was so little further performance improvement available. Although this debate still crops up on occasion, the original result is limited to IID Gaussian sources and high bit rates, and often in practice large improvements in compression over simple scalar quantization and entropy coding have been achieved by taking advantage of known structure in the signal and by using more sophisticated distortion measures than squared error (analysis-by-synthesis speech coding is a good example).

Another surprising and signficant result was first published by Tom in his 1965 *IT Transactions* paper "Theoretical Limitations on the Transmission of Data from Analog Sources" where Tom showed that in some cases *no coding at all* provides nearly optimal performance. Shannon showed that if an information source has a rate-distortion function $R(D)$ and a noisy channel has a Shannon channel capacity C, then $R(D) \leq C$ is a necessary condition for the existence of a communication system to achieve average distortion D or less. In other words, if $D_{\min}$ is the smallest value of D for which $R(D) = C$, then $D_{\min}$ is the smallest average distortion that can be achieved when communicating the source over the channel, no matter how complex the codes or how great the delay. Furthermore, provided $R(D) < C$, then there exist codes with performance near D, provide one allows codes of arbitrary complexity and delay. Many engineers haven taken this to mean that to perform near the Shannon limits, complicated codes with large delays are always required. Tom showed that at least in one case—stationary band-limited Gaussian sources and additive white Gaussian noise channels with an average power constraint and the same bandwidth—performance at the optimal point $R(D_{\min}) = C$ is possible with no "coding" at all in the traditional sense, that is, no mappings of Euclidean space into discrete sets are needed. Simple scaling of the source to meet the power constraint coupled with optimal linear filtering at the receiver suffices.

As final note—Tom and Irv Stiglitz are attributed as the originators of the inequality $(1 - ab)^K \leq 1 - b + e^{-Ka}$ for $a, b \in (0, 1)$ and K a positive integer, which played a key role in simplifying post-Shannon proofs of the source coding theorem with a fidelity criterion.

Tom was a part of our information theory community for only a little more than a decade, but it was a formative decade and he was at the center of activity. The novelty, creativity, and insight of his contributions place him in a small group of the most influential of the pioneers of Shannon information theory.

GOLOMB'S PUZZLE COLUMN™

Counting Necklaces

Solomon W. Golomb

When a finite group G of operators (or symmetries) operates on a finite set S, it partitions the elements of S into "patterns" (or "orbits"), where two elements s_1 and s_2 are in the same pattern if and only if there is an operator g in G such that $g(s_1) = s_2$. The classical formula (it has been traced back as far as Cauchy) for the numbers, Γ, of such patterns, is

$$\Gamma = \frac{1}{|G|} \sum_{g \in G} I(g),$$

where $|G|$ is the "order" of (number of elements in) G, the summation is over all elements g in G, and $I(g)$ is the number of s in S for which $g(s) = s$. (Thus, Γ is the average number of "fixed points" in S, averaged over the operators g in G.)

Now, suppose identically shaped beads are available in unlimited amounts in each of c colors. Then, when n beads are put on a string, there are c^n possible sequences.

Here are your problems,

1) When the two ends of the string are tied together to form a necklace, how many of the resulting necklaces are distinct, relative to the group (C_n) of cyclic rotations of the necklaces?

2) How many distinct necklaces are there relative to the group (D_n) of rotations *and reflections* (flipping over) of the necklaces? (Consider even n and odd n separately.)

3) How many of the necklaces in question 1 have no "periodic substructure" (i.e. no pattern that repeats two or more times throughout the necklace)?

4) Evaluate your answers for all c with $2 \leq c \leq 5$ and all n with $4 \leq n \leq 8$.

GOLOMB'S PUZZLE COLUMN™

Elementary Arithmetic Solutions

Solomon W. Golomb

A) A month has a Friday 13th if and only if it begins on Sunday. Each of the seven months from May through November starts on a different day of the week.

1) In a "normal" (non-leap) year, a Friday 13th in May, June, or August will be the only one that year. In a leap year, a Friday 13th in May, June or October will be the only one that year.

2) A normal year having two Friday 13th may have them either in January and October, or in April and July, or in September and December. A leap year with two Fridays 13th may have them either in February and August, in March and November, or in September and December.

3) If a normal year has three Fridays 13th, they will occur in February, March, and November. A leap year with three will have them in January, April, and July, all within half a year (183 days).

4) In every year (normal or leap) a Friday 13th in May or June is the only one in its year; and if either September or December has a Friday 13th they both do, and there is no other in that year.

B) 1) $\frac{23}{59} = \frac{1}{3} + \frac{1}{18} + \frac{1}{1062}$. 2) $\frac{167}{385} = \frac{1}{5} + \frac{1}{7} + \frac{1}{11}$.

3) $\frac{687}{2800} = \frac{1}{7} + \frac{1}{16} + \frac{1}{25}$. 4) $\frac{22}{37} = \frac{1}{3} + \frac{1}{4} + \frac{1}{111} + \frac{1}{444}$.

Did you find any better: either fewer summands, or the same number of summands but a smaller largest denominator?

C) 1) Given the remainders of an integer N, $0 \le N \le 104$, when divided by 3 (say R_3), by 5 (say R_5), and by 7 (say R_7), then $N = 70R_3 + 21R_5 + 15R_7 \pmod{105}$. Here the numbers 70, 21, and 15 serve as "unit vectors" in three "dimensions". As a "mind-reading" parlor trick, ask for R_7 first, multiply it mentally by 15, then add 21 times R_5, and finally either add $70R_3$, or more often subtract $35R_3$. If your answer is outside the range of (0, 104), then mentally add or subtract 105 to bring it within range. If told your answer is wrong, it may be either your mistake in mental arithmetic, or their mistake in calculating one or more of the remainders.

2) Given the remainders R_7, R_{11}, and R_{13} when an integer N, $0 \le N \le 1000$, is divided by 7, 11, and 13, respectively, to recover $V \pmod{1001}$, use $N \equiv 715R_7 + 364R_{11} + 924R_{13} \pmod{1001}$, or in practice, $N \equiv 715R_7 + 364R_{11} - 77R_{13} \pmod{1001}$.

Call for Nominations

IEEE Communications Society
Data Storage Technical Committee (DSTC)
2013 Best Paper Award and 2013 Best Student Paper Award

The Data Storage Technical Committee of IEEE Communications Society invites you to nominate or self-nominate papers for the 2013 Best Paper Award and the 2013 Best Student Paper Award.

Eligibility and Requirements:

- The paper must appear in print in a peer-reviewed journal or a peer-reviewed conference proceeding in 2013, i.e., from January 1, 2013 to December 31, 2013.
- The specific technical content of the nominated paper is expected to have a clear connection to the general theme of data storage. The nominated paper needs to show substantial meaningful impact on both the theory and the practice of the existing/future data storage systems, or on emerging storage technologies that are gaining momentum.
- A paper may be nominated for both awards, but only one will be awarded.
- If awarded, all the co-authors will each receive a plaque, but only the first author will receive a monetary award.

Additional Eligibility and Requirements for Best Student Paper Award:

- The first author must be
  - a student at the time the paper is accepted for publication; or
  - a graduated student and the paper was submitted within 6 months of the graduation date.
- The contribution of the first author must be greater than 50%.

For nominations and enquiries, please contact Dr. Edward Au, Chair of the 2013 Best Paper Awards Committee, at edward.au@huawei.com and edward.ks.au@gmail.com. The nomination deadline is May 1, 2014.

Committee Members

Prof. John B. Anderson, Lund University/Sweden,
Dr. Edward Au, Huawei Technologies/China,
Prof. Marc Fossorier, ENSEA/France,
Prof. Jae Moon, KAIST/Korea,
Dr. Peter Mueller, IBM/Switzerland,
Dr. Bazhong Shen, Broadcom/United States,
Prof. Bane Vasic, University of Arizona/United States.

FIFTY-SECOND ANNUAL ALLERTON CONFERENCE

ON COMMUNICATION, CONTROL, AND COMPUTING

October 1 – 3, 2014
Call for Papers

The Fifty-First Annual Allerton Conference on Communication, Control, and Computing will be held from Wednesday, October 1 through Friday, October 3, 2013, at Allerton House, the conference center of the University of Illinois. Allerton House is located twenty-six miles southwest of the Urbana-Champaign campus of the University in a wooded area on the Sangamon River. It is part of the fifteen-hundred acre Robert Allerton Park, a complex of natural and man-made beauty designated as a National natural landmark. Allerton Park has twenty miles of well-maintained trails and a living gallery of formal gardens, studded with sculptures collected from around the world.

Papers presenting original research are solicited in the areas of communication systems, communication and computer networks, detection and estimation theory, information theory, error control coding, source coding and data compression, network algorithms, control systems, robust and nonlinear control, adaptive control, optimization, dynamic games, multi-agent systems, large-scale systems, robotics and automation, manufacturing systems, discrete event systems, multivariable control, computer vision-based control, learning theory, cyber-physical systems, security and resilience in networks, VLSI architectures for communications and signal processing, and intelligent transportation systems.

Information for authors: Regular papers suitable for presentation in twenty minutes are solicited. Regular papers will be published in full (subject to a maximum length of eight 8.5" x 11" pages, in two column format) in the Conference Proceedings. Only papers that are actually presented at the conference can be included in the proceedings, which will be available after the conference on IEEE Xplore.

For reviewing purposes of papers, a title and a five to ten page extended abstract, including references and sufficient detail to permit careful reviewing, are required.

Manuscripts must be submitted by **Monday, July 7, 2014**, following the instructions at the Conference website: http://www.csl.uiuc.edu/allerton/**.**

Authors will be notified of acceptance via e-mail by August 6, 2014, at which time they will also be sent detailed instructions for the preparation of their papers for the Proceedings.

Final versions of papers to be presented at the conference will need to be submitted electronically by October 5, 2014.

Conference Co-Chairs: Olgica Milenkovic and Angelia Nedich
Email: *allerton-conf@illinois.edu* URL: www.csl.illinois.edu/allerton/

COORDINATED SCIENCE LABORATORY AND THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

University of Illinois at Urbana-Champaign

ITW Jerusalem 2015

2015 IEEE Information Theory Workshop
Jerusalem, ISRAEL | April 26 – May 1

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The 2015 IEEE Information Theory Workshop will take place from April 26th until May 1st in Jerusalem, Israel, at the Mishkenot Sha'ananim Conference Center. Jerusalem is one of the oldest cities in the world, a place where ancient history intertwines with the twenty-first century. Located in the Judean Mountains, between the Mediterranean and the Dead Sea, it offers a unique experience for the visitor with relics dating back as far as around 1000 BC, finest museums and breathtaking scenery.

Built over 150 years ago, Mishkenot Sha'ananim became the first Jewish residential area outside the Old City walls. Nowadays it is an alluring place with a conference center that serves as a center of academic inquiry and cultural value, a critical piece of Jerusalem's landscape that reframes the city as a vibrant, dynamic, cultural center of local, national and international appeal.

Call for Papers

Original technical contributions are solicited in all areas of Information Theory, with special emphasis on innovative and interdisciplinary research related to:

- Information theory and computer science
- Information theory and estimation
- Network information theory
- Codes for special applications

Paper Submission

Interested authors are invited to submit previously unpublished contributions. Papers for the contributed sessions, not exceeding five pages, should be submitted according to the directions which will appear on the conference website:
http://itw2015.eew.technion.ac.il

Schedule

Paper submission deadline: Oct. 24th 2014
Acceptance notification: Jan. 10th. 2015
Final paper submission: March 1st. 2015

Plenary Speakers

Plenary lectures will feature leading researchers in the workshop's emphasis areas

Conference Calendar

DATE	CONFERENCE	LOCATION	WEB PAGE	DUE DATE
June 10–14, 2014	**IEEE International Conference on Communications (ICC 2014)**	Sydney, Australia	http://www.ieee-icc.org/	Passed
June 18–21, 2014	**2014 IEEE North American School on Information Theory**	Toronto, Canada	http://www.fields.utoronto.ca/programs/scientific/13-14/infotheory/	Passed
June 22–25, 2014	**The 15th IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)**	Toronto, Canada	www.spawc2014.org	Passed
June 29–July 4, 2014	**2014 IEEE International Symposium on Information Theory (ISIT 2014)**	Honolulu, Hawaii, USA	http://www.isit2014.org/	Passed
August 18–22, 2014	**8th International Symposium on Turbo Codes & Iterative Information Processing**	Bremen, Germany	http://www.jacobs-university.de/turbo-symposium-2014/	Passed
October 1–3, 2014	**52nd Annual Allerton Conference on Communication, Control, and Computing**	Monticello, Illinois, USA	http://www.csl.uiuc.edu/allerton/	July 7, 2014
October 26–29, 2014	**2014 International Symposium on Information Theory and its Applications (ISITA 2014)**	Melbourne, Australia	http://www.isita.ieice.org/2014/	Passed
November 2–5, 2014	**IEEE Information Theory Workshop (ITW 2014)**	Hobart, Tasmania, Australia	http://itw2014.jaist.ac.jp/	Passed
December 3–5, 2014	**IEEE Global Conference on Signal and Information Processing (GlobalSIP 2014)**	Atlanta, Georgia, USA	http://www.ieeeglobalsip.org/	Passed
December 8–12, 2014	**2014 IEEE Global Communications Conference (GLOBECOM 2014)**	Austin, Texas, USA	http://www.ieee-globecom.org/	Passed

Major COMSOC conferences: http://www.comsoc.org/confs/index.html