IEEE Information Theory Society Newsletter

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President's Column

Steven W. McLaughlin

Steven W. McLaughlin

I am writing this column from the Georgia Tech campus in Metz, France, where I have been for much of the last two years. During that time I have come to appreciate the efforts and roles of the local chapters and individuals in Europe. I have participated in events sponsored by the German Chapter and the Benelux Chapter, and had the chance to visit colleagues in Switzerland, Spain, Italy, Portugal, Ireland, Belgium, the UK, and of course France. It is very gratifying to see the huge commitment and dedication that so many people in Europe have to information theory. In the last two years the IT Society Best Chapter Awards have gone to the German and Benelux Chapters, respectively, and to see the kind of work they do, it is no wonder why they are recognized. Our colleagues from the Society of Information Theory and its Applications (SITA) in Japan also came to Europe in the last year – sponsoring the ISITA 2004 in Parma. Special thanks have to go to Professors Ezio Biglieri and Katsuhiro Nakamura. I can attest that information theory is much very alive and well in Europe, and thanks to so many of you for your warm hospitality.

Our Transactions continues to grow at a furious rate. Our page counts this year will go over 4000 pages, that is a 17% growth in the last year, and nearly 100% growth in the last decade. We think there will be over 900 papers submitted in 2005. Our Editor-in-Chief Vince Poor, Publications Editors Gerhard Kramer and Kevin Quirk, new editor Adriaan van Wijngaarden, and the group of Associate Editors and support staff (most notably Lynn Stetson and Nela Rybowicz) do a tremendous job to keep up with the deluge of papers. The tools for handling this load of papers have gotten better, but their efforts on our behalf are greatly appreciated.

This kind of growth is generally good for the Society from the financial point of view. As you may know, the greatest source of revenue for the Society is the income distribution we receive from the IEEE Electronic Library (IEL), which is the primary product IEEE sells to libraries, companies and institutions. IEEE is in the process of phasing-in a new financial model that rewards high quality content in IEL. Our revenue from IEL is tied directly to the number of papers in IEL and the frequency of access to those papers. The projections for 2006 and 2007 indicate that we will benefit under this new system.

The growth does, however, bring up a number of important issues – we would like to get your feedback on some of them (swm@ece.gatech.edu, poor@princeton.edu);

Should we split the Transactions? With a single publication becoming increasingly difficult to manage, should we split our actions into two publications? While we believe it can be managed for now, continued growth makes this an important consideration.

Should we enforce page limitations? The Society has always been steadfastly opposed to any kind of page limitations on our papers. Many transactions impose limits on sizes of papers or require mandatory over-length page charges. For now we do not have an apparent need for this, but should we keep this as a hallmark of our publications?

Should we develop other electronic-only publications? One of the challenges we face is the long delays between submission and publication in our Transactions. One possibility is to develop more open-access oriented electronic-only publications. We are already engaged in supporting ArXiv (see my Jan 2005 column), but we might also consider other options. There are a number of new initiatives, e.g. Optics Express (http://www.opticsexpress.org/), where authors pay to publish their papers in a very timely fashion in a reputable journal that is freely available to everyone. Should we consider this?

You are probably aware that our membership structure has changed in the last two years to provide lower Society membership fees to members who select electronic-only distribution of the Transactions through IEEE Explore. For a long time, the Society has subsidized those members who select paper copies of the Transactions – it costs considerably more to produce the paper copies than we charge the members. We will continue to slowly reduce this subsidy again this year, believing that the price members pay for paper copies is still quite reasonable.

As always I am very interested in hearing your feedback on these important issues for the sustained health of our Society.

Best wishes for a pleasant Autumn.

From the Editor

Lance C. Pérez

The past several issues of the Newsletter have featured articles describing, and encouraging the use of, the arXiv e-print server at http://arxiv.org. The March 2005 issue is particularly informative on this subject. The arXiv Ad Hoc Committee is pleased to report that arXiv is being increasingly utilized by the Information Theory community, as shown in the accompanying bar chart. The arXiv websited continues to undergo improvements in both look and feel and a new alias is planned for math.IT to complement the existing cs.IT area.

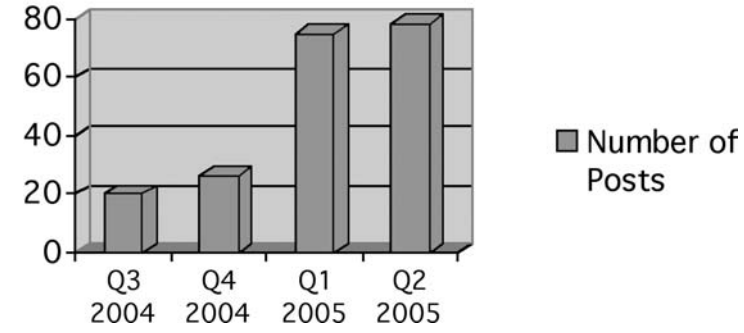
Please help make the Newsletter as interesting and informative as possible by offering suggestions and contributing news. The deadlines for the next four issues of the Newsletter are as follows:

Issue	Deadline
December 2005	October 15, 2005
March 2006	January 15, 2006
June 2006	April 15, 2006
September 2006	August 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:

Lance C. Pérez
Department of Electrical Engineering
209N Walter Scott Engineering Center
University of Nebraska, Lincoln
Lincoln, NE 68588-0511
Phone: (402)472-6258
Fax: (402)472-4732
Email: lperez@unl.edu



cs.IT ArXiv Posts for the Past 4 Quarters

IEEE Information Theory Society Newsletter

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Reflections and Reminiscences

by David Middleton

At the kind invitation of the Editor, Prof. Lance C. Pérez, I have been asked to share a few thoughts about our field of Communication Theory (CT) and its components: Information Theory (IT) [1], and "Signal Processing" (SP), on this occasion of my eighty-fifth birthday and in the sixty-third year (since 1942) of my professional activity in the field. The following few remarks are my purely personal thoughts. I hope they may be of some interest and possibly some pertinence. ([2], 2000)

David Middleton
April 19, 1920 -

First, let me "locate" what I mean by Communication Theory (CT) and its major components in the general spectrum of physical science, and from this, locate my own views of and interests in CT. The rather ad hoc sketch in figure 1 may help.

Here D+E signifies Detection and Estimation and CP, channel physics, propagation, etc. Communication Theory actually has a wider scope than the diagram indicates, since it is a component one way or another in all scientific activity.

Briefly put, science is itself phenomenological: it builds models of reality, subject to the tests of experiment. Technology, broadly stated, is the application of the results of scientific exploration, i.e. verified models to public use. The models themselves have a hierarchy of refinement: from broad generality to different levels of subtlety, from the macroscopic to the microscopic, to the molecular, atomic, and subatomic; from the continuum to quantum discreteness, each having its mathematical description. At all levels, some type of Communication Theory and its accompanying technology play a central role: conveying information from one space-time point to another such point, with (ideally) minimal interference, i.e. "noise". My own interests in CT have centered largely on the middle ground where the continuum model is appropriate, on the applied physics and mathematics of most signal processing and noise modeling, usually above the quantum level.

I. Reflections: Next, I'd like to make a few remarks about where and how we are today in CT, at least as I see it: Let me begin with

(1) *Publications (Authors)*: Papers being authored in CT in the US today are going strong, but the authorship is very skewed toward foreign or foreign-born authors. The same is observed in the number of Ph.D. candidates (in CT) in our own graduate schools. A quick look at the reference lists of papers in the IT and SP forwards shows approximately 85-90% foreign vs. indigenous authors. Other technical journals indicate the same orders of magnitude. This is not intended as a criticism of these authors and students. Rather, they are to be commended for their hard work and expertise. It is we "natives" who seem to have largely abandoned these difficult fields of study. Our native students prefer the pursuit of money early on, and leave the science and technology to others. I think this is one major and long lasting effect of the Vietnam War – which effectively punched at least a ten-year hole in the continuity of growing up. (I myself have two children who joined the rebellion in the sixties and seventies ("Haight-Ashbury, Communes," LSD, etc.), who "dropped out" for ten years. To their ultimate credit, they did go back to school and college, as thirty-year old freshmen, and graduated as magna and summa students.)

But those ten years are still with us, expressed in the excessive consumerism of our society and the abandonment of the difficult disciplines [3]. It is the recent immigrants and temporary visitors who in the main carry on and push the progress of our science and technology. And when they leave, as many are now temporarily here? The US is losing its cutting edge, and its advantages in science and technology, which maintains our still envied economy. I hope I am unduly pessimistic, but as a child of the Great Depression ('29-'40), a young man during World

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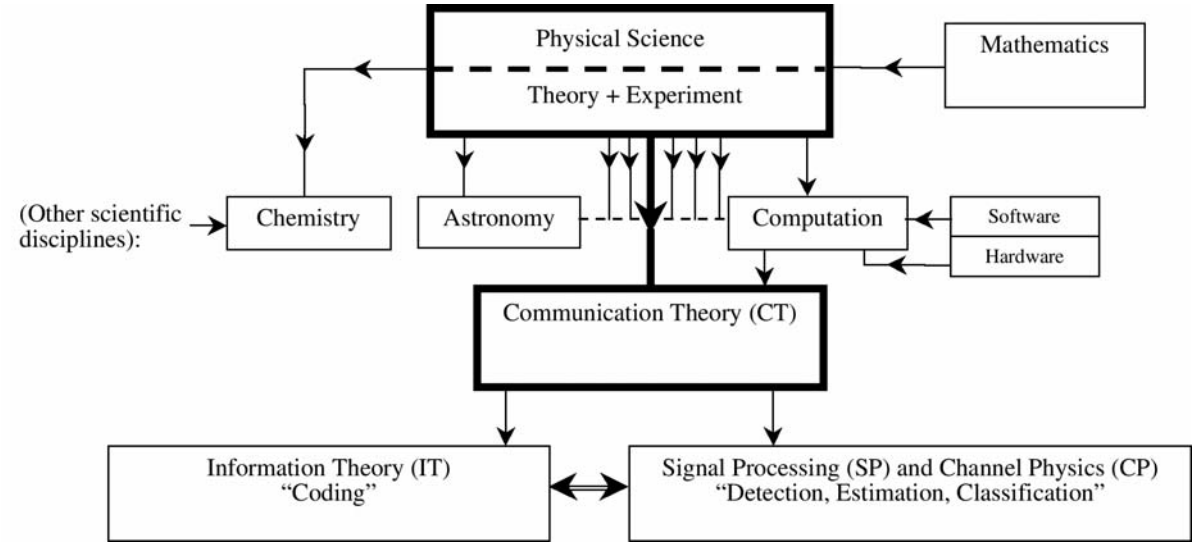


Fig. 1. A schematic diagram of the place of CT in the physical sciences and its connectivity; (DM's personal viewpoint) (See Glossary of abbreviations at end of this note.)

The Historian's Column

A. Ephremides

Our International Symposia are always sources of intense memories. So many of us gather at remote places and our individual or common experiences are amplified and heightened in the course of the week-long interaction and coexistence. In addition to memorable technical "happenings", there are numerous personal events that frame our impressions and memories.

Let me focus today on the 1983 ISIT that took place in the vicinity of Mont Tremblant (literally, Trembling Mountain), in a beautiful but rustic resort to which winter sport enthusiasts and summer nature lovers flock every year from nearby Montreal as well as from elsewhere in Quebec, Canada, North America, and the world. The Symposium took place in late September/early October when, despite the turning fall foliage, the resort is considered "off-season" (and, hence, made available to us at logical prices). The name of the exact location was Gray Rocks and the locality is named St. Jovite. The registration fee was $110 US and the room rate $56 US per day (…those were the days!).

It was the first ISIT in Canada and the proud co-chairs were John Anderson and Ian Blake. There were three (3) vice-chairmen (the IT Society always had creative ways of elevating people to positions of … well, some prominence). They were Vijay Bhargava, Bob Gray, and G. Seguin. The 14-member (yes, you read right, fourteen) technical program committee was chaired by Lorne Campbell and included people like J. Koplowitz, T. Papantoni-Kazakos, J. Modestino, and S. Pasupathy. There was also a, by now defunct, International Advisory Committee, the role of which no one managed to define or explain succinctly. It was chaired by Jerry Hayes and included Ezio Biglieri, Marat Burnashev, Imre Csiszar, Joachim Hagenauer, Paddy Farrell, Jim Massey, Jim Omura and other luminaries from Czechoslovakia, Sweden, China, Holland, Israel, Belgium, and Poland.

The social events included a "soiree quebecoise" and a banquet for which an attending spouse had to pay $12 US and $24 US, respectively. These prices were real, folks! There were five parallel sessions and the plenary speakers included George Nagy who talked about, simply, "Trees", Robin Milner, whose topic was "Algebraic Models of Discrete Communications", Jack Salz on "Data Communications over Microwave Radio Channels", Ron Graham on "Isometric Embeddings of Graphs," Rudi de Buda, who spoke on Lattice Codes, and Bob Gallager who gave the Shannon Lecture entitled "Multiple Access and Protocols".

The program included invited sessions on Bandwidth Efficient Coding (that was the time of Coded Modulation), Computational Geometry (that was the time that codes had started getting fancy), Cryptography (always a favorite), and Spectrum Estimation (a classic).

But amidst the charged technical give-and-take there were a zillion little personal noteworthy events. I'll give you a few that I sampled. On the adjacent mirror-like lake there were hydroplane rides that the most intrepid amongst us decided to try. I recall sharing a ride with Stamatis Cambanis (a dear friend and scholar who passed away prematurely more than ten years ago) and Nick Georganas, now the Dean at the University of Ottawa. It was a magical evening, the winds were calm, and you could see your face reflected on the surface of the lake (along with a motley of autumn colors from the surrounding forest). I don't know how many of you have ridden hydroplanes but what impressed me was the "immediacy" of the flying experience. The plane took off like a crane before you would think it could. And upon landing (if this is the proper term), the transition from flying to sailing was so stunning and abrupt that it felt like stumbling. It was a noisy ride and only at a height of a few hundred feet (literally over the tree tops). The sun was setting and the feeling was totally sublime.

History has not passed or resident Historian by.

After the flight, we proceeded to the dining room of the resort for the banquet. And there we saw that David Cohn, who had gone fishing with a guide on the lake, had landed a giant Northern Pike (about four feet in length). It was decided to include it in the banquet offerings for the select few who gathered around the fish and paid their respects. The cook started slicing the fish for cleaning. It was then with utter surprise that we saw its heart still beating. The size of the cavity was large enough that we could identify the individual organs. Some of the faint-hearted "chickened out", that is they decided to only eat the chicken that was on the menu. I must say, that despite its utter freshness and good looks the Northern Pike cannot lay claims to fame for flavor. Perhaps it was the "touch" of the Canadian cook that could be improved, but I thought I might have fared better if I had also chickened out.

Finally, a delightful moment that I recall took place at the end of a session which was densely attended in a crowded, stuffy room. Tom Cover was sitting towards the back and I was nearby. The last talk was rather monotonously delivered and perhaps the jet lag and fatigue caused Tom to briefly close his eyes. After the session ended, a brash young student who obviously didn't know who Tom was, addressed him with the boldness of ignorance and asked him whether he had a good nap. Tom looked at him kindly and gave him a trademark "Tom Cover" answer. "Yes", he said, "but I was awakened by very interesting theorems"! The smile froze on the student's face, while everybody else contemplated this classic "double-edged" answer.

Yes, every ISIT has memorable moments. We'll be back for more.

continued from page 3

War II, of our *resorgiotmento* of the forties-sixties, and as a (very) amateur student of history, I see our future as a country as that of a declining empire (to be compared with that of Great Britain, for example).

However, like Henry V - "once more into the breach" - perhaps we can through understanding and wise actions avoid this historical outcome. It is not yet completely inevitable.

(2) *Scholarship*: What does this mean to me, at least in the context of our published work? It means primarily a serious attempt at adequate referencing (and its use), of original sources and subsequent (significant) contributions based on them. I note, consulting the aforementioned journals, for example, that most references (i.e., at least 80%) go back in time only about 10 years for papers and books. But no subject is so new that it doesn't have a key "old" paper or two or three for the "new wave" hot topic. With the search engines available (Google, AOL, and others), there surely must be worthy material preceding the citations listed. (However, see my cautionary comments under "Computers" following below.) There is the danger of "reinventing the wheel" here.

I attribute this effect to youth. (A youth I am no longer, and I recognize that 50-60 years ago the flood of papers was a trickle compared to the present. Adequate referencing was then much easier (but not, of course, perfect). Also, my teachers were older (I call them the Zeroth Generation), and more careful about this kind of thing. Moreover, the rush to publish was more restrained, in fact, downright leisurely!) Finally, in any field (particularly in ours), the research generation is about 15 years - from Ph.D. to some form of professorial life. Thus, there are four generations (including mine, the First) of teachers, between me and the current crop of Assistant Professors. No one can grasp all the relevant material in any one generation, particularly, with the increasing avalanche of papers coming along. Much of the valued past is being lost, inevitably, but experience can be at least a partial corrective - one gets to know many of the critical papers.

(3) *Women in S + T*: This is hardly an original topic now but it deserves attention. We badly need to encourage more women into S + T I realize that the critical times of encouragement are in the early teens, but at least we can be encouraging at the undergraduate level. More young women in S + T would go a long way to repairing the gap produced by the male drop-out noted above in (1). This sounds like PC but that it is not my intent: an original mind is always welcome. This is a valuable resource which needs to be greatly developed.

(4) *The Computer - Some Remarks*: Let me begin this complaint (?) by stating the obvious up front: the computer, in a very important way, has saved science. It is a prodigious instrument for solving problems which, though formulated, could never be handled otherwise. It also makes it possible to translate (read: obtain numbers for) the "macro-algorithms" of theoretical and applied physics, technology, etc. into specific, quantitative results. In short, it is a magnificent tool, a magnificent symbiote for every scientific discipline. (I am not mentioning its misuses, trivial and unfortunate applications for games, trivial messages, gossip, invasion of privacy, identity theft, and so on.)

But, the computer is not a substitute for thought [4] — [8], not only logical thought but intentional, inspirational, and other forms of human mental creativity. (This gets into Philosophy, unsolvability (Godel's theorem, etc.), paradoxes, Platonism vs. inspirationism, etc. All I will say is that computers may be developed to have consciousness, but it will always be a machine consciousness, not a human one, with an ultimate Turing test which still does not distinguish any difference. (I refer the reader to Penrose [8] for a fascinating discussion.))

My practical complaint is one involving the human-machine interface with regard to finding key references. I maintain that in the finite time available to a human being it is not possible to obtain and select all (finite no.) of the key references in a scientific field, or for that matter, in a reasonably-sized subfield, for instance D + E in "Signal-Processing" (SP). Even with a sufficiently detailed interrogation of the computer (say, updated Google, etc.), which also takes time to compose, one will miss key papers. Why? Because it takes a comparatively long time to read and understand the abstract (the title is only enough to wet one's appetite). One can end up, in a finite number of cases, with say a couple of thousand abstracts, of which maybe only a hundred (to an experienced interrogator) appear relevant. Winnowing these down to, say ten takes time (which is always at a premium), which then gets the reader's full attention. I'll wager that the whole process can take a week [for $2000 \rightarrow 100 \rightarrow 10 \rightarrow$ (?) scientific papers], possibly longer. In most cases this becomes a waste of time (unless, possibly, one is a technical historian, who usually does not have that high level of expertise to make discerning decisions). In the interest of overall efficiency, one picks one or some of the papers, without a guarantee of selecting the one (or two) really important ones. Being knowledgeable in the field is a very great help, but one always runs the risk of missing key material. (This is my a priori apology for the missing ones.)

It is worth pointing out, finally, that preservation of desired material by computers is dubious. (Paper (or papyrus) is much longer lived!) There is also the problem for the observer/user — one does not have the old computers to read the old stuff? (Ask the Librarians!)

(5) *Some Future Research Topics*: I would like to suggest a number of areas worthy of attention — some of which have already been mentioned (see Verdu, IT Newsletter of December, 1994, on Shannon Theory and Imai's "President's Column," IT Newsletter of December 2004.) They are:

(i) More physics of the channel and EM environment (see (6) below). Space-time extensions of present MIMO applications as well as spatial diversity generally;

(ii). Nongaussain noise (physical models) as important interference in dealing with the coding process for transmission and reception, etc.;

(iii). Shannon Theory in nongaussian noise: limits on channel capacity, finite time effects, etc.;

(iv). Hardware and software design for the above.

And many others I'm sure the reader can think of.

(6). *The Book*. On a personal note, let me briefly describe my book-in-progress, now half-done. The tentative titles are, at this point:

(An Introduction to) NonGaussian Communication Theory, or NonGaussian Communication Physics, (Propagation, Noise, and Signal Processing for the Canonical Channel),

subject to some possible modulation – a small volume of some 1200 pages (!).

The emphasis here is on discrete sampling of space-time signal and noise fields, jointly coupled detection and estimation for improved performance, four-dimensional matched filters, and physical non-gaussian noise models. Scattering Theory – classical and now probabilistic treatments, as well as Ambient Noise models. Considerable attention is also given to Threshold Signal Theory, i.e. the detection and estimation of weak signals in (generally), nongaussian noise, and to some aspects of "learning", with sequences of decisions (i.e. tracking). Doppler effects, fading, and other channel modifications are included. These, and other examples, occupy three of the four parts of the book. A fourth part is devoted to special topics: noise signals, path integrals, some elements of optical communications and a brief excursion into quantum effects, with applications to astrophysics, matched field processing, among others. Communication Theory has become such an all-inclusive field that it cannot be technically described in one volume, even by the present volume, which treats Signal Processing and the Canonical Channel.

The Book is necessarily incomplete: many important topics are unavoidably omitted due to space and knowledge constraints. Hence, the necessity for the word "Introduction". This volume is intended to complement my earlier book and the many important works by others on Information Theory (i.e. Coding etc.): see Figure 1 above. It is conceptually related to the coding world through the generality of the signal waveforms chosen (but not otherwise specified here in detail), and by the physical character of the prototypical channel specified therein. [Finally, I expect to finish this work in a couple more years, then off to the Publisher (IEEE Press + Wiley) by '07 (or '08).]

(7) *Reminiscences*: My final topic here is a personal note, in memoriam for the many professional acquaintances, teachers, colleagues, and friends, whom I worked with or have know personally and who at this writing are no longer with us. They are among the ones (the Zeroth Generation) who largely created the Communication Theory field [9], during and since World War II, and thereafter by the succeeding 0th generations.† I list them more or less chronologically (with approximate dates and places of my initial meeting)

(Later >'45):	S.O. Rice (1943 — Bell Labs)	J.A. Stratton (1948 — MIT); Pres. (MIT)
(Nobel L.)	J.H. VanVleck (1943 — Harvard + RRL)	W.B. Davenport (1946 — MIT)
(Nobel L.)	Felix Bloch (1944 —" ")	W. Root (1946 _ MIT)
	N. Wiener (1946 — MIT)	
	C. Shannon (1947 — MIT — Bell Labs.)	Kolmogoroff (1973, Moscow), Math.
(Nobel L.)	W. Brattain (1948 — Bell Labs.)	Pinsker (1973, 76, Moscow)
	A. Siegert (1943 —MIT — Rad. Lab.)	*Brekhovskii (1973, Moscow), Acoustic Inst.
	Uhlenbeck (1943 – MIT – U. Mich. – Rad Lab.)	*Lysanov (1973, Moscow), "
	D.O. North (1943 – RCA)	*Ol'Shevskii (1973, Moscow), "
	J. Van Newmann (1947 — Princeton)	
	L. Brillouin (1947 — Harvard)	
	J.B. Wiesner (1947 — Rad. Lab. — MIT); Pres. MIT M. Hammermesh (1944 — Harvard, RRL)	

(and a few more, whom I can't remember without my archives, many of which have been sent to MIT). The presence of the large number of physicists stems from the fact that it was mainly a physicists' war [93] with the engineers taking over predominantly since about 1950. (I was Research Assistant to Van Vleck during the war (late '42 — '44) and did my Ph.D. thesis (1947) under his direction [2]. I still have swell memories of my time at RRL and MIT when my World was young. "O Brave New World, that had much creatures in it".

† Among the living colleagues of my generation, are Irving Reed and Nelson Blackman, and possibly others of the 1st generation.

* These may be still alive, among my Russian friends.

References:

[1]. L. Brillouin, Science and Information Theory, Academic Press (New York), 1962.

[2]. D. Middleton, "A Brief Personal History in Science and Information Theory: April 19, 1920" IEEE Information Theory Soc. Newsletter, June, 2000. See also, ibid, Dec. 1995, "A Conversation with David Middleton" and "Some Personal Reminiscences: Communication Theory and Nobel Prize," IEEE Communications Society Mag., July 1978, pp. 9, 10.

[3]. T. Friedman, "It's a Flat World, After All," NY Times Magazine, 4/03/05, p. 33-.

[4]. E. Rothstein, "Deciphering the Grammer of Mind, Music, and Math," p. A19, N.Y. Times, Sat. 6/19/04.

[5]. K. Hafner, "Digital Memories, Piling Up, May Prove Fleeting," N.Y. Times, Wednesday, Nov. 10, 2004.

[6]. E. Ullman, "The Boss in the Machine," N.Y. Times, 2/19/05.

[7]. J. Fallows, "Enough Keyword Searches. Just Answer My Question," N.Y. Times, Techno Files, 6/12/05.

[8]. R. Penrose, The Emperor's New Mind, (Concerning Computers, Minds, and the Laws of Physics), Oxford Univ. Press (New York), 1989.

[9]. P. Baxter, Scientists Against Time

Glossary:

CT	Communication Theory
IT	Information Theory
SP	Signal Processing
D+E	Detection and Estimation
C.P. (C. Phys.)	Channel Physics
S+T	Science & Technology
EM	Electromagnetic
US	United States
PC	Political Correctness

Norman C. Beaulieu Awarded Thomas W. Eadie Medal

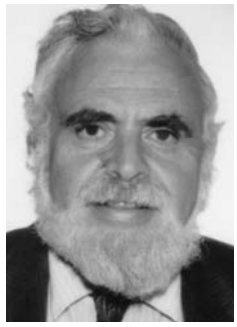
Dr. Norman C. Beaulieu, Department of Electrical and Computer Engineering, has received the Thomas W. Eadie Medal awarded by the Royal Society of Canada in recognition of major contributions to Engineering and Applied Science. The Royal Society of Canada, the Canadian Academy of the Sciences and Humanities, presents medals and awards to Canadians for extraordinary achievement in the social sciences, humanities, and pure and applied sciences. The Thomas W. Eadie Medal, in recognition of major contributions to Engineering of Applied Science, with preference given to those having an impact on communications, in particular the development of the internet, is awarded thanks to the generous financial support of Bell Canada.

The citation of the award reads, in part, "Norman Beaulieu, FRSC, is Professor, iCORE Research Chair and Canada Research Chair in the Department of Electrical and Computer Engineering at the University of Alberta. He is a scientific leader in the analysis and modelling of wireless communications systems. He has discovered ingenious mathematical solutions and models for a wide range of digital communications components and applications, including prediction of coverage areas and outage rates of cellular telephony systems, error rate performances of interference hampered receivers, error propagation in decision feedback equalizers, efficient and statistically accurate simulation methods and tools, and novel electrical pulse shapes for data modems. International researchers have widely used his methods, models and results to design wireless communication components and systems, and to predict the quality of service experienced by users of wireless networks."

Professor Beaulieu is also internationally recognized for his leadership in the communications field. He is the only resident Canadian to serve as Editor-in-Chief of the world's leading research journal for communications, the IEEE Transactions on Communications. He was instrumental in the creation of the Alberta Informatics Circle of Research Excellence (iCORE) Wireless Communications Laboratory and has given extended service as President of the Canadian Society for Information Theory.

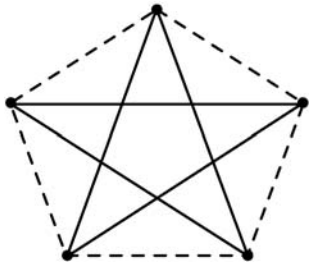
GOLOMB'S PUZZLE COLUMN™

Ramsey's Triangles



Solomon W. Golomb

The original **Ramsey Theorem** is often stated as follows: In any collection of six people, there will always be either three people mutually acquainted, or three mutually unacquainted. In graph theory terms, this says that if K_6 is the "complete graph" on 6 points (i.e.~there is an edge between each pair of points, for a total of $\binom{6}{2} = 15$ edges), if two colors are used to color the 15 edges there must always be a solid-color triangle (3 points connected by 3 edges of the same color). In contrast, the $\binom{5}{2} = 10$ edges of K_5 *can* be 2-colored without forming a solid-color triangle, as shown:



(Here the two colors are represented by solid or dotted lines.)

1. How many of the 15 edges of K_6 must be deleted so that the remaining edges can be 2-colored without forming a solid-color triangle?

2. How many of the $\binom{10}{2} = 45$ edges of K_{10} must be deleted so that the remaining edges can be 2-colored without forming a solid-color triangle?

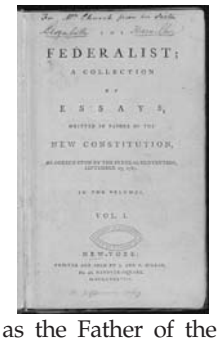
3. It is known that if the $\binom{17}{2} = 136$ edges of K_{17} are colored using 3 colors (i.e.~3-colored), a solid-color triangle must be formed, but that it is possible to 3-color the $\binom{16}{2} = 120$ edges of K_{16} without forming a solid-color triangle. How many edges of K_{17} must be deleted so that the remaining edges can be 3-colored without forming a solid-color triangle?

4. Let $r = r(c)$ be the smallest positive integer such that, if the $\binom{r}{2}$ edges of K_r are colored using c colors, then there must be a solid-color triangle. How many of the edges of K_r must be deleted so that the remaining edges can be c-colored without forming a solid-color triangle anywhere? (Surprisingly, the answer to this question does not depend on knowing the value of r for the given value of c.)

Information Theory Helps Historians

Pavol Hanus and Joachim Hagenauer

Following the appeal in the President's Column from March this year, stressing out the importance of doing a better job reaching out to other communities, and in the hope of pleasing our Society's historian A. Ephremides , we developed an information theoretical method helping historians clarify disputed authorship attribution of texts, e.g. of the so called "Federalist papers".



The Federalist Papers were written and published during the years 1787 and 1788 in several New York State newspapers. Their purpose was to persuade New York voters to ratify the proposed constitution. In total, the Federalist Papers consist of 85 essays outlining how the new government would operate under the new constitution and why this type of government was the best choice for the United States of America. All of the essays were written by A. Hamilton, J. Madison, and J. Jay under the pseudonym Publius. Madison, widely recognized as the Father of the Constitution, would later go on to become President of the United States. Hamilton would serve in the Cabinet and Jay would become the first Chief Justice of the US Supreme Court. Altogether Hamilton wrote 52 of these essays, Madison wrote 16, and Jay contributed 5. The authorship of the remaining 12 is disputed. These are essays No. 49-58, 62 and 63. The majority of historians believe that they were all written by Madison and the results obtained by our method support this claim. The Federalist Papers discuss very similar topics and are written in an almost identical style typical for political discourse of that time. It is therefore considered a very challenging task for purely algorithmic approaches to correctly determine the authorship attribution of these essays.

When it comes to assessing relatedness, mutual information is the intuitive tool of choice for an information theorist. Mutual information precisely describes the amount of information shared by stochastic processes and can thus be used to derive distance measures quantifying the similarity of these processes. Different authors writing essays, modeled as sources generating messages, can be regarded as such stochastic processes. The task of authorship attribution is a content recognition type classification problem, trying to assign each disputed essay (message generated by an unknown source) to one of the authors characterized by their respective essays. Mutual information is an absolute measure of information common to both sources whose relatedness is to be quantified. It can be transformed into a bounded distance through normalization. For content recognition (CR), we normalize by the maximum possible mutual information $I(S_i; S_j)$ the two sources S_i, S_j can share, which corresponds to the minimum of their respective entropy rates,

$$d_{CR}(S_i, S_j) = 1 - \frac{I(S_i; S_j)}{\min(H(S_i), H(S_j))} \leq 1.$$

The defined distance measure can be reformulated in terms of entropy rates. To determine the entropy rate of a source from a message it generated, we make use of Shannon's compression theorem. In terms of compression the distance measure becomes

$$d_{CR} \approx \frac{|comp(s_j, s_i)| - |comp(s_j)|}{|comp(s_i)|}.$$

The sequence s_j with larger compressed size $|comp(s_j)|$, where $|.|$ denotes the size in bits or symbols, is used as training for the compressor. Thus, the distance can be regarded as the ratio of the compressed size with training to the compressed size without training. For more details, please refer to [1].

The Federalist Papers were obtained from the website of the Gutenberg Project. As content, several concatenated essays by all three authors were used: Madison=(41,…,48), Hamilton=(59,…,61,65,…,69), Jay=(2,…,5,64). From all the different kinds of investigated compression algorithms Prediction by Partial Matching (PPM) performed best for content recognition of linguistic data. A PPM compressor was used to generate the distances presented in Table 1. The term "best" marks the author who most likely wrote the essay. The % value is the relative difference between the distance to the current author and to the best matching author. It is a good indicator for the reliability of the assumed attribution, e.g., essay No. 57 might also have been written by Hamilton judging by the small relative distance.

PPM	Madison	Hamilton	Jay
No.	d_{CR} - relative dist. in %		
49	0.60-best	0.65-7.9%	0.71-17.7%
50	0.59-best	0.62-4.8%	0.69-16.7%
51	0.63-best	0.68-7.3%	0.73-15.8%
52	0.63-best	0.67-6.4%	0.74-17.2%
53	0.66-best	0.69-5.8%	0.75-13.7%
54	0.66-best	0.69-3.6%	0.75-13.6%
55	0.65-best	0.68-4.8%	0.75-14.9%
56	0.64-best	0.67-5.4%	0.73-14.2%
57	0.67-best	0.67-1.0%	0.76-13.7%
58	0.64-best	0.67-4.2%	0.74-15.7%
62	0.67-best	0.70-5.3%	0.75-12.3%
63	0.68-best	0.72-4.7%	0.77-13.0%

TABLE I
DISPUTED FEDERALIST PAPER RECOGNITION USING PPM

Our results coincide with the findings of others [2] based on word frequencies, but our method using a naïve information theoretic approach is very general and can be used to tackle open problems from many different kinds of fields apart from history and linguistics. E.g., information theoretic methods based on mutual information can successfully be used to address problems in genetics, such as phylogenetic research or gene mapping [3].

References

[1] Z. Dawy, J. Hagenauer, P. Hanus, and J. C. Mueller, "Mutual information based distance measures for classification and content recognition with applications to genetics," in Proc. of the ICC'05, May 2005.

[2] G. Fung, "The disputed federalist papers: SVM features election via concave minimization," in Proc. of the Conf. on Diversity in Computing, pp. 42–46, Oct. 2003.

[3] J. Hagenauer, Z. Dawy, B. Goebel, P. Hanus, and J. C. Mueller, "Genomic analysis using methods from information theory," in Proc. of the ITW'04, pp. 55–59, Oct. 2004.

Introduction of Sampling Theory in Signal and Image Processing – An International Journal (ISSN:1530-6429 http://stsip.org/)

The STSIP Journal appears three times a year and publishes refereed, well-written, original research articles on the development and applications of sampling and interpolation theory, wavelets, tomography, the Gibbs phenomenon, and other closely related fields.

Its editorial board consists of thirty established researchers at well-known universities and institutes worldwide. The journal is reviewed and indexed by Zentralblatt MATH, the Math. Reviews, and INSPEC.

The journal's web site is http://stsip.org/ where its online version is available.

New Books

by Raymond Yeung

Wireless Communications,

by Andrea Goldsmith. Cambridge University Press, 2005, 648 pp., $75.00 £40.00, ISBN 0521837162.

Contents:
Overview of wireless communications; Path loss and shadowing; Statistical multipath channel models; Capacity of wireless channels; Digital modulation and detection; Performance of digital modulation over wireless channels; Diversity; Coding for wireless channels; Adaptive modulation and coding; Multiple antennas and space-time communications; Equalization; Multicarrier modulation; Spread spectrum; Multiuser systems; Cellular systems and infastructure-based wireless networks; Ad-hoc networks.

Elliptic Curves, Number Theory and Cryptography,

by Lawrence C. Washington. Chapman & Hall CRC, 2003, 440 pp., $79.95 £pounds 45.99, ISBN 1-58488-365-0.

Contents:
Introduction; The basic theory; Torsion points; Elliptic curves over finite fields; The discrete logarithm problem; Elliptic curve cryptography; Other applications; Elliptic curves over Q; Elliptic curves over C; Complex multiplication; Divisors; Zeta functions; Fermat's last theorem.

Cryptography, Theory and Practice, Second Edition,

by Douglas R. Stinson. Chapman & Hall CRC, 2002, 360 pp., $79.95 £39.99, ISBN 1-5848-8206-9.

Contents:
Classical cryptography; Shannon's theory; Block ciphers and the advanced encryption standard; Cryptographic hash functions; The RSA cryptosystem and factoring integers; Public-key cryptography based on the discrete logarithm problem; Signaure schemes.

Combinatorics of Permutations,

by Miklós Bóna. Chapman & HallCRC, 2004, 400 pp., $89.95 £49.99, ISBN 1-58488-434-7.

Contents:
In one line and close. Permutations as linear orders. Runs; In one line and anywhere. Permutations as linear orders. Inversions; In many circles: permutations as products of cycles; In any way but this: pattern avoidance. The basics; In this way, but nicely: pattern avoidance. The follow-up; Mean and insensitive: random permutations; Permutations vs. everything else: algebraic combinatorics of permutations; Get them all: Algorithms and permutations.

Introduction to Coding Theory,

by Jurgen Bierbrauer. Chapman & Hall CRC, 2005, 416 pp., $79.95 £39.99, ISBN 1-58488-412-5.

Contents:
Part I: An elementary introduction to coding; The concept of coding; Binary linear codes; General linear codes; Reed-Solomon codes; Recursive construction I; Universal hashing; Designs and the binary Golay code; Shannon entropy; Asymptotic results; 3-dimensional codes, projective planes; Summary and outlook. Part II: The theory of codes and their applications; Subfield codes and trace codes; Cyclic codes; Recursive constructions, covering radius; OA in statistics and computer science; The geometric description of codes; Additive codes; The last chapter.

Codes, The Guide to Secrecy from Ancient to Modern Times,

by Richard A. Mollin. Chapman & Hall CRC, 2005, 704 pp., $79.95 £44.99, ISBN 1-58488-470-3.

Contents:
From the Riddles of Ancient Egypt to Cryptography in the Renaissance---3,500 Years in the Making; From Sixteenth-Century Cryptography to the New Millennium--The Last 500 Years; Symmetric-Key Cryptography; Public-Key Cryptography; Cryptographic Protocols; Key Management; Message Authentication; Electronic Mail and Internet Security; Applications and the Future; Non-Cryptographic Security Issues; Information Theory and Coding.

Handbook of Elliptic and Hyperelliptic Curve Cryptography,

by Henri Cohen, Gerhard Frey, Roberto M. Avanzi, Christophe Doche, Tanja Lange, Kim Nguyen, Fré Vercauteren. Chapman & Hall CRC, 2005, 800 pp., $99.95 £56.99, ISBN 1-58488-518-1.

Contents:
Introduction to Public-Key Cryptography; Mathematical Background; Elementary Arithmetic; Arithmetic of Curves; Point Counting; Computation of Discrete Logarithms; Applications; Realizations of DL Systems.

Wireless Mesh Networks,

by Gilbert Held. Auerbach Publications, 2005, 160 pp., $79.95 £44.99, ISBN 0-8493-2960-4.

Contents:
Introduction to Wireless Mesh Networking; Radio Frequency Utilization; Mesh Network Components; Routing Protocols; Network Operation; Creating a HotPoint-Based Mesh Network; Wireless Mesh Standards; The Future of Wireless Mesh Networking.

Security in Wireless LANs and MANs,

by Thomas Hardjono, Lakshminath R. Dondeti. Artech House Publishers, 2005, Approx. 306 pp., £54, ISBN 1-58053-755-3.

Contents:
Introduction to Wireless LAN Security; Background: 802.11 Wireless LANs; Over-the-Wire Encryption; TKIP and Michael; 802.11i; Authentication in WLANs; Security in WLAN Roaming; Security in 3G-WLAN Inter-Network Roaming; 80216 WiMax® Security.

Genomic Signal Processing and Statistics,

edited by Edward R. Dougherty, Ilya Shmulevich, Jie Chen, Z. Jane Wang. Hindawi Publishing Corporation, 2005, 449 pp., $119.95 £54, ISBN 977-5945-07-0.

http://www.hindawi.com/books/spc/volume-2/

Contents:
Genomic signal processing: perspectives. Part I. Sequence Analysis: Representation and a nalysis of DNA sequences. Part II. Signal Processing and StatisticsMethodologies in Gene Selection: Gene feature selection, Ioan Tabus and Jaakko Astola; Classification; Clustering: revealing intrinsic dependencies in microarray data; From biochips to laboratory-on-a-chip system. Part III. Modeling and Statistical Inference of Genetic Regulatory Networks: Modeling and simulation of genetic regulatory networks by ordinary differential equations; Modeling genetic regulatory networks with probabilistic Boolean networks; Bayesian networks for genomic analysis; Statistical inference of transcriptional regulatory networks. Part~IV. Array Imaging, Signal Processing in Systems Biology, and Applications in Disease Diagnosis and Treatments: Compressing genomic and proteomic array images for statistical analyses; Cancer genomics, proteomics, and clinic applications; Integrated approach for computational systems biology.

Introduction to Information Theory and Data Compression, Second Edition,

by Darrel Hankerson, Greg A. Harris, Peter D. Johnson. Chapman & Hall CRC, 2003, 384 pp., $94.95 £53.99, ISBN 1-58488-313-8.

Protocols for Secure Electronic Commerce, Second Edition,

by Mostafa Hashem Sherif. Chapman & Hall CRC, 2004, 640 pp., $94.95 £53.99, ISBN 0-8493-1509-3.

Handbook of Discrete and Computational Geometry, Second Edition,

edited by Jacob E. Goodman, Joseph O'Rourke. Chapman & Hall CRC, 2004, 1560 pp., $139.95 £79.00, ISBN 1-58488-301-4.

Computer Science Handbook, Second Edition,

edited by Allen B. Tucker. Chapman & Hall CRC, 2004, 2752 pp., $139.95 £79.00, ISBN 1-58488-360-X.

Statistical Methods in Computer Security,

edited by William W.S. Chen. CRC Press, 2005, 376 pp., $89.95 £49.99, ISBN 0-8247-5939-7.

Handbook on Theoretical and Algorithmic Aspects of Sensor, Ad Hoc Wireless, and Peer-to-Peer Networks,

edited by Jie Wu. Auerbach Publications, 2005, 856 pp., $129.95 £74.99, ISBN 0-8493-2832-2.

GOLOMB'S PUZZLE COLUMN™

Some Matrix Questions Solutions

Solomon W. Golomb

1. The matrices $A = \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix}$ are similar, since $P^{-1}AP = B$ with $P = \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$ and $P^{-1} = \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$. However, $AB = \begin{pmatrix} 0 & 2 \\ 0 & 0 \end{pmatrix}$ and $BA = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ are not similar, since clearly $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ is similar only to itself.

2. *Theorem*. If, for a given complex matrix M, there exists a unitary matrix U such that $U^{-1}MU = \Lambda$, where Λ is a diagonal matrix, then M is normal.

   Proof. From $U^{-1}MU = \Lambda$, we have $\Lambda^* = \Lambda^H = (U^{-1}MU)^H = U^H M^H (U^{-1})^H = U^{-1}M^H U$. Now $\Lambda\Lambda^* = \Lambda^*\Lambda$, because if Λ is the diagonal matrix with $\lambda_1, \lambda_2, \ldots, \lambda_n$ as its diagonal elements, then Λ^* is the diagonal matrix with $\lambda_1^*, \lambda_2^*, \ldots, \lambda_n^*$ as its diagonal elements, and both $\Lambda\Lambda^*$ and $\Lambda^*\Lambda$ are diagonal matrices with $|\lambda_1|^2, |\lambda_2|^2, \ldots, |\lambda_n|^2$ as their diagonal elements. Now $\Lambda\Lambda^* = (U^{-1}MU)(U^{-1}M^HU) = U^{-1}(MM^H)U$, $\Lambda^*\Lambda = (U^{-1}M^HU)(U^{-1}MU) = U^{-1}(M^HM)U$, and since these are equal, $MM^H = M^HM$, so M is normal. □

3. "If N_1 and N_2 are normal $n \times n$ matrices then N_1N_2 is normal" is *false*. For a counter-example, we can use the fact that every (real) symmetric matrix S is normal, since $S^H = S^T = S$, from which $SS^H = S^2 = S^HS$. Then with $N_1 = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ and $N_2 = \begin{pmatrix} 2 & 1 \\ 1 & 4 \end{pmatrix}$, we have $P = N_1N_2 = \begin{pmatrix} 4 & 9 \\ 7 & 14 \end{pmatrix}$ and $P^H = P^T = N_2^T N_1^T = N_2N_1 = \begin{pmatrix} 4 & 7 \\ 9 & 14 \end{pmatrix}$. Now $PP^H = \begin{pmatrix} 4 & 9 \\ 7 & 14 \end{pmatrix} \times \begin{pmatrix} 4 & 7 \\ 9 & 14 \end{pmatrix} = \begin{pmatrix} 97 & 154 \\ 154 & 245 \end{pmatrix}$ but $P^HP = \begin{pmatrix} 4 & 7 \\ 9 & 14 \end{pmatrix}\begin{pmatrix} 4 & 9 \\ 7 & 14 \end{pmatrix} = \begin{pmatrix} 65 & 134 \\ 134 & 277 \end{pmatrix}$, so that $P = N_1N_2$ is not normal.

4. Let $R = \left\{ \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix} \right\} = \{O, Z, I, J\}$ over $GF(2)$. R forms a commutative group with respect to matrix addition modulo 2, and R is closed under matrix multiplication modulo 2. In this ring, both I and J are "left identities", since $\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}\begin{pmatrix} a & b \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} a & b \\ 0 & 0 \end{pmatrix}$ and $\begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}\begin{pmatrix} a & b \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} a & b \\ 0 & 0 \end{pmatrix}$, but neither one is a "right identity", since $ZI = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} = 0$, and $ZJ = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}\begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} = O$.

5. "If the n^2 elements of an $n \times n$ matrix A are integers chosen independently and at random, what is the probability that $|A|$, the determinant of A, is odd?"

   For all $n \geq 2$, the answer is *not* one-half. Rather than worry about what sample space integers can be chosen from "independently and at random", we need only agree that each entry in A is equally likely to be even or odd, and independently of the other entries. Then our question is equivalent to: "What fraction of the $n \times n$ matrices over $GF(2)$ are non-singular?" (The *even* determinants all reduce to 0, and the *odd* determinants all reduce to 1, modulo 2.) To form a non-singular $n \times n$ matrix over $GF(2)$, we can pick the top row in $2^n - 1$ ways (only the all-zeroes case is excluded), the second row in $2^n - 2$ ways, and the j^{th} row in $2^n - 2^{j-1}$ ways, for all j, $1 \leq j \leq n$. This gives $\prod_{j=1}^{n}(2^n - 2^{j-1})$ non-singular matrices, out of $2^{(n^2)}$ matrices altogether. Then the probability is the ratio, which simplifies to $\prod_{j=1}^{n}(1 - 2^{-j}) = \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{7}{8} \cdots \frac{2^n - 1}{2^n}$. This sequence of probabilities, $\frac{1}{2}, \frac{3}{8}, \frac{21}{64}, \frac{315}{1024}, \cdots$, converges rather rapidly to a positive limiting value, $\prod_{j=1}^{\infty}\left(1 - \frac{1}{2^j}\right) = 0.2887878\ldots$. Thus, the probability that a "large" $n \times n$ matrix of "random" integers would have an odd determinant is a bit less than 29%. (At $n = 8$, this probability is already down to $0.289919\ldots$.)

Announcement and Call for Papers

Information Theory Workshop (ITW'2006)

March 13–17, 2006, Punta del Este, Uruguay

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Important Dates

Submission:	**Oct. 31, 2005**
Notification:	**Dec. 23, 2005**
Final version:	**Jan. 15, 2006**

The 2006 IEEE Information Theory Workshop (ITW 2006), organized by Facultad de Ingeniería—Universidad de la República, Uruguay, and the IEEE Information Theory Society, will take place from the evening of Monday, March 13, through Friday, March 17, 2006, at the Conrad Resort and Casino in Punta del Este, Uruguay.

The sessions of the workshop will cover the following topics:

- Algebraic and combinatorial coding theory
- Algorithms in finite fields
- Analysis of algorithms in information theory
- Application of coding theory in computer science
- Coding techniques for storage
- Communication complexity
- Cryptography and data security
- Data compression algorithms and source coding
- Data networks
- Detection
- Information theory and statistics
- LDPC codes, turbo codes, and iterative decoding
- Multi-user information theory
- Pattern recognition and learning
- Shannon theory
- Universal prediction and on-line algorithms

Sessions will consist mainly of invited talks, but will also include slots for contributed papers. Submission of papers on the above topics is hereby solicited. The deadline for submission is **October 31, 2005**. Authors will be notified of acceptance decisions by **December 23, 2005**. The final versions of all contributions, to be published in the workshop proceedings CD, will be due by **January 15, 2006**.

Further information, such as submission guidelines, contacts, and local information, will be available at the workshop web site,

`http://www.fing.edu.uy/itw06.`

Location: Punta del Este is one of the premier resort cities in South America. It offers cultural attractions, sophistication, excellent restaurants, natural beauty, and fabulous beaches (the workshop takes place at the end of summer). It is about 1.5 hrs of scenic drive from the capital Montevideo, or a 30 min flight from Buenos Aires, Argentina.

TURBO - CODING - 2006

4th International Symposium on Turbo Codes & Related Topics

6th International ITG-Conference on Source and Channel Coding

Munich, Germany
3-7 April 2006

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Institute for Communications Engineering
Munich University of Technology
D-80290 Munich
Germany
Phone: +49 89 289 23466
Fax: +49 89 289 23490
E-mail: info@turbo-coding-2006.org

Second Call for Papers

The 4th International Symposium on Turbo Codes & Related Topics, organized by ITG and TUM/LNT (Munich University of Technology, Institute for Communications Engineering), will be held on Monday 3rd - Friday 7th April 2006 at the Bavarian Academy of Sciences and Humanities in Munich, Germany.

The Symposium will be the opportunity to provide a broad overview of the current status and advanced research in iterative methods and their application to information theory, especially for digital communications. The Symposium will include regular papers and poster sessions as well as some invited papers.

The non-exhaustive list below gives possible topics for the papers submitted:

- error correction coding, turbo codes and LDPC codes
- coded and turbo coded modulation
- detection and turbo detection
- equalization and turbo equalization
- synchronization and turbo synchronization
- multi-user detection
- bounds, performance and convergence
- algorithms for constituent codes
- interleaving and graphs
- fountain codes
- network coding

The 6th International ITG Conference on Source and Channel Coding (SCC 06) will be held in connection with the Symposium on Turbo Codes. Some technical sessions will take place in parallel. Papers on the following subjects are welcome for SCC 06:

- information theory
- algebraic coding
- MIMO and CDMA systems
- source coding and data compression
- speech, audio, image and video coding
- joint source and channel coding, error concealment
- cryptography and digital watermarking

As in the previous Turbo Symposium and ITG's SCC Conference, some papers will be selected for publication in an extended version, in a special issue of the *"European Transactions on Telecommunications"* journal.

Submissions

Authors are invited to submit a full 4-page paper before **October 17, 2005**. Only electronic submissions will be accepted. Further details can be found on the Symposium web page **www.turbo-coding-2006.org**

At least one author of the accepted paper must be registered for the Symposium by **January 15, 2006** in order to be published in the proceedings.

Key dates

For information regarding registration, accommodation and transport please check the Symposium website http://www.turbo-coding-2006.org.

Submission of papers deadline:	October 17, 2005
Notification of acceptance:	December 15, 2005
Final versions of papers:	January 15, 2006
Preferential rate registration deadline:	February 15, 2006

Princeton University

Call For Papers CISS '06

40TH Annual Conference on Information Sciences and Systems

Department of Electrical Engineering, Princeton University

March 22, 23, and 24, 2006

Authors are invited to submit previously unpublished papers describing theoretical advances, applications, and ideas in the fields of information theory (including application to biological sciences); communication, networking; signal, image, and video processing; systems and control; learning and statistical inference.

Two types of contributed papers are solicited:

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

Electronic summaries in Adobe PDF format, together with a "regular" or "short" designation and 2-3 keywords must be submitted by **January 2, 2006** through the conference website http://www.ciss.us. Summaries should be of sufficient detail and length to permit careful reviewing. Authors will be notified of acceptance no later than **February 3, 2006**. Final manuscripts of accepted papers are to be submitted in PDF format no later than **February 24, 2006**. **These are firm deadlines that will permit the distribution of a CD containing the conference proceedings at the Conference.**

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IMPORTANT DATES:
Submission deadline:
Monday, January 2, 2006

Notification of acceptance:
Friday, February 3, 2006

Final manuscript and advance registration:
Before Friday, February 24, 2006

Conference dates:
Wednesday, Thursday and Friday
March 22, 23, and 24, 2006

www.ciss.us

Call for Papers

NETCOD 2006

Second Workshop on Network Coding, Theory, and Applications
April 3-7, Boston, Massachusetts
(in conjunction with WiOpt 2006)

Multiuser information theory has been an important research area since the 1970's. In the past few years, there has been a surge in research activities in the area due to its potential applications to communication networks. In particular, the recent theory of network coding reveals the surprising fact that unlike what was believed in the past, information should not be regarded as a commodity in a network. Since its inception, network coding has emerged as a new paradigm that has influenced information and coding theory, networking, wireless communications, computer science, graph theory, and matrix theory. NETCOD 2006 will be organized as a one day workshop within WiOpt 2006 (`www.wiopt.org`) focusing on practical and theoretical aspects of network coding.

Submissions and final versions appearing in the workshop proceedings shall be 6 pages long in IEEE double-column format. Submissions should be sent to either `medard@mit.edu` or to `koetter@uiuc.edu` by **December 12, 2006**. For further information about the workshop and organizational details see the url:

http://www.netcod.org

Conference Calendar

DATE	CONFERENCE	LOCATION	CONTACT/INFORMATION	DUE DATE
September 4-9, 2005	**2005 IEEE International Symposium on Information Theory (ISIT)**	Adelaide Convention Center Adelaide, AUSTRALIA	http://www.isit2005.org Dr. Alex Grant Institute for Telecommunications Research University of South Australia SA 5095 Australia Prof. Rodney A. Kennedy Research School of Information Sciences and Engineering Australian National University ACT 0200 Australia rodney.kennedy@anu.edu.au	January 30, 2005
September 28-30, 2005	**43rd Annual Allerton Conference on Communication, Control and Computing**	Allerton, Illinois USA	http://www.comm.csl.uiuc.edu/allerton	July 1, 2005
April 3-7, 2006	**4th International Symposium on Turbo Codes and Related Topics**	Munich, Germany	http://www-turbo-coding-2006.org	Oct. 17, 2005
April 3-7, 2006	**4th International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt '06)**	Boston, Massachusetts, USA	http://www.wiopt.org	Oct. 5, 2005
May 30-June 1, 2006	**23rd Biennial Symposium on Communications**	Kingston, Ontario, CANADA	http://www.ece.queensu.ca/symposium qbsc@post.queensu.ca	January 25, 2005
March 13-17 2006	**2006 Information Theory Workshop (ITW 2006)**	Punta del Este, URUGUAY	http://www.fing.edu.uy/itw06	October 31, 2005
July 2-7, 2006	**The 11th Information Processing and Management of Uncertainty International Conference (IPMU 2006)**	Paris, FRANCE	http://ipmu2006.lip6.fr ipmu2006.secretariat@poleia.lip6.fr	December 10, 2005
TBA	**2006 IEEE International Symposium on Information Theory (ISIT)**	Seattle, Washington, USA	TBA	TBA