IEEE Information Theory Society Newsletter

President's Column

David L. Neuhoff

David L. Neuhoff

Among the many things that happen on January 1 of each year is that the Information Theory Society acquires a new president. This year the mantle has passed to me from the capable hands of Steve McLaughlin. It is indeed an honor to take this responsibility. I do so with the knowledge that under his leadership, as well as that of his predecessors, and others who have contributed so much, our Society is in good shape.

I would like to mention a few of the important things that happened this past year under Steve's watch. With the latest IEEE formulas for receiving revenues from our publications and for paying infrastructure costs (a kind of overhead charge), our finances have stabilized in the black. The number of papers published in our transactions continues to grow at a rapid rate, while quality remains high. This is a strong indication of the continued and growing importance of the field. Indeed, the transactions is becoming so large that the question of splitting it into two publications has arisen. Our annual International Symposium on Information Theory (this year in Adelaide, Australia) was a big success (thanks to Alex Grant, Rodney Kennedy et al.), as were the two Information Theory Workshops: ITW New Zealand (thanks to Mark Titchener et al.) and ITW Japan (thanks to Hideki Imai, Yuliang Zheng et al.). A Student Committee, spearheaded by Andrea Goldsmith, was formed to increase the ways that our society can help students with interests in information theory. We can expect to see much from this committee in the future. The IT Society began a process of increasing the number of conferences for which it is a technical cosponsor. The goals are to allow the proceedings of such conferences to be included in IEEE Explore and, thereby, receive increased exposure and accessibility to our members as well as others,

and to permit the Society to be credited for providing this content to IEEE Explore. This past year was the first full year in which we have encouraged authors to submit paper preprints to the arXiv e-print server (http://arxiv.org), in order to foster rapid dissemination of information theory results. In response, nearly 400 papers were posted in the information theory category. Finally, we have just begun to initiate an upgrade of our website.

With all these good things happening, there do remain some challenges. For one, membership remains an issue. Last year the number of IT members declined approximately 8%. This is a smaller decline than the 10 to 12% of the two previous years. However, it remains a concern. Most puzzling was the 18% decline in student membership. I would like to hear from people who have ideas about the source of the student decline. Another issue is the IEEE revenue and infrastructure formulas. While the IT Society's finances have stabilized, it now appears that the largest IEEE societies, such as the Computer Society, are disadvantaged by the present formulas. This will likely create the need to reevaluate and, possibly remake, them. We will need to keep a close eye on these deliberations to see how they might affect us. Also to be monitored are proposed changes to the organization of the IEEE Technical Activities Board (TAB). At present, this organization consists largely of the presidents of IEEE technical societies and councils, who act as one large group to make decisions about new societies and publications, operating rules for such and for conferences, and so on. A proposal is now being considered to reform this into two bodies: a Presidents Council comprising the present members, plus a new TAB, which is to be a smaller and presumably more agile and effective body, chosen from the society presidents, division directors, and so on.

I would like to close by wishing everyone a happy and productive new year.

From the Editor

Daniela Tuninetti

This is my first issue as the editor of the Information Theory Society Newsletter. I would like to thank my predecessor Lance Pérez for his excellent work over the past five years and his help in getting me started. I will try my best to follow his example and keep the IT Newsletter an interesting read. I would also like to thank the IT Board of Governors for their trust and the warm welcome. I am looking forward to working with every one who wants to contribute to the growth of the Information Theory Society and of this Newsletter in particular.

In this issue, I hope you will enjoy the column of our President David L. Neuhoff, as well as Anthony Ephremides' Historian's column, and Sol Golomb's puzzle. In addition, there are announcements of prestigious awards recently won by members of our Society, a report on the Japan IT workshop, and an update on the activities of the IT society student committee.

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

Issue	Deadline
June 2006	April 15, 2006
September 2006	July 15, 2006
December 2006	October 15, 2006

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

I may be reached at the following address:

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Sincerely,
Daniela Tuninetti

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The Historian's Column

A. Ephremides

It has been more than twenty years since the Information Theory Workshop took place in Cesaria, Israel. It was 1984. The reason this event came to my mind, as I sat to write this column, is twofold. First, world conditions were more benign at that time and there was no reason to worry about safety in holding an international meeting in Israel. To be sure, the security measures were always extraordinary, but there had not been serious terrorist attacks for some time either within or outside Israel. The only worrisome thing was the value of the Shekel (the national currency of Israel) that was spinning almost out of control and was being devalued every day. So much so, that when Jim Massey offered as an incentive to the speakers in his session ten thousand shekels to finish their talks on time, he had to clarify whether the payment would be made before or after the talk. The value of the offer would be different!

But the second and main reason I remembered that workshop was Bob Lucky's plenary talk. The title was "Who Needs Communication Theory?" When Bob Lucky gives a talk, no matter what the subject is, you know it is going to be interesting and entertaining, and you know that the message will be important. Few people have the vast experience and vision that Bob has. The intriguing title made it even more puzzling. So, with a full house in attendance, Bob proceeded to give, as anticipated, an entertaining talk but one that had a conclusion that was, uncharacteristically, ….. wrong?

Remember, 1984 was first of all the ominous year that was supposed to bring about the complete mechanization of people's minds. Happily this didn't happen, just like the ominous software disaster did not happen in the year 2000. In fact, who even remembers the modern Cassandras around the world who were predicting biblical disasters at the turn of the century? But, in addition, 1984 was the year by which the major development in the history of communications (in addition to Sergio Verdu's completing his Ph.D. degree) was the proliferation of optical fiber. Here was finally a medium that had huge bandwidth, practically zero noise, and a path loss that could be easily mitigated. So, at least for the telephone network (recall, there was not Internet yet) gone were the days of sizeable Gaussian noise and limited bandwidth. And, in Bob Lucky's view of the world (that centered around that precious network, in fact so precious a network that in those predivestiture days, AT&T made sure, as

Bob himself admitted in gest on another occasion, that nobody would get … on it!), the major problems that Communication Theorists were hired to solve had disappeared. Indeed, with infinite bandwidth and zero noise, capacity is infinite and everyone can, in theory, transmit at tera-speeds with pico-power to everyone else. So, after carefully developing this theme, Bob concluded that it is us, Communication Theorists, the only ones who need Communication Theory! The message was deeply troubling and ominous. Under the sugar coat of lightness, Bob was essentially telling us that it was all over for us. The trip had ended! The advent of optical fiber was the coup-de-grace to our discipline and to our profession! There was a residual feeling of light depression lingering in the air, as the audience started mulling over Bob's unanticipated view.

And, yet, some of us did not worry and did not take the message seriously. Like players at a poker game who hold the right cards, we knew that this was not the case. We were sporting a secret and contented smile. We knew that there was also a wireless medium that people were falling in love with. We knew that the bandwidth was severely limited! We knew that noise and fades were significant! We knew that there would be …. Interference! And, we knew that we could not run around tethered to optical fiber wires! And, therefore, we knew that the whole world continued to need Communication Theory. As Bell's image started waning behind the window of optical fiber, the image of Marconi grew larger and more severe. No easy solution to the wireless communication problem. And, if you added the notion of a network, then not all the communication theorists in the world would suffice to even make a dent. Yes, there was a bright future for communications (literally)… in the air!

It has been said that the vitality of a field is proportional to the number of times it is declared dead. And, the 1984 workshop stands out in my memory as one of those times that our field was mildly challenged, only to be reborn vigorously, like the Phoenix, and dominate a large segment of the world economy!

IT Society Members Receive Major IEEE Awards

IEEE Jack S. Kilby Signal Processing Award - *sponsored by Texas Instruments, Inc to:*

THOMAS KAILATH (F'IEEE) - Hitachi America Professor of Engineering, Emeritus, Stanford University, Stanford, CA

For seminal contributions to the theory and applications of statistical signal processing.

THOMAS KAILATH has also been selected for inclusion into the Silicon Valley Engineering Hall of Fame (February 2006)

IEEE Alexander Graham Bell Medal - *sponsored by Lucent Technologies to:*

JOHN WOZENCRAFT (LF'IEEE) – Professor Emeritus, M.I.T., MA

For the development of sequential decoding and the signal space approach to digital communication.

IEEE Richard W. Hamming Medal - *sponsored by Qualcomm Inc. to:*

VLADIMIR I. LEVENSHTEIN (F'IEEE) – Leading Scientific Researcher, Keldysh Institute for Applied Mathematics, Moscow, Russia

For contributions to the theory of error-correcting codes and information theory, including the Levenshtein distance.

IEEE Control Systems Award - *sponsored by Control Systems Society to:*

P.R. KUMAR (F'IEEE) - Franklin W. Woeltge Professor of Electrical and Computer Engineering, University of Illinois, Urbana-Champaign, Urbana, IL

For contributions to adaptive control, manufacturing systems and wireless communications.

IEEE Leon K. Kirchmayer Graduate Teaching Award - *sponsored by the Leon K. Kirchmayer Memorial Fund to:*

TOBY BERGER (F'IEEE) – Jacobs Professor of Engineering, CornellUniversity, Ithaca, NY

For sustained excellence in graduate education and research in information theory.

IEEE Koji Kobayashi Computers and Communications Award - *sponsored by NEC Corporation to:*

NICHOLAS F. MAXEMCHUK (F'IEEE) - Professor, Columbia University, New York, NY

For contributions to Metropolitan and Local Area Networks, reliable multicast, and protocol testing.

IEEE Eric E. Sumner Award - *sponsored by Lucent Technologies to:*

ROBERT A. SCHOLTZ (LF'IEEE) - Fred H. Cole Professor, University of Southern California, Los Angeles, CA

MOE Z. WIN (F'IEEE) - *Associate Professor, Massachusetts Institute of Technology, Cambridge, MA*

For pioneering contributions to ultra-wide band communications science and technology.

IEEE Donald G. Fink Prize Paper Award - *sponsored by IEEE Life Members Committee to:*

SUHAS N. DIGGAVI, School of Computer & Communication Sciences Laboratory of Information & Co, Lausanne, Switzerland

NAOFAL AL-DHAHIR, University of Texas at Dallas, Richardson, TX

ANASTASIOS STAMOULIS, QUALCOMM, San Diego, CA

ROBERT CALDERBANK, Princeton University, Princeton, NJ

For their paper entitled, "Great Expectations: The Value of Spatial Diversity in Wireless Networks."

IT Society Members receive Eduard Rhein Award

IT Society Fellow members Hisashi Kobayashi (Sherman Fairchild University Professor at Princeton University) and Evangelos Eleftheriou (IBM Fellow at the Zurich Research Laboratory), together with François Dolivo (IBM Zurich Research Laboratory), received the 2005 Eduard Rhein Technology Award. Their award citation reads: "For their pioneering role in the introduction of innovative digital signal processing and coding techniques into hard disk drives, based on partial response signaling, maximum likelihood sequence and noise-predictive detection. These advances in the recording channel were instrumental to the unique increase of the storage density and data rates of hard disk drives during the past decades."

The Eduard Rhein Foundation has been honoring outstanding achievements in information technology since 1979, and recent recipient of this leading technology award include Tim Berners-Lee (1998), Norman Abramson (2000), and Nicklaus Wirth (2002). The award ceremony took place at Ehrensaal (Hall of Fame) of Deutsches Museum, Munich on October 15, 2005. The pre-award colloquium was held on October 14 at the Technical University of Munich, hosted by Professor Joachim Hagenauer. A lecture on "35 Years of Progress in Digital Magnetic Recording" was presented by Eleftheriou. The same talk will be presented by Kobayashi at the forthcoming "2006 Hawaii, IEICE, and SITA Joint Conference on Information Theory" (http://www.ieice.org/~it/HISC06   co-

IT Society Members Elected to Fellow in 2006

The following Information Theory Society members were elected to the grade of Fellow by the IEEE Board of Directors effective January 1, 2006.

Name/Affiliation	Society List	Evaluating Society
Prof. Frank Kschischang	IT, COM	IT

University of Toronto, Dept. of Electrical and Computer Engineering

for contributions to trellis structures, graphical models and iterative decoding techniques for error-correcting codes.

Prof. Steven McLaughlin	IT, COM	IT

Georgia Institute of Technology, School of Electrical and Computer Engineering

for contributions to information theory and applications to digital recording technology.

Prof. Johannes Huber	IT, BT, C, COM	IT

Telecommunications Laboratory (LNT), University Erlangen-Nuremberg

for contributions to coded modulation and digital subscriber line design.

Prof. Alon Orlitsky	IT	IT

University of California, San Diego, ECE Department

for contributions to zero-error information theory.

Dr. Marc Fossorier	IT, COM	IT

University of Hawaii at Manoa, Department of Electrical Engineering

for contributions to coding and decoding methods.

Prof. Venugopal Veeravalli	IT, COM, SP	IT

University of Illinois at Urbana-Champaign, Coordinated Science Laboratory

for contributions to wireless communication systems and sensor networks.

Dr. Sedat Olcer	IT, COM	COM

IBM Zurich Research Laboratory

for contributions to signal processing techniques in digital data transmission and storage.

Dr. Ye Li	IT, COM, SP	COM

Georgia Institute of Technology

for contributions to signal processing for wireless communications.

Prof. Masao Nakagawa	IT, AP, CE, COM, BT	COM

Keio University

for contributions to the advancement of code division multiple access (CDMA) and mobile communications.

Dr. Giovanni Cherubini	IT, COM	COM

IBM Zurich Research Laboratory

for application of signal-processing techniques to digital data transmission and storage.

Prof. Armand Makowski	IT, COM	COM

University of Maryland

Dept. of Electrical and Computer Engineering

for contributions to traffic modeling and performance evaluation in communication and computer networks.

Prof. Hamid Jafarkhani	IT, COM, SP	COM

University of California, Irvine, EECS

for contributions to space-time coding.

Prof. Rayadurgam Srikant	IT, COM, CS	CS

University of Illinois at Urbana-Champaign, Coordinated Science Lab

for contributions to modeling and control of communication networks.

Prof. Dirk Slock	IT, SP	SP

Eurecom Institute, Depatment of Mobile Communications

for contributions to adaptive filtering and signal processing for wireless communications.

Prof. Richard Olshen	IT	SP

Stanford University, Stanford University School of Medicine

for contributions to theory and design of decision trees and tree-structured classifiers and codes.

Dr. Gary Sullivan	IT, C, CAS, COM, SP	SP

Microsoft Corporation

for contributions to video coding and its standardization.

Dr. Hermann Rohling	IT, AES, COM, SP, VT	AES

Technische Universitat Hamburg-Harburg, Department of Comminications

for contributions to automotive radar.

Prof. Sitthichai Pookaiyaudom	IT, LEO, Ed, AES, AP, BT, C	CAS

Mahanakorn University of Technology

for contributions to circuits and systems and engineering education.

Prof. Ulrich Reimers	IT, BT, CAS, CE, COM, VT	CE

Braunschweig Technical University, Institute for Communications Technology

for contributions to the development of Digital Video Broadcasting (DVB).

Dr. Harrison Barrett	IT, NPS, SP	EMB

University of Arizona, Optical Sciences Center

for contributions to medical imaging, image processing and optics.

Prof. Michael Loui	C, CS, IT, SIT	SIT

University of Illinois at Urbana-Champaign, Coordinated Science Laboratory

for leadership in teaching of engineering ethics.

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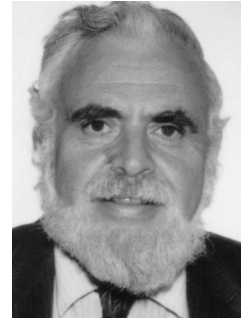
Mini-Sudoku

Solomon W. Golomb

As everyone by now is surely aware, the normal Sudoku puzzle requires the solver to complete a 9×9 Latin square, using the symbols 1 through 9, with the added requirement that each of the nine 3×3 subsquares uses each of the nine symbols exactly once. (The "Latin square" requirement is that each row, and each column, uses each of the symbols exactly once.) A Sudoku puzzle is properly posed if and only if there is one and only one way to complete the 9×9 array, consistent with the symbols already filled in.

An analogous "generalized Sudoku" puzzle can be defined on any $n^2 \times n^2$ array, using n^2 distinct symbols, and requiring that each row, each column, and each of the n^2 subsquares of size $n \times n$ contain each of the symbols exactly once. Normal Sudoku uses $n = 3$. The challenge clearly increases as n gets larger. Instead, we will look at the case $n = 2$. This "Mini-Sudoku" is played on a 4×4 array, using four distinct symbols (say 1, 2, 3, 4), where each row, each column, and each quadrant must contain each of the four symbols exactly once. Here are some Mini-Sudoku questions.

1. How many distinct Mini-Sudoku *solutions* (i.e. filled-in arrays) are there? (Here we consider two solutions *distinct* unless they are identical.)

2. Can you find a Mini-Sudoku solution in which the two diagonals also contain each of the four symbols exactly once?

3. What is the minimum number of cells in the 4×4 array which must be filled in to guarantee a unique Mini-Sudoku solution? Exhibit an example of such a minimum configuration.

4. The partial array

1			
		2	
	3		

does not guarantee a unique solution. However, show what entry *must* appear in the lower right-hand corner.

5. What is the maximum number of cells in the 4×4 array which can be filled in such that the Mini-Sudoku solution is not unique? Exhibit an example of such a configuration.

6. Two $n \times n$ Latin squares are called *orthogonal* if the n^2 ordered pairs of corresponding entries are all distinct. Find a pair of orthogonal Mini-Sudoku solutions.

7. The 4×4 Magic Square

0	5	10	15
14	11	4	1
7	2	13	8
9	12	3	6

contains each of the numbers $0, 1, 2, \ldots, 15$ exactly once. Each row, column, and diagonal sums to 30. So too do the four Mini-Sudoku 2×2 subsquares, and the four Mini-Sudoku "anti-subsquares" indicated by the letters A, B, C, D in

A	B	B	A
C	D	D	C
C	D	D	C
A	B	B	A

Can you explain how I generated this Magic Square from Mini-Sudoku solutions? (*Hint*: Look at problems 2 and 6.)

Workshop Report: The 2005 IEEE Information Theory Workshop on Theory and Practice in Information-Theoretic Security

Junji Shikata

Participants to the 2005 workshop.

October 16-19, 2005

Awaji Island, Japan

The 2005 IEEE Information Theory Workshop on Theory and Practice in Information-Theoretic Security, sponsored by IEEE Information Theory Society and in cooperation with The International Association for Cryptologic Research (IACR), took place in Awaji Island, one of the most beautiful islands in Japan, on October 16-19, 2005.

General co-chairs of the workshop were Hideki Imai (University of Tokyo, Japan) and Yuliang Zheng (University of North Carolina at Charlotte, USA), and program chair was Ueli Maurer (ETH Zurich, Switzerland).

The workshop was devoted to the dissemination and further development of boundary areas between information theory and information security. The main goal of the workshop was to create a unique and excellent venue for researchers working in diverse disciplines to exchange latest research results on information-theoretic security and to discuss directions for future explorations. The topics covered by the workshop included: theoretical and practical issues concerning information-theoretic security, information theory, quantum information theory applicable to information security, applications of information theory to computational security, topics in the bounded storage model and the noisy channel model, and quantum cryptography.

The workshop attracted 85 participants from 19 countries over the world, which assured us that many people had great interest in the topics of the workshop. The technical program consisted of several regular sessions of 23 invited talks given by distinguished speakers from related research areas, and a rump session of 6 short talks on latest progress by researchers. The invited speakers were:

Charles H. Bennett, Carlo Blundo, Gilles Brassard, Anne Canteaut, Yvo Desmedt, Yevgeniy Dodis, Serge Fehr, Matthias Fitzi, Goichiro Hanaoka, Hiroki Koga, Kaoru Kurosawa, Chi-Jen Lu, Keith Martin, Tsutomu Matsumoto, Kirill Morozov, Joern Mueller-Quade, Tatsuaki Okamoto, Rafail Ostrovsky, Michael Rabin, Rei Safavi-Naini, Stefan Wolf, Hirosuke Yamamoto, Moti Yung.

The workshop was a great success thanks to the wonderful presentations given by the invited speakers and the fruitful discussions among the participants.

In addition, it was nice autumn weather during the whole workshop.

The workshop proceedings was published, and it is available through IEEE Xplore®.

A Blurb on the IT-SOC Student Activities

Lalitha Sankar

As IT-SOC student volunteers, it gives us great pleasure to announce the IT-SOC-student mailing list and new online resources for students interested in Information Theory. We thank Prof. Sergio Servetto for hosting the site and Prof. Andrea Goldsmith for coordinating our efforts. Amin Mobasher (amin@cst.uwaterloo.ca), doctoral student at the University of Waterloo, is our current webmaster and has done a fantastic job integrating volunteer contributions. The site, available at http://itsoc-students.ece.cornell.edu/, lists the upcoming IT-SOC student meetings, allows students to upload their doctoral dissertations, has a link to current job opportunities (academic and industrial), as well as a list of classical papers in Information Theory pertinent to students interested in working in IT. The job opportunities page also includes an invaluable list of tips on academic job interviews, courtesy of Prof. Andrea Goldsmith. The useful links page contains guidelines on how to write, present and review papers, as well as a list of journals and upcoming conferences.

We welcome comments and contributions to the above mentioned areas and other areas that we haven't yet explored. We are also interested in creating an online discussion group where students can discuss technical and technology-related topics. Help with these and other aspects are most welcome. To volunteer, please contact Lalitha Sankar at the email address below. Participation in meetings and volunteer opportunities are open to all students and do not require IEEE or IT-SOC membership. Last, but certainly not least, we also welcome and seek participation in the student meeting at the upcoming CISS conference (http://conf.ee.princeton.edu/ciss/). The Student Meeting at CISS will be held on Friday, March 24, 2006 at the Prospect House from approximately 12:30pm - 1:30pm.

IT-SOC student co-chairs:
Ivana Maric (ivanam@winlab.rutgers.edu)
Brooke Shrader (bshrader@umd.edu)

IT-SOC volunteer coordinator:
Lalitha Sankar (lalitha@winlab.rutgers.edu)

Call for Nominations:
2006 IEEE Information Theory Society Paper Award

The Information Theory Society Paper Award is given annually for an outstanding publication in the fields of interest to the Society appearing anywhere during the preceding two calendar years.

The purpose of this Award is to recognize exceptional publications in the field and to stimulate interest in and encourage contributions to fields of interest of the Society. The Award consists of a certificate and an honorarium of US$1,000 for a paper with a single author, or US$2,000 equally split among multiple authors. The 2006 award will be given for a paper published in 2004 and 2005.

NOMINATION PROCEDURE: By March 1, 2006, please email the name of the paper you wish to nominate, along with a supporting statement explaining its contributions, to the IT Transactions Editor-in-Chief, Vincent Poor, at poor@princeton.edu, with a cc to Lynn Stetson at lstetson@princeton.edu.

Call for Nominations:
2006 Joint Information Theory/
Communications Society Paper Award

The Joint Information Theory/Communications Society Paper Award recognizes one or two outstanding papers that address both communications and information theory. Any paper appearing in a ComSoc or IT Society publication during the year 2005 is eligible for the 2006 award. A Joint Award Committee will make the selection.

NOMINATION PROCEDURE: By February 1, 2006, please email the name of the paper you wish to nominate, along with a supporting statement explaining its contributions, to IT Society First vice president, Bixio Rimoldi (bixio.rimoldi@epfl.ch).

Call for Nominations:
2006 Information Theory Society Aaron D. Wyner Award

The IT Society Aaron D. Wyner Award honors individuals who have shown outstanding leadership in, and provided long standing exceptional service to, the Information Theory community. This award was formerly known as the IT Society Distinguished Service Award.

Nominations for the Award can be submitted by anyone and are made by sending a letter of nomination to the President of the IT Society by April 15, 2006. The individual or individuals making the nomination have the primary responsibility for justifying why the nominee should receive this award.

NOMINATION PROCEDURE: Letters of nomination should
- Identify the nominee's areas of leadership and exceptional service, detailing the activities for which the nominee is believed to deserve this award;
- Include the nominee's current vita;
- Include two letters of endorsement.

Current officers and members of the IT Society Board of Governors are ineligible.

Please send all nominations by April 15, 2006 to
David L. Neuhoff
email: neuhoff@umich.edu

Call for Papers: Special Issue of the IEEE Transactions on Information Theory on Information Theoretic Security

A special issue of the IEEE Transactions on Information Theory will be devoted to the exciting research field of Information Theoretic Security. Cryptographic systems that are currently employed in practice are predominantly based on unproven mathematical assumptions such as the assumed infeasibility of factoring large integers and finding discrete logarithms over large finite fields. Advances in cryptanalytic attack algorithms and new computing technologies such as quantum computers may eventually render these systems insecure and obsolete in the future. As such, among both information security researchers and practitioners there has long been a sense of urgency to investigate into novel encryption and authentication systems that do not rely for their security on unproven mathematical assumptions. The past two decades have witnessed a number of significant developments in information theoretic security, including the discovery of unconditionally secure encryption schemes, authentication codes and signature methods, and the development of quantum key distribution protocols.

This special issue will focus on research efforts in all major areas in Information Theoretic Security including encryption, authentication, signature, key distributions, information sharing and quantum cryptography. High quality research papers, expository articles, survey papers, and correspondence items pertaining to all aspects of Information Theoretic Security are solicited. Specific topics include, but are not limited to, the following:

- Theoretical and practical topics concerning information theoretic security
- Paradigms, approaches and techniques concerning information theoretic security
- Information theory applicable to information security
- Applications of information theory to computational security
- Topics in the bounded storage model and the noisy channel model
- Quantum information theory applicable to information security
- Quantum cryptography

Further information on guidelines and instructions for submissions can be found at the following web site:
http://www.isac.uncc.edu/ITS-special-issue

Schedule:
Submission Deadline: October 31, 2006
Acceptance Notification: August 31, 2007
Final version due: October 31, 2007
Publication: March 2008

Guest editorial board:
Hideki Imai, University of Tokyo, Japan
Ueli Maurer, ETH Zurich, Switzerland
Yuliang Zheng, University of North Carolina at Charlotte, USA

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Simple Probabilities Solution

Solomon W. Golomb

1. After the first four cards dealt are all seen to be hearts, the deck still contains 9 hearts among 48 cards, so the probability that the fifth card will also be a heart is $\frac{9}{48} = \frac{3}{16} = 0.1875$.

2. The number of ways to select 5 cards, all hearts, is $\binom{13}{5} = 1287$. The number of 5-card hands with *at least* four hearts is the number of hands with 5 hearts *plus* the number of hands with 4 hearts and one non-heart, which equals $\binom{13}{5} + \binom{13}{4}\binom{39}{1} = 1287 + 27,885 = 29,172$. Thus the probability that a 5-card hand with at least four hearts actually contains five hearts is $\frac{1287}{29,172} = \frac{3}{68} = 0.044117647\ldots$.

3. (a) For *at least* one of six dice to show a **5**, the probability is $1 - \left(\frac{5}{6}\right)^6 = \frac{31,031}{46,656} = 0.6651020233\ldots$, or nearly two-thirds.

   (b) For *exactly* one of six dice to show a **5**, there is a choice of *which* of the six dice shows the **5**, and the other dice must *avoid* showing a **5**; so the probability is: $\frac{6 \times 5^5}{6^6} = \frac{5^5}{6^5} = \frac{3125}{7776} = 0.40187757\ldots$.

4. (a) The probability that all six dice turn up the same is $\frac{6}{6^6} = \frac{1}{7776} = 0.000128601\ldots$.

   (b) The probability that all six dice turn up different (i.e. that every number from 1 to 6 appears) is $\frac{6!}{6^6} = \frac{5}{324} = 0.015432099\ldots$.

5. Originally, your chance of guessing right is one in four, or 25%. After two wrong alternatives are removed, your original choice is still only 25% right, so by switching you increase your winning probability to 75%. (The two remaining doors are *not* equally likely!)

6. Among the four honest coins plus one two-headed coin, there are six head faces, two of which belong to the crooked coin; so the probability that the unseen side is also heads is $\frac{2}{6} = 0.333333\ldots$.

7. Expected number of tosses of a pair of dice to see a total of k, $2 \le k \le 12$, on the two dice, is $E(k)$, where

k	$E(k)$	k	$E(k)$	k	$E(k)$
2	24.6051	5	5.8849	9	5.8849
3	12.1268	6	4.6355	10	7.9662
4	7.9662	7	3.8018	11	12.1268
		8	4.6355	12	24.6051

$E(k)$ is the solution to $\left(\frac{36-k+1}{36}\right)^{E(k)} = \frac{1}{2}$, and is given by $E(k) = \log 2/(\log 36 - \log(36 - k + 1))$ for $2 \le k \le 7$, and $E(7 + a) = E(7 - a)$ for $1 \le a \le 5$.

8. Although the grass always looks greener on the other side of the fence, it can't be true mathematically that *no matter which* of the two envelopes you picked, the *other* one is 25% better (at least in expectation)! So where is the fallacy? The problem stated that x, a positive real number, was picked "at random", but it didn't specify the *distribution* from which x was selected. The reasoning tacitly assumed it was from the "uniform distribution", but there is no uniform distribution on the positive real numbers. Your best strategy is to assume (best guess) what the *mean* of the unrevealed distribution is, accept y if it exceeds this mean, but switch if it is below. Another defensible strategy is to accept y if you would be satisfied with that amount of money, but reject y otherwise (the "minimum regret" approach).

Guest Column: from the National Science Foundation

Sirin Tekinay

Dear reader,

When I wrote the first column in this series, which appeared in the last issue, I had just started my job at the National Science Foundation. I am delighted to report to you five months later, this time as an experienced program director: five months is a very long time in units of experience here! As usual, I hope to fuel our interaction on ideas, visions, and issues that impact us all as professionals in the communications community as I provide you with insight to relevant NSF programs and news.

Thank you ever so much for your "communications" since I took this position. I am thrilled to serve our dynamic, diverse, responsive community. Please keep your opinions, inquiries, suggestions, and comments coming.

A Few Words on Computing and Communications Foundations (CCF) Organization

In the last issue, I offered some background on the general NSF organization and mission, with emphasis on the directorate and division I belong to, Computer and Information Science and Engineering (CISE), and Computing and Communications Foundations (CCF), respectively. This time, I would like to zoom in on the Theoretical Foundations (TF) Cluster in CCF where the Communications Research Program is housed.

TF consists of communications, signal processing, and computing components we call "program elements." It is clear that the clustering was based on the overlaps between these components. Furthermore, we expect the theoretical work that cuts across these areas to increase, as exemplified in the emerging Theory of Networked Computing. I will say more about the evolution of research areas in TF later. Clustering is still considered an experiment we, in CCF, are carefully monitoring the performance of. Our performance metrics include dwell time from proposal submission to award decision. A less obvious metric is the ability to get away from the zero-sum game of budget allocation to different elements, and find more ways of supporting cross-cutting research. In the usual democratic, collegial mode of interaction, a couple of months ago, our division held a meeting to discuss and evaluate the cluster structure for efficiency. One of the exercises was to make up Venn diagrams showing the sets of research topics highlighting those that fall in intersections of pairs of program elements and beyond. It turned out my Venn diagram, with communications research in the middle, is not a closed set but one that reaches out in many directions, beyond its immediate neighboring research areas in the cluster, into physical sciences, social computing, operations research, and economics theory. I look forward to maintaining this organic evolution as we, as a community, expand our area to include tools, and applications in other research areas.

From an organizational standpoint, I am proud to see us geared up so well to handle the challenges of cross-layer, interdisciplinary research. The cluster structure indeed gives us the freedom to quickly maneuver in putting together panels, review teams, meetings and workshops that transcend our individual program elements. As the scientific staff of CCF, we enjoy a seamless administrative support fabric that cushions our every whim, paying individual attention to our handling of every

research project, proposal, or program virtually on a case-by-case basis. Without the clockwork orchestration of people, ideas, and tools (coinciding with the same three foci in NSF's mission statement) at NSF, my job would not be anywhere near as pleasurable as it is.

News on Communications Research

I recently completed the highly competitive CAREER program, making difficult decisions to choose the best of the best research and education plans submitted by junior faculty. The Faculty Early Career Development (CAREER) Program is a Foundation-wide activity that offers the National Science Foundation's most prestigious awards in support of the early career-development activities of those teacher-scholars who most effectively integrate research and education within the context of the mission of their organization. We expect such activities to build a firm foundation for a lifetime of integrated contributions to research and education. NSF encourages submission of CAREER proposals from junior faculty members at all CAREER-eligible organizations and especially encourages women, members of underrepresented minority groups, and persons with disabilities to apply. While I am frustrated that some good solid proposals could not make the cut due to our finite financial resources, on the positive side, I am thrilled to make awards to extremely competent young researchers with groundbreaking ideas they articulated so well. I enthusiastically look forward to their high impact results.

In addition to the CAREER program, I ran the wireless infrastructure panels within the panel series towards our cross-cutting Computer Research Infrastructure (CRI) program. I naturally look forward to our area receiving its deserved share of funding for infrastructure. The Computing Research Infrastructure program supports the acquisition, development, enhancement, and operation of research infrastructure that enables discovery, learning, and innovation in all computing fields supported by CISE. Supported infrastructure includes instrumentation needed by a few research or research and education projects, major experimental facilities for an entire department or for multi-institutional projects, and testbeds or data archives for an entire subfield of CISE researchers. The CRI program is committed to maintaining a broad portfolio that supports research and education across a diverse population and lessens the digital divide. The program encourages proposals that are from or that include minority-serving institutions.

Through the holidays, I worked on preparing the annual TF program solicitation. At the time of writing, the program solicitation is under administrative review, due to be posted within a week. Please check out the TF website to view the solicitation, which reflects our priorities. My colleagues in TF and I will hold a webcast panel session to go over the solicitation and answer any questions with our communities. We look forward to supporting projects that address fundamental issues of information science and technology, both within Computation and Communication, and also at the interface between these, and other disciplines. These projects are expected to bring advanced capabilities from computer science, scientific computing, communication theory, signal processing theory, mathematics, and application areas to bear on fundamental problems throughout science and engineering. Our cluster is broadly concerned with prob-

lems of information processing that fall between the extremes of purely theoretical studies and of applications within a discipline. A new area of emphasis in our current solicitation is, Scientific Foundations for Internet's Next Generation (SING). In formulating this new research area, we hope to cultivate and encourage fundamental research bringing together our other, more traditional areas of research, both serving and drawing from the CISE initiative, GENI, our clean-slate approach to a new Internet.

On a Personal Note

NSF is a microcosm of what it promotes in terms of the three foci in its mission statement: ideas, tools, and people, brought together in organizational excellence. One of the daily recurring themes at NSF is diversity, more than at any other workplace. The reason is, beyond ensuring diversity at NSF, we are dedicated to ensuring, sustaining, and improving it at the institutions we fund. I will call attention to women in science and engineering in this section.

I am extremely proud that since November, I have been serving as the CISE representative to the foundation-wide IGERT (Interdisciplinary Graduate Education Research Traineeship) Program, which upholds diversity as one of its major goals and requirements. The IGERT program has been developed to meet the challenges of educating U.S. Ph.D. scientists and engineers who will pursue careers in research and education, with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change. The program is intended to catalyze a cultural change in graduate education, for students, faculty, and institutions, by establishing innovative new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to the development of a diverse, globally-engaged, science and engineering workforce.

NSF People

In every column, I introduce some of the people I work with; who embody the culture and spirit of NSF. I'd like to dedicate this section to some of the women leaders at NSF who have inspired me. It is impossible to list all of the wonderful women I work with. Instead, I will express pride and gratitude for their trailblazing achievements they do not seek credit for, the role models they are, the endless interactions they have cultivated whose impact will be long, long lived. Below are only a handful of portraits of such leaders.

I can easily cite my meeting with Dr. Deborah Crawford during my interview last year as one of the reasons why I embraced the job offer so readily. Anyone who has ever met her will agree she simply radiates enthusiasm and excitement. At that time, she was the Deputy Assistant Director of CISE. By the time I joined, she had assumed the role of Office Director for our Office of Cyber Infrastructure, one of the twelve major parts of NSF. She will return to her office as the Deputy Assistant Director soon. Debbie's competence, efficiency and dedication are only matched with her kindness and warmth. My first impression of her as a caring mentor has been confirmed by her generous allocation of time and energy to help whenever I called, always with a beautiful smile. I also credit myself for correctly guessing she is a girl scout mom.

Another juggler of leadership positions in CISE is Dr. Suzanne Iacono who was acting as the Deputy Assistant Director when I joined. Suzi is now heading up the Division of Information and Intelligent Systems (IIS), one of the three divisions in CISE. With all her experience and proficiency, she is one of those endless resources to turn for advice, for information, for direction. Suzie's is the face of confidence. A short encounter with her, modulated with her cheerful disposition, makes me feel I know so much more than I did a few minutes before. She transmits insight beyond exchanging words in a conversation.

Relevant research efforts to those in communications research in TF are housed in the Electrical and Communications Systems (ECS) Division of the Engineering Directorate (ENG), headed up by Dr. Usha Varshney. Usha is one of those people that make the job look easy. The whirlwind style with which she runs her division magically includes tea and sense of humor. I'm still thinking of an appropriate come back for the witty comments she made as we compared and contrasted CISE and ENG research communities.

Dr. Rita Virginia Rodriguez is the Project Manager for Computing Research Infrastructure in CISE. I had the opportunity to run merit review panels with her, evaluating the proposals for research infrastructure acquisition in our area. The entire CISE community is lucky to have such a caring representative in the foundation-wide infrastructure program. She is a powerful angel (in her words, "a wealthy woman" with a significant research budget in her command), an almost iconic, beloved figure that draws staff out of their offices to talk with her as she walks the corridors on our floor.

The "Social Scene"

A word of advice from previous program directors is a familiar one: "never do lunch alone." I feel so lucky to meet and get to know brilliant, inspirational, creative researchers who are also caring and nurturing to research efforts in their fields.

Following the theme of this column, I would like to talk about a special lunch meeting I attended recently: the joint luncheon of Executive Women in Government (EWG) and Women in Technology (WIT). Many NSF women were there, underlining similarities and differences between NSF and other agencies within the federal context. As an organization, NSF has achieved great improvement in its own diversity, especially in terms of promoting women in its scientific staff. However, all agree there are mountains in front of us to implement the same across all science and engineering communities.

I am reasonably settled in my routine of spending one day out of each week (typically Mondays) at my office in NJIT, meeting with my graduate students, working on their projects, theses, and dissertations. My obsessive-compulsive email habit is handsomely rewarded by the uninterrupted productivity they sustain. The time on the train gave me the opportunity to write this.

I will "cross the t's and dot the i's" before the train pulls into the beautiful Washington DC Union Station.

… Till next time, dream big, and keep in touch!

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CALL FOR PAPERS
IEEE Transactions on Information Theory Special Issue on
Models, Theory & Codes for Relaying & Cooperation in Communication Networks

A special issue of the *IEEE Transactions on Information Theory* will be devoted to relaying and cooperation in communication networks. The relay channel and models of cooperation in networks have been known in the information theory community for some time. Recently, however, applications in a wide array of wireless communication networks—including cellular networks, wireless local area networks (WLANs), ad hoc networks, and sensor networks—have once again fueled research on relaying and cooperation. The academic and industrial communities have developed new models, problem formulations, and solutions motivated by these particular applications, as well as fresh insights on long-standing approaches.

A special issue that focuses on these activities and gives an overview of related efforts will serve the information theory community as well as the broader communications and networking communities. Papers for this special issue should have an information theoretic component and relate to the developments described above. Expository papers, survey papers, research papers and correspondence items are welcome. Topics include, but are not limited to, the following aspects of relaying and cooperation:

- Physical layer models, e.g., channel models (statistics, fading, MIMO, feedback)
- Device constraints (power, energy, T/FDMA, half-duplex, synchronization)
- Code design, e.g., iteratively decodable codes, strategies, distributed codes
- Cooperation via network coding, wireline and wireless
- Resource allocation, e.g., power, bandwidth, nodes
- Performance metrics, e.g., capacity, cost, outage, delay, energy, scaling laws
- Sensor networks, e.g., distributed compression, rate-distortion theory
- Cross-layer issues, e.g., PHY/MAC/NET interactions, joint source-channel coding, separation theorems
- Multi-terminal information theory
- Historical perspectives

Prospective authors should follow the regular guidelines and submission instructions of the *IEEE Transactions on Information Theory*.

Schedule

- Submission Deadline: August 15, 2006
- Acceptance Notification: May 15, 2007
- Publication: October 2007
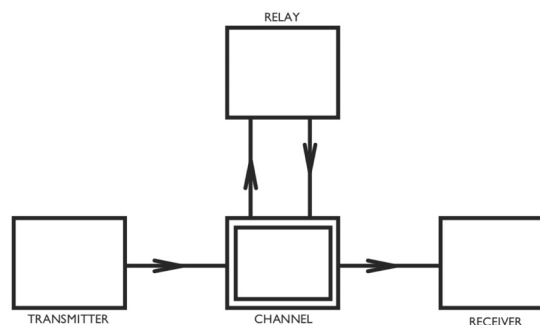
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2006 IEEE Information Theory Workshop

Call for Papers

October 22 –26, 2006, Chengdu, China, http://sist.swjtu.edu.cn/imc/itw06/
In cooperation with SWJTU, UESTC, NSFC and IEEE VT BC

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The 2006 IEEE Information Theory Workshop will be held at the Chengdu International Exhibition and Convention Center, Chengdu China, October 22 (Sunday) through October 26 (Thursday) 2006. Detailed information including submission guidelines, contact links, technical program, registration, travel, accommodation, getting around, and social events will be available at the workshop website: http://sist.swjtu.edu.cn/imc/itw06/ and its mirror site http://www.ee.cityu.edu.hk/~itw06/.

Topics
The workshop aims to explore current topics in the areas of coding and information theory. The workshop has a three and half-day technical program featuring plenary talks, as well as invited and contributed paper presentations. Possible topics include, but are not necessarily limited to:

- error control codes
- iterative decoding and detection techniques
- data compression
- joint source and channel coding
- quantum-theoretical aspects of coding
- network coding
- space-time codes, multi-user and MIMO systems

Paper Submission
Papers presenting new results in the above areas are hereby solicited. Only electronic submissions via above websites in PDF or PS formats are accepted. Each submission must be at most 5 pages in length and conform to the double-column IEEE conference proceedings format (style file and templates can be downloaded from above website). Submissions that cannot be accommodated in contributed paper sessions may be considered for poster sessions.

Conference Proceedings
All papers accepted for oral and poster presentation will be published in the Workshop Proceedings by IEEE Press (in both printing and CDROM forms). All the accepted papers will be included in the IEEEXplore online database and be indexed by Engineering Index (Ei).

Important Dates

Submission deadline:	**June 1, 2006**
Notification of acceptance:	**August 1, 2006**
Camera-ready deadline:	**September 1, 2006**

About Chengdu:
Chengdu, a city with longstanding history and civilization, is the capital of Sichuan Province. The province is the home of giant pandas and is well known for its historical and natural attractions. It has four places on the World Cultural and Natural Heritage: Jiuzhaigou Scenic Area, Huang Long Valley, Mount Emeishan and ancient Dujiang Yan irrigation systems. Chengdu is also well known for its spicy Cuisine. October is in the middle of autumn in Chengdu with average temperatures ranging from 15°C (night) to 21°C (day). There are direct flights to Chengdu from Hong Kong, Tokyo, Osaka, Fukuoka, Seoul, Singapore, Bangkok, Beijing, Shanghai and other major cities.

Further Inquiries
Inquiries on general matters related to the workshop should be addressed to:
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CALL FOR PAPERS

ISITA 2006

October 29 - November 1, 2006
COEX, Seoul, Korea   http://www.isita2006.org

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The 2006 International Symposium on Information Theory and its Applications (ISITA), sponsored by the Society of Information Theory and its Applications (SITA) with the technical co-sponsorship of the IEEE Information Theory Society and the IEICE, will be held at COEX in Seoul, Korea, from Sunday, October 29, through Wednesday, November 1, 2006.

Topics of interest include, but are not limited to, the following:

Error Control Coding	Coding Theory and Practice
Coded Modulation	Data Compression and Source Coding
Communication Systems	Optical Communications
Detection and Estimation	Mobile Communications
Spread Spectrum Systems	Pattern Recognition and Learning
Signal Processing	Speech/Image Coding
Rate-distortion Theory	Shannon Theory
Stochastic Processes	Cryptology and Data Security
Data Networks	Applications of Information Theory
Multiuser Information Theory	Quantum Information Processing

Papers will be selected on the basis of an extended summary (not exceeding 3 pages). The deadline for submission is April 3, 2006. Notification of decisions will be made by June 30, 2006.

The accepted papers will appear in the Proceedings. Detailed information on the technical program, special events, accommodations, and registration will be posted to the Symposium web site:

http://www.isita2006.org

Inquiries on matters related to the Symposium should be addressed as follows:

General matters: Technical program matters:
jcpark@jcinter.co.kr   isita2006tpc@sita.gr.jp

Deadline for the submission of extended summary	**April 3, 2006**
Notification of paper acceptance	**June 30, 2006**
Deadline for final paper submission	**August 1, 2006**
Deadline for author registration	**August 1, 2006**

Conference Calendar

DATE	CONFERENCE	LOCATION	CONTACT/INFORMATION	DUE DATE
March 13-17, 2006	**2006 Information Theory Workshop (ITW 2006)**	Punta del Este, Uruguay	http://www.fing.edu.uy/inco/eventos/itw06/	October 31, 2005
March 22 – 24, 2006	**Conference on Information Sciences and Systems (CISS 2006)**	Princeton, NJ, USA	http://conf.ee.princeton.edu/ciss/	January 2, 2006
April 3-7, 2006	**4th International Symposium on Turbo Codes and Related Topics**	Munich, Germany	http://www.turbo-coding-2006.org	October 17, 2005
April 3-7, 2006	**Second Workshop on Network Coding, Theory, and Applications (NETCOD 2006)**	Boston, MA, USA	http://www.netcod.org/	December 12, 2005
April 3-7, 2006	**4th International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt '06)**	Boston, MA , USA	http://www.wiopt.org	October 5, 2006
May 30-31, 2006	**Signal Processing for Wireless Communications conference (SPWC 2006)**	London, United Kingdom	http://www.spwc2006.org	January 31, 2006
May 30-June 1, 2006	**23rd Biennial Symposium on Communications**	Kingston, Ontario, Canada	http://www.ece.queensu.ca/symposium/	February 1, 2005
June 11 – 15, 2006	**2006 IEEE International Conference on Communications (ICC 2006)**	Istanbul, Turkey	http://www.icc2006.org/index/welcome.html	September 25, 2005
July 2-5, 2006	**IEEE International Workshop on Signal Processing Advances for Wireless Communications (SPAWC 2006)**	Cannes, France	http://spawc2006.eurecom.fr/	February 1, 2006
July 2-7, 2006	**The 11th Information Processing and Management of Uncertainty International Conference (IPMU 2006)**	Paris, France	http://ipmu2006.lip6.fr	December 10, 2005
July 9 -14, 2006	**2006 IEEE International Symposium on Information Theory (ISIT 2006)**	Seattle, WA, USA	http://www.isit2006.org/	January 16, 2006
October 22-26, 2006	**2006 IEEE Information Theory Workshop (ITW 2006)**	Chengdu, CHINA	http://www.ee.cityu.edu.hk/~itw06/	June 1, 2006
October 29 – November 1 2006	**The 2006 international Symposium on Information Theory and Applications (ISITA 2006)**	Seoul, Korea	http://www.isita2006.org/	April 3, 2006
November 27 – December 1, 2006	**2006 IEEE Global Telecommunications Conference**	San Francisco, CA, USA	http://www.ieee-globecom.org/2006/	March 5, 2006
July 24 -29, 2007	**2007 IEEE International Symposium on Information Theory (ISIT 2007)**	Nice, France	http://www.isit2007.org/	TBA