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IFORS NEWS

International Federation of Operational Research Societies

Operational Research and the Age of Analytics

Mike Trick <trick@cmu.edu>

When I was a doctoral student way back in the 1980s, getting and using data was a tremendous impediment to finishing a dissertation. Data was precious and very difficult to obtain. Even when received, data often was in an unusable form, involving arcane formatting and coding. We had email, but I can't recall using it very often. I do recall sending paper letters asking for information, with the resulting weeks before getting a response. Fortunately, I was at a top research university in the United States (Georgia Tech): the data situation elsewhere was undoubtedly worse.

The world has certainly changed. Now, companies and organizations are drowning in data with countless systems generating mega-, giga-, tera-, and even petabytes of data. In 2001, when I first put together a data mining course at Carnegie Mellon, I breathlessly talked about how the books at the U.S. Library of Congress held 20 terabytes of data, then an unimaginable number. I can now buy 20 terabytes of storage for my computer for about $500. Companies like Google, Facebook, Baidu, Twitter and many more take in hundreds of petabytes of data per day.

And, excepting privacy restrictions, this data is not slowed down by national borders. While most of us do not have the bandwidth or computing capability to handle petabytes of data, the kilo- or megabytes of data used by most operational research models are much easier to handle. For any place with a reasonable connection to the internet, data is just a few clicks away.

This has been a tremendous boon to international operational researchers. If you are doing research in integer programming, you have immediate access to MIPLIB, a library of challenging mixed-integer programming instances. You can send instances to NEOS, an online server that can solve a huge range of problems, including linear, mixed-integer, semi-definite, and much, much more. Similar data sources and system exist for a wide range of operational research areas. The internet has been a tremendous force for uniting disparate researchers from around the globe.

But companies around the world are faced with a huge problem: what to do with the data. Whether it be the petabytes of a huge, internet-based company or the kilobytes of a locally run firm, companies need to translate their data into information into knowledge into better decisions. And that that challenge is exactly what operational research is all about. We turn data into decisions. And we do it on a global scale.

Many people recognize company's needs and I see over and over again attempts to turn data into decisions without understanding that there are a set of tools and skills that we have developed over the past 60 years that do exactly that. We, as a field, need to recognize and embrace the changes in the world. The Age of Analytics should lead to the Age of Operational Research.

My question to you is: what can IFORS do to help individuals and national societies bring on the Age of Operational Research? We bring together people at our conferences, we publish results in our journals, we aid in the education of young people through our support of summer and winter schools, we encourage and support the creation of new national OR societies. What else should we be doing?

I welcome your thoughts and comments at trick@cmu.edu. And I hope to see many of you at an upcoming conference, be it EURO in Poznan, INFORMS in the US, or any other conference where our paths cross. And don't forget to put IFORS 2017 in Quebec City on your calendar: July 17-21, 2017. And Seoul 2020!

M. Trick is 2016-2018 IFORS President and Professor of OR at the Carnegie Mellon's Tepper School of Business where he also serves as Sr Associate Dean for Faculty and Research.

What's Inside

From the Editor

What to Expect

Elise del Rosario <elise.del.rosario@stepforward.ph>

In this issue, IFORS President Mike Trick, in his thought-provoking *Editorial*, sums up very nicely what we do - **turn data into decisions**. With the huge amounts of data available here and now, the Age of Analytics ushering in an Age of OR is an exciting future for all of us! It is also worth noting that these data are transmitted through network connections that could be made more efficient through OR, as explained by our IFORS Vice President Luciana Buriol who enlightens with her *Tutorial* piece.

This frenetic pace of change, will however, be farthest in the minds of patients waiting in long lines to get the health care they need as our piece in the *OR for Development* shows. *OR Impact* tells us how an OR tool has helped in a similar queuing problem. And there is OR too, in the way leaders have historically been elected, as we can glean from the *Book Review*.

Indeed, OR had been there in the past, is now here in our present and if we do things right, will be there for a glorious future. It is therefore, but fitting that this issue has something for OR workers – both those in the early stage of their careers (*Call to Organize Schools in OR*) and our departed OR thought leaders (*Obituary*). We also take this opportunity to recognize people who have contributed to development through OR (*IFORS Prize*) and through their involvement with IFORS. This issue contains the *Administrative Committee Report* on what IFORS has accomplished in 2015, by the set of officers led by 2013-2015 President Nelson Maculan.

As we recount what had been done, we think of the things left for us to do – and we do hope that includes your making plans to be with us at the IFORS 2017 in Quebec, which the Canadian Operational Research Society, featured in this issue's *OR Society in Focus*, is meticulously preparing for us.!

CONFERENCES

A Workshop Worth its Salt

Tatiana Tchemisova <tatiana@ua.pt>**, Gerhard-Wilhelm Weber** <gweber@metu.edu.tr>

OR in the Modern World was the subject of the Workshop organized by the Department or Mathematics of the University of Aveiro (UA) in Portugal from March 29 to 30. This was the result of collaboration between main organizer, Prof. Tatiana Tchemisova and Prof. Gerhard-Wilhelm-Weber from the IAM of METU, Ankara, Turkey, also affiliated with the Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro.

The workshop consisted of three sections, dedicated to different application areas of OR in modern society: *Smart Cities: Better Evacuation* (with an associated talk on *Transportation Interval Situations and Related Games*); *Smart Cities: Improvements in Education of Migrant Students, and Smart Cities: Earthquake "Prediction"*. A separate seminar on *Finance, Economics and Nature: Optimal Control of Stochastic Systems with Regime Switches, Jumps and Delay* comprised the Workshop.

The choice of this wide range of subjects aimed to present the various dimensions of OR - its fields, directions and emerging challenges – as well as to stimulate research and collaboration in the OR discipline. With the open invitation to the Workshop participants to *EURO 2016* in Poznan, Poland (http://www.euro2016.poznan.pl/), and *IFORS 2017* in Quebec, Canada (http://ifors2017.ca/), Weber gave the participants a taste of what to expect from these conferences.

Although the workshop was mainly dedicated to graduate and postgraduate students in mathematics from University of Aveiro, attendees also included experienced OR colleagues. The Workshop was highlighted by lively discussions among speakers and listeners, exchange of interests, individual and institutional data, and formulation of research plans that extend to future thesis work. There was also talk of PhD. students from METU visiting UA.

(l to r): Graduate student Gozde Sezdin, Tchemisova, Weber and Isabel Pereira, taken at end of the Workshop

Workshop sponsors were the *APDIO*, the Portuguese national society of OR, and by CIDMA, Center for Studies in Mathematics and Applications at UA. UA (https://www.ua.pt/#) is a public university founded in 1973 to provide premium education. A research and development university, it has a student population of around 12,500. Its location, Aveiro, is considered one of Portugal's most unique and inspiring cities, with employment sustained by UA and commerce. Aveiro is also known for its production of salt.

The program was supported by great local hospitality, and complemented by a fruitful meeting with the Board of the active and lively *APDIO* (http://apdio.pt/home) in the beautiful city of *Coimbra*. The cities of Coimbra and Aveiro belong to the *Centro Region* of Portugal.

Cuba Rolls Out The Red Carpet for OR Delegates and Obama

Carlos Bouza

The March 8 to 11 conference was jointly organized by Universidad de La Habana and Université Paris 1, Panthéon-Sorbonne and co-sponsored by Asociación Latinoamericana de Investigación Operativa. (ALIO); Asociación Mexicana de Estadística (AME); American Statistical Association (ASA); International Federation of Operational Research Societies (IFORS); Institute for Operations Research and the Management Sciences (INFORMS); Sociedad Cubana de Matemática y Computación (SCMATCOM-Investigación Operacional); and Universidad Técnica Particular de Loja (UTPL).

Speaker J. Cochran shows off his unique speaker plaque.

The Conference is in commemoration of the 50th anniversary of the journal *Investigación Operacional*. This journal has featured conferences and workshops that have taken place in Cuba over the last twenty-five years. These conferences and workshops have served scientists working with Operations Research - mathematicians, statisticians, economists, engineers, educators, and practitioners - by providing the venue for the exchange of the latest theories, techniques, and experiences in applications of OR and its related areas.

Venue of the conference was the icon of 1950s architecture, the Habana Rivera Hotel. The conference immediately preceded the historic visit of the President of the United States to Cuba, an event that had a profound effect on the initial planning of the Opening Session and social activities. Cuban hospitality provided a pleasant atmosphere, and the Organizing and Program Committees arranged a scientific program of 3-4 parallel streams of sessions daily. Each session began with a main talk provided by a well-known expert from the associated field. The plenary speakers , outstanding professionals from France, Spain, Germany, and USA, included: Charles Bouveyron (Université Paris-Descartes) *Model-Based Clustering of Functional Data: Application to the Analysis of Bike Sharing Systems*; James J. Cochran (University Of Alabama) *The Importance of Collective Science*; Paul Doukhan (Université De Cergy-Pontoise) *A New Vision Of Extreme Values Theory Under Dependence*; Martin Grötschel (Berlin-Brandeburg Academy Of Sciences And Humanities) *Digital Humanities and Operations Research*; L. Robin Keller (University of California, Irvine) *A Markov Decision Tree Model to Evaluate Cost-Effectivness of Cervical Cancer Treatments*; and José Luis Verdegay (Universidad De Granada) *Fuzzy Optimization: Since 1970 Until Today And Back*

Approximately 150 participants attended the conference. Participants, coming from Argentina, Colombia, Cuba, Czech Republic, Ecuador, France, Germany, Japan, Mexico, Panama, Peru, South Korea, Spain, Switzerland, United Kingdom, and the United States, were invited to contribute their papers to a volume of the I*nvestigacion Operacional*. Acceptance of papers are subject to review by the Editorial Committee.

IFORS 2017 is Coming Your Way!

M. Grazia Speranza <grazia.speranza@gmail.com>

It was 60 years ago when the first IFORS conference was held in Oxford. IFORS has not looked back since, holding conferences every three years, the last one having been in Barcelona in 2014, preceded by Melbourne, Australia in 2011, Sandton, South Africa in 2008 and so on, for a total of 20 conferences.

Irène Abi-Zeid

The 21st IFORS triennial conference, IFORS 2017, will take place in the Convention Centre of Québec City, Canada from July 17 to 21, 2017. The Convention Centre is conveniently located in the heart of the World Heritage city and was declared the world's best convention centre in 2006. The Organizing Committee (OC) is composed of Irène Abi-Zeid (chair), Bernard Gendron and Angel Ruiz, the team that has started working on the plan years ago.

I have the privilege of chairing the Program Committee (PC), whose members consist of: Ahti Salo (Finland), Alberto Franco (UK), Andres Weintraub (Chile), Bernard Fortz (Belgium), Bernard Gendron (Canada), Gerhard-Wilhelm Weber (Turkey), Ignacio Garcia Jurado (Spain), Janny Leung (Honk Kong), José Mario Martinez (Brazil), Karla Hoffman (USA), Luce Brotcorne (France), Marielle Christiansen (Norway), Natashia Boland (USA), Peter Bell (Canada), Richard Eglese (UK), Roger Rios (Mexico), Shoshana Anily (Israel), Stefan Nickel (Germany), Svetlozar Rachev (USA), Theodor Stewart (South Africa).

M. Grazia Speranza

IFORS 2017 aims to bring together researchers from around the globe to discuss the full spectrum of topics in OR, with a particular emphasis on the theme *OR/Analytics for a Better World*. Prominent plenary speakers will give their views on the state of the art and research directions in various relevant areas.

Several interesting conferences are held yearly in the field of operational research, but IFORS conferences have the unique characteristic of attracting participants from all over the world, providing them the opportunity to meet, listen to each other, discuss, and talk to renowned researchers one would never meet otherwise. The triennial frequency of this conference is another distinctive characteristic.

All researchers, academics, practitioners, and students interested in all branches of operational research are invited to participate in IFORS 2017.

Each member of the PC will be responsible for specific areas (see http://ifors2017.ca/) for the full range of areas and the responsible PC members). These PC members will gladly welcome your abstracts even as they organize sessions of three to four talks or streams of sessions. Just remember that abstract submission will be open from **November 1st, 2016 to February 10th, 2017.**

IFORS 2017 is an exciting international forum and a great opportunity to meet new and old friends and colleagues from all over the world. On behalf of the Program and Organizing committees, I look forward to meeting you in Québec City in 2017!

Bringing Workshops to Another Level

Jose Fernando Camacho Vallejo <jose.camachovl@uanl.edu.mx>

The 1st International Workshop on Bilevel Programming (IWOBIP'16) was held at one of the top Mexican public universities, the Universidad Autónoma de Nuevo León, sponsored by the Facultad de Ciencias Físico-Matemáticas from March 7 to 11, 2016. The workshop had 65 attendees from 13 different countries: Belgium, Brazil, Cuba, Colombia, France, Germany, India, Ireland, Italy, Mexico, Russia, Spain, and the Unites States.

The IWOBIP'16 consisted of 5 plenary lectures given by Vyacheslav Kalashnikov (Tecnológico de Monterrey, Mexico) on *A Heuristic Algorithm to Solve Bilevel Toll Optimization Problems*, Martine Labbé (Université Libre de Bruxelles, Belgium) on *Stackelberg Games And Bilevel Bilinear Optimization Problem*, Boris Mordukhovich (Wayne State University, USA) on *Bilevel Programming via Generalized Convexity and Variational Analysis*, Leo Liberti (École Polytechnique, France) on *Measuring Smart Grids: Optimal Placement of Sensors in Power Grids*, and Ted Ralphs (Lehigh University, USA) on *Algorithms for Multilevel and Multistage Discrete Optimization Problems*.

In addition, four short-courses of 3.5 hours each were taught by Carmen Galé (Universidad de Zaragoza, Spain) on *Theoretical and Algorithmic Approaches to Bilevel Programming*, Stephan Dempe (TU Bergakademie Freiberg, Germany) on *Solution Approaches for Optimistic Bilevel Optimization Problems*, Ankur Sinha (Indian Institute of Management Ahmedabad, India) on *Evolutionary Bilevel Optimization: Applications and Methodologies*, and Jakub Mareček (IBM Research, Ireland) on *Probabilistic Analyses in Bi-level Optimisation Under Uncertainty*.

From the submitted abstracts, 26 were accepted and scheduled, classified into eight sessions: Reformulations, Logistics 1 and 2, Location, Energy, Applications, Transportation, and Related Topics. There was one daily main session, which encouraged discussions and enriching comments.

The Workshop was full of social events, as follows: the Monday welcome reception at *La Catarina Eventos* where participants enjoyed Tacos al Pastor with Mexican beer and wine; Wednesday afternoon guided tour to the *Grutas de García* (a natural cavern with ancient stalactites and stalagmites); Thursday IWOBIP dinner featuring real typical cuisine from Nuevo León, Mexico, and finally, on Friday night, an impromptu tour at a precious river walk in downtown Monterrey named *Paseo Santa Lucía*. That tour ended at *La Chunga*, a bohemian bar in the *Barrio Antiguo* where a Latino American evening was enjoyed.

The IWOBIP'16 was sponsored by the *Universidad Autónoma de Nuevo León, Técnológico de Monterrey*, the Mexican National Council of Science and Technology (CONACYT), the Mexican Society of Operations Research (SMIO), the Mexican Society of Mathematics (SMM) and the government of Nuevo León. The chair and organizer of this workshop was José Fernando Camacho Vallejo (UANL, Mexico), with the able assistance of Selene Casas, Sayuri Maldonado, Dámaris Dávila, and Lilian López. The Workshop atmosphere and the fruitful daily interactions inspired Luce Brotcorne (INRIA, France) to propose that the following IWOBIP be held in Lille, France, in 2018.

Obituary

David S. Johnson (1945–2016)

Silvano Martello, introducing the late David Johnson during the ECCO-CO Conference in Munich, May 2014

David S. Johnson, world famous for his pioneering work on NP-completeness, passed away on March 8, 2016, at the age of 70. His famous 1979 book *Computers and Intractability* (co-authored with Michael Garey) has been a milestone of computational complexity, and has collected over 55,000 citations, according to Google Scholar. Both authors were awarded the 1979 Lanchester Prize.

He earned his Ph.D. in mathematics from the Massachusetts Institute of Technology in 1973, with a seminal thesis on bin packing approximation algorithms. From 1988 to 2013, he has been head of optimization and computing departments at AT&T Bell Labs. Since 2014, he was a visiting professor at Columbia University. He edited the *Journal of the ACM* from 1983 to 1987. In 2007 he was awarded the INFORMS Computing Society Prize. In 2010, he was awarded the Knuth Prize. More complete information on his life and achievements can be found at http://cacm.acm.org/news/199553-in-memoriam-david-s-johnson-1945-2016/fulltext .

European combinatorialists remember very well his plenary speech at the joint ECCO-CO Conference in Munich, in May 2014, a fascinating lecture on open and closed problems in NP-Completeness. Silvano Martello writes: "Few months ago, he wrote me about the disease that had started showing up late the same year. In spite of his painful physical condition, his mind was strong, and he was very determined to fight against the sickness. He has been working until the day before he died. Computer Science and Combinatorial Optimization have lost one of the fathers of computational complexity and will miss him deeply."

President's Report

Nelson Maculan <maculan@cos.ufrj.br>

It is with a great sense of accomplishment and gratitude that I bring this end of term report to you, our IFORS members. This year marks the end of the 3-year term of the Administrative Committee. Initiatives started at the beginning of this AC's term in 2013 together with the follow up activities of 2014 were continued on into 2015. Regular programs that included the Conferences, IDL, ITL, Publications and Developing Countries, Scholarships as well as the IFORS News and website were further enhanced over the last three years.

In 2015, three new member societies joined IFORS, namely: the Institute for Operations Research of Nigeria (INFORN) in June, Norwegian Operations Research Society (NORS) and the Tunisian Operational Research Society (TORS) both in March. They were in addition to the ratification of the membership of the Mexican Society of Operations Research (SMIO) the year before, in 2014.

I had the opportunity of attending the various regional meetings – INFORMS (2013, 2014). EURO (2013, 2015), ALIO (2014) and APORS (2015) and was very pleased at the leadership of our national societies as well as the presence of regional vice presidents of IFORS in these activities. The 2015 Annual report of the regional Vice Presidents, **Lorena Pradenas** (ALIO), **Ya-xiang Yuan** (APORS), **Jacek Blacewicz** (EURO) and **Michel Gendreau** (NORAM) give a vibrant, global picture of how OR is doing all over the world. The memberships of the national societies, which span academicians, practitioners and students, have all contributed to the various activities undertaken within the regions. I also take note of the IFORS involvement in the training of the future OR professionals through the Summer and Winter Schools conducted within and between the ALIO and the EURO regions.

Members had been updated of these in a regular fashion, quarterly through the IFORS News and the website, chaired by **Elise del Rosario**. These media have kept everyone in the community in touch, closer than ever. On the other hand, IFORS publications continued to earn the revenues that enabled IFORS to pursue its activities. Publications Chair **Graham Rand** dealt with publication challenges encountered along the way.

Over the three years, **Celso Ribeiro** has brought the IFORS journal, *International Transactions in Operations Research* (ITOR) impact factor to 0.977, placing ITOR 49th out of 81 in the ranking for OR/MS journals. *International Abstracts in Operations Research* (IAOR) Executive editor, **K. Preston White, Jr**. and editor **Peter Whitehead** are responsible for IAOR, which in 2015, published the 130,000th abstract. The hard work of the editors enabled IAOR to catch up with the targeted number of abstracts for the year.

The Developing Countries Committee under **Sue Merchant** actively pursued holding of the ICORDs. For the first time, ICORDs were held every year during the period 2013-2015. Furthermore, the ICORD 2015 held in Sri Lanka encouraged the formation of its national OR society. Cooperation with the Euro Working Group on OR for Development (EWG ORD) have made more forums in the area possible. Apart from this, several sponsorships of both speakers and students from developing countries were extended.

Treasurer **Peter Bell** turned over his work of managing the IFORS funds after IFORS2014 to an equally competent treasurer in **Richard Hartl**, who started his work with a review of financial policies and guidelines. His report paints a continuing healthy financial picture for IFORS.

Past President **Dominique de Werra** oversaw the continuity of programs this year, and looked after the implementation of the IFORS Tutorial Lecture, a program which he introduced. Speakers sponsored by IFORS in the three-year period were:

Program	Speaker	Year	Regional Meet
IFORS Invited Tutorials (ITL)	Clovis Gonzaga	2013	EURO
	Peter Letmathe	2015	APORS
IFORS Distinguished Lecture (IDL)	John Little	2013	EURO
	Pascal Van Hentenryck	2013	INFORMS
	Lyn C. Thomas	2014	INFORMS
	Sheldon Ross	2014	ALIO
	Rudiger Schultz	2015	CORS/INFORMS
	Terry Rockafellar	2015	EURO

Activities for the year received the full administrative support of IFORS Secretary **Mary Magrogan** with assistance from **Beth West**. They coordinated activities of the organization and provided great help in the conduct of the conference calls that the AC conducted throughout the three years.

I consider myself lucky to be a part of the AC, a dynamic team which has generously given time and talent to serve the OR community.

To you our members, this annual report marks the end of the three-year term of your AC. On behalf of the 2013-2015 officers, I thank you for giving us the opportunity to be of service to you. The new AC, under the able leadership of Mike Trick, will be counting on you to help it push the IFORS agenda forward.

Report of the Treasurer

Richard Hartl <richard.hartl@univie.ac.at>

Considering the financially successful IFORS 2014 conference in Barcelona, 2015 is a relatively normal year in financial terms. While IFORS ran an operating deficit in 2015, this was in line with the budget and supports a strong long term IFORS financial position.

Unaudited results for 2015 (all numbers in $US) show revenues from publications with IAOR and ITOR cash receipts of $133,503, way above the budget of $125,000. Exchange rate variations when converting the payments in £ to US$ account for deviations from plan. Members' dues collections ($21,654) were above budget ($20,000). >>

	2014	2015	
	Actual Audited	Budget	Actual (Cash)
INCOME			
Member Society Dues	21,460	20,000	21,654
Royalities			
IAOR	87,091	75,000	70,774
ITOR	63,011	50,000	62,729
Interest	2,173	2,500	1,927
Other Income			
Triennial Conferences			
Barcelona 2014	270,127		
Special Conferences			761
TOTAL INCOME	***443,862***	***147,500***	***157,845***
EXPENSES			
Triennial Conferences			
Barcelona 14			7,768
Quebec City 17	18,739		
Activities			
Administrative Committee	18,027	12,000	17,029
Publications Committee			
IAOR Editor	34,500	34,500	36,500
ITOR Editor	20,313	21,000	22,742
Scientific Activities & External Affairs			
IDL, ITL, Fellowships, & Grants	7,243	17,000	14,592
IFORS Website	3,350	5,000	5,030
Education Committee		7,500	
Meetings Committee			
Barcelona 2014	5,801		
Quebec 2017			364
ITOR Subscriptions	20,525		
IFORS Newsletter	5,738	9,000	7,359
Developing Countries Committee	22,111	26,000	19,286
General Business Operations			
Office & Secretary	49,629	48,000	51,517
Auditor	3,238	3,000	2,982
Banking	1,643	1,500	1,257
Contingency		2,500	
Exchange Difference	(239)		
TOTAL EXPENSES	***210,619***	***187,000***	***186,426***
OPERATING RESULT	***233,243***	***(39,500)***	***(28,581)***

>> Interest revenue continued to decline with the continued global decrease in interest rates. it will be recalled that the 2008 interest of $27,280 declined to $2,344 in 2011 even with an increase in IFORS reserves. This downward trend in interest earnings despite increases in reserves continued to 2015, which registered interest earnings of $1,927. The net effect of these revenue movements resulted in an income of $ 157,845, above the budget of $147,500.

As expected, 2015 spending at $186,426 (vs. budget of $187,000) was down from 2014 ($210,619) which had a lot of expenses associated with the triennial conference. Most line items were close to budget, but items that were significantly above budget included the administrative committee expenses ($17,029 vs. $12,000 resulting from additional travel), and some delayed payments associated with IFORS 2014 ($7,768 which had not been budgeted). The Education and Developing Countries committees did not spend their full budgets. In 2015, no payments for ITOR subscriptions were made.

The actual cash deficit of $28,581 was less than the budgeted amount of $39,500, with a note that the audited statements may be slightly different as a result of the way that the auditors handle accruals.

Since additional activities such as Summer/ Winter Schools have been introduced, the 2016 budget approved by the IFORS AC reflects an operating loss of $78,080 and if history repeats, the actual deficit will be less than this. For most of IFORS history, the profits from the Triennial conference have covered annual operating deficits in recurring items and there is no reason to expect a change in this trend.

On balance, 2015 did not materially change IFORS financial strength, which is consistently guided by a conservative investment strategy. With reserves kept in US dollars, IFORS assets in other currencies increase and decrease with the $US exchange rate. Prospects for the future are expected to be sound.

In view of the Federation's financial position and prospects, no change in member society dues is recommended at this time.

Report of the IFORS VP at large and Chair, Developing Countries Committee

Sue Merchant <suemerchant@hotmail.com>

The Developing Countries Committee (DCC), comprising members Elise del Rosario (Philippines), Adam Ouorou (France/ Benin), Yindong Shen (China),Theo Stewart (South Africa) and Sue Merchant (UK) as chair, continued its work of trying to support OR in developing countries and development work in a range of ways.

• The Committee analysed the returns from a questionnaire completed by members of the Consultative Group of OR people from around the world to help guide DCC decisions. Ideas emerging from this exercise included trying to get OR more involved with real world problems. Contact with UNCTAD (UN Conferenceon Trade and Development) indicated that IFORS could count on its help in circulating offers to its member countries on its capacity building/training events for researchers from developing and transition countries on the use of quantitative methods in the area of economics if these are accompanied by scholarships.

• The following two events were organized/ assisted by the DCC:

European Working Group OR for Development Workshop in Glasgow in July 2015. Delegates from 12 different countries: Chile, Ukraine, Colombia, the USA, India, the Philippines, UK, Turkey, Russia, Nigeria, Brazil and Tunisia benefited from the exchange and the sharing of experienced speakers who gave time to deliver plenary talks and workshops. Speakers included Geoff Royston (a former UK ORS president) who described the benefits of and need for OR in Health, Sander Vermeulen from Simul8 who ran a workshop on simulation, and Josie Coburn and Bipashyee Ghosh from Sussex University who demonstrated and helped delegates try out their new decision analysis tool. Feedback from the conference was positive and the networking opportunities were particularly appreciated. Thanks are due to all speakers and delegates and especially to Elise del Rosario and her bank of hard working helpers.

ICORD in Sri Lanka in December 2015. The ICORD (International Conference on OR for Development) was held in Sri Lanka, ably organised by Arabinda Tripathy, Elise del Rosario and Prof Sarath Peiris with great assistance from John Fernando, who also organised discussions on the setting up of a Sri Lankan ORS. Thanks are due to all organisers and to Wiley who, through the good offices of Jim Cochran in the USA kindly sponsored a number of students to attend the conference. 23 delegates from from Sri Lanka, Philippines, Indonesia, Czech Republic, Korea, the USA, UK, Bangladesh, Korea, Nepal and India all gave very positive feedback on their experience.

• Under the planning stage are: the OR Teachers' conference in South Africa in September 2016 (postponed as of May, 2016), headed by Theo Stewart and the ICORD 2016 to be held in Mexico City in June 2016.

• Support was given to a number of organisations in furtherance of good research and practice in OR:

ORPA (OR Practice in Africa), Algeria. IFORS supported two speakers – Hans Ittman on transportation and Sheetal Silal on epidemiology.

National OR Societies. Continuing encouragement was given to a number of national OR societies in developing countries to join IFORS, including: Nigeria which, having joined IFORS, is now taking the lead in considering the formation of some sort of African OR regional group. Support was also given to the first conference of the recently joined Tunisian OR Society in the form of a contribution to support two international speakers, Fouad Abdelaziz and Jacques Teghem. In the light of IFORS' President's support for summer schools and problems being experienced in Ukraine, some support for the attendance of key OR speakers at the summer school in Kiev was provided.

• Other activities - **Developing Countries Resources** website continues to evolve, thanks to the efforts of many interested individuals throughout the world, especially Gerhard Wilhelm Weber and his wide range of contacts who provide many articles on issues connected with development for the site. Google Analytics was used again this year to try to understand better how the site is used and by whom with a view to improving it and this work in ongoing, ably assisted by Ruel Tan (the web master), Sadia Samar Ali in India , several colleagues in the Ukraine and of course the unstinting efforts of the editor Elise del Rosario: thanks are due to them all. Efforts continued to find ways of improving facilities offered by the website and a drop down menu was introduced to improve direct access to some specific parts of the site, and links to open source OR software were added.

Many thanks are due to all DCC members and to Mary Magrogan and Beth West in the IFORS office for their support. DCC looks forward to another year's hard work guided by a new VP.

Report of the VP representing ALIO

Lorena Pradenas Rojas <lpradena@udec.cl>

During 2015, important and relevant events of *Operations Research* (OR) were organized and carried out by the Operations Research Societies that make up the ALIO (http://www-2.dc.uba.ar/alio/eventos.htm).

Ecuador ELAVIO 2015 was organized and carried out by the Operations Research Society of Ecuador and was held at the Quito National Polytechnic School from 23 to 27 February. Teachers from Argentina, Germany, Spain and Ecuador shared their expertise with 70 students from Germany, Spain and Italy and from Latin American countries. The national society also conducted the annual scientific seminar at the Quito National Polytechnic School, from 9 to 12 November, 2015 with participants coming from France, Argentina, Brazil, Colombia, Chile, Ecuador, Paraguay, Peru, Uruguay and Venezuela.

Colombia Preparations for the ELAVIO 2016 (http://elavio2016.univalle.edu.co/) to be held in Cali, from 9 to 13 May 2016 is in full swing. It is organized by the Operations Research Society of Colombia (ASOCIO) in cooperation with the School of Industrial Engineering of the Valle University, the University of Antioquia and the Pontifical Javeriana University of Cali, chaired by Juan Guillermo Venegas.

Argentina (http://www.sadio.org.ar/) The 44JAIIO (http://44jaiio.sadio.org.ar/) annual Argentinian Conference on Informatics and Operations Research was held from August 31 to September 4, 2015. Organized by SADIO and the Faculty of Engineering of the Rosario National University, it was chaired by professors Pablo M. Granitto (CIFASIS - CONICET/ UNR) and Diego Milone (sinc(i) - FICH-UNL/CONICET).

Brazil (http://www.sobrapo.org.br/): The Sociedade Brasileira of Operations Research organized the XLVII SBPO - *Simposio Brasileiro de Pesquisa Operacional* (http://www.sbpo2015.iltc.br/), from August, 25 to 28, 2015 at Porto de Galinhas, Pernanbuco, in cooperation with the Pernambuco Federal University (https://www.ufpe.br/ufpenova). It was chaired by professors Caroline Mota and Suzana Daher (both from UFPE-BR). Participants numbered 500 for the total of 4 conferences, 4 tutorial courses and paper presentations.

Chile (www.ichio.cl): The Chilean Society of Operations Research conducted a number of conferences in different universities and cities: Antofagasta, Valparaiso and Santiago, each with the participation of more than 60 under- and post graduate students. In October 2015, the OPTIMA 2015 was held in the city of Antofagasta (Northern Chile), organized by the Department of Industrial Engineering of the Northern Catholic University and coordinated by Professor Raul Carrasco.

This featured 6 lecturers, Christian Blum (University of the Basque Country), Roussos Dimitrakopoulos (University of McGill), Elena Fernández (Universidad Politecnica de Catalunya), Nelson Morales (University of Chile), Alexandra Newman (Colorado School of Mines) and Andrés Weintraub (University of Chile) and more than 100 refereed papers from all areas of OR. Meanwhile, preparations for **CLAIO2016** (http://web.ing.puc.cl/~claio/) to be held in Chile, from October 2 to 6 2016 are being carried out by the Pontifical Catholic University of Chile and the Chilean Institute of Operations Research (www.ichio.cl), under the chairmanship of Jorge Vera.

Cuba The main activities carried out in 2015 include: the 11th International Workshop on Operations Research 10-13 March 2015; Congress of the Mathematics and Computer Science in Havana, 26-28 November 2015 along with Mathematical Models and Methods in Biomedicine and the Coordination of the Round Table Application of the Mathematical Models; and one session for the International Conference of Economy and Administration (October 2015).

México The Mexican Society of Operations Research (SMIO) held its 4th annual meeting in Juarez city last October 2015. The conference was attended by over 100 people, of which 40 were graduate students. Plenary talks were given by Prof. Maxim Todorov from Universidad de Las Americas, Prof. Oliver Schutze from CINVESTAV, and Dr. Roberto Ley Borras from the consulting firm *Consultoria en Decisiones*.

Uruguay AUDIIO actively promoted in 2015 the development of Operations Research initiatives in Uruguay. Members supported and participated in open events intended for academic and professional exchanges, which tackled, among others, *Transport Planning, Sustainable Smart Cities, Communications Networks Performance and Dependability*. International experts, academic and professional members of AUDIIO, and policy makers at the regional and national levels participated in these events, inviting considerable press impact. Activities also included the launch of the first MSc in Operations Research in the country offered by the Universidad de la República, the largest and oldest Uruguayan university. Previously, OR thesis could only be conducted within other graduate programs. In addition, several members of AUDIIO served as Guest Editors of a special issue of the International Transactions in Operational Research (ITOR), covering presentations during the ALIO/EURO Workshop on Applied Combinatorial Optimization held in Montevideo last December 2014.

Report of the Chair, Education Initiatives

OR teaching occurs in all countries that participate in IFORS activities. An important part of this education is provided directly in various lectures, tutorials and summer/winter schools conducted in the various annual or biannual events, which always find massive participation of undergraduate and postgraduate students and teachers. In each of the national conferences, there are prizes for the best undergraduate and postgraduate theses, providing great interest and motivation on the part of the students.

IFORS has a large set of tools to support the Education in Educations Resources http://ifors.org/wiki/index.php?title=Main_Page. It consistently receives contributions and new material from the different OR societies. The Committee welcomes receiving the links from people interested to share their learning and contributions for inclusion among the education resources.

Report of the VP representing APORS

Yuan Ya-xiang < yyx@lsec.cc.ac.cn>

The Association of Asia-Pacific Operational Research Societies held its 10th Triennial Conference in 2015 and was organized by the Management Science/Operations Research Society of Malaysia (MSORSM). The APORS 2015 took place last August 2 to 6 at the Imperial Hotel in the city of Kuching, Sarawak in Malaysia with the theme *OR and the Environment*. IFORS President 2012-2015, Nelson Maculan with NORAM Vice President Michel Gendreau, Past President Elise del Rosario, and Past APORS Vice President Tatsuo Oyama were on hand to greet the delegates.

R. Tyrrell Rockafellar receives ITL plaque from IFORS President N. Maculan (left)

The conference consisted of 76 technical talks presented by most of the 100 delegates from 21 countries. IFORS Tutorial Lecturer Peter Letmathe from the RWTH Aachen University, Germany who was joined by Stefan Pickl from Universität der BundeswehrMünchen, Germany, Eric Sandoshamof the Red & White Consulting Partners LLP, Singapore, Murali Sambasivan from Taylor's University and Graham Kendall from the University of Nottingham Malaysia Campus.

The excursion to the Sarawak Cultural Village culminated with the conference dinner. At the Village, delegates experienced the cultures of the seven local ethnic tribes by visiting a re-creation of their dwellings.

Rüdiger Schultz (right) receives ITL plaque from NORAM VP Michel Gendreau.

The APORS Council Meeting was also held during this Conference. Ilias Mamat was elected IFORS Vice President representing APORS for the term 2016-2018. During the meeting, preparations for the APORS 2018 in Nepal were discussed by the organizing committee Chair Sunity Shrestha Hada (Nepal), who was also elected President of the Council. Other elected officers were: Chang Won Lee (Korea) as Vice President, Francis Miranda (Philippines) as Secretary and Degang Liu (China) as Treasurer.

Report from the Chair for IDL and ITL

Two IFORS IDLs were selected in 2015. One was given by Professor Rüdiger Schultz at the CORS/INFORMS International Conference, Montreal, Canada in June 2015. The other was given by Professor R. Tyrrell Rockafellar at the 27th European Conference on Operational Research, Glasgow, Scotland in July 2015. One IFORS ITL was given by Professor Peter Letmathe at the APORS 10-th triennial conference, Kuching, Malaysia in August 2015.

Report of the VP representing EURO

Jacek Blazewicz <jblazewicz@cs.put.poznan.pl>

EURO, The Association of European Operational Research Societies, www.euro-online.org, is a regional grouping within IFORS which has 31 member societies. EURO is regulated by a Council consisting of representatives of all its members and an Executive Committee, which constitutes its board of directors. The 2015 Executive Committee of EURO was composed of President Elena Fernández (Spain), Past President Gerhard Wäscher (Germany), VP1 Sally Brailsford (United Kingdom), VP2 Kenneth Sörensen (Belgium), VP3 Silvano Martello (Italy), Secretary Jesper Larsen (Denmark), and the treasurer Marino Widmer (Switzerland). The Manager is Sarah Fores (United Kingdom), the Webmaster Bernard Fortz (Belgium) and the Website Editor and Administrator Marie-France Rogge (Belgium). In addition, IFORS Vice-President for EURO – Jacek Blazewicz (Poland) is responsible for the links between EURO and IFORS.

In 2015, the EURO-k conference was organized in Glasgow (UK), July 12-15, 2015 with ca 2300 delegates. The Program Committee Chair was David Pisinger, while the Organizing Committee Chairs were Valerie Belton and Tim Bedford.

During the EURO Council meeting held in Glasgow in July, the applications of Norway and Tunisia to become members of EURO were approved. The current President of the Norwegian OR Society (NORS) is Lars Magnus Hvattum, and the current President of the Tunisian OR Society (TORS) is Mohamed Ayman Boujelben.

During the EURO-k conference, several awards were conferred upon distinguished scientists. These were: *EURO Gold Medal* Alexander Schrijver; *EURO Distinguished Service Medal* Bernard Roy; *EURO Doctoral Dissertation Award* Joachim Arts; *EURO Excellence in Practice Award* Jesse O'Hanley;

EURO Award for the Best EJOR Paper (Innovative Applications of OR) Trine Krogh Boomsma, Nigel Meade, Stein Erik Fleten; *EURO Award for the Best EJOR Paper* (Review) Victor Pillac, Michel Gendreau, Christelle Guéret, Andrés L. Medaglia; *EURO Award for the Best EJOR Paper* (*Theory and Methodology*) Viet Phuong Nguyen, Christian Prins, Caroline Prodhon and *EthOR Award* Anastasiia Lisogor.

In addition to the EURO-k conference, EURO Mini-Conferences are organized. The XXXI EURO Mini-Conference on *Improving Healthcare*: *New Challenges, New Multidisciplinary Approaches* was held in Coimbra, Portugal in March.

On the other hand, a pretty high number of smaller workshops took place, associated with the activity of various EURO working groups.

The last year also witnessed significant developments in the EURO journals. The European Journal of Operational Research (EJOR) kept its ranking among the best OR journals in Thomson Reuters' JCR. The three new EURO journals: EURO Journal on Computational Optimization (EJCO), EURO Journal on Decision Processes (EJDP), and EURO Journal on Transportation and Logistics (EJTL) were published regularly and received an increasing number of submissions. The EURO e-newsletter continues to be a success.

There are 32 working groups in EURO (EWGs) which cover different areas within OR. The EWGs meet regularly during the EURO-k Conferences and, possibly, during other events, where thematic streams are organized. These meetings are all supported by EURO.

The EURO PhD School (EPS) is an educational instrument created by EURO in 2013 to encourage the organization of post-graduate education initiatives for PhD students under a school format. The 2015 EURO PhD School, devoted to Routing and Logistics, was held in Brescia, Italy during the period June 24 – July 3, 2015. Also under this initiative, EURO supported 16 students across the region to attend NATCOR courses in 2015 that are offered in the UK.

The series of EURO Summer and Winter Institutes (ESWIs) was launched in 1984. The basic idea is that ca 25 early stage researchers meet for about two weeks, present their material, discuss with others and with a handful of specially invited senior experts in the field, prepare a paper to be considered for inclusion in a future issue of an OR publication. In 2015, ESI XXXII on the theme *Online Optimization* was held at the University of Szeged, Hungary, from 15-27 June 2015.

During the last year, some important decisions were made. In order to promote and further develop international cooperation, EURO will (co-) organize and support joint conferences with national OR Societies outside Europe and other regional bodies within IFORS. Significant financial support can be made available for the organization of such events (other than EURO-k Conferences). On the other hand, EURO will support international meetings on relevant OR topics held in one of its member countries by sponsoring a plenary presentation (The EURO Plenary) of an internationally renowned operations researcher (scientist or practitioner) from a EURO member country.

Finally, Valencia (Spain) was approved as the host of EURO 29 in 2018.

Report of the VP representing NORAM

Michel Gendreau <michel.gendreau@cirrelt.net>

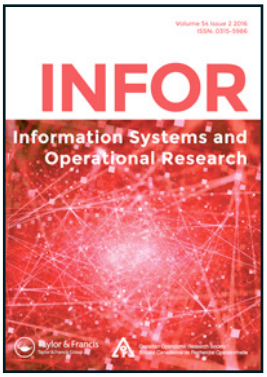
The North American Research Societies (NORAM) is made up of two societies, namely the Canadian Operations Research Society (CORS) and the Institute for Operations Research and the Management Sciences (INFORMS). Activities of the two societies for 2015 are reported below.

CORS ACTIVITIES. CORS is administered by a Council of eleven members, produces a journal, called INFOR and a Bulletin, which reports society's activities quarterly. CORS also actively moderates the website: www.cors.ca, and twitter account by the President: @CORS_President. CORS arranges an annual conference and actively supports students, OR practice, and diverse array of local section activities.

Awards. The 2015 *Harold Lardner Prize* was awarded to Professor Matteo Fischetti, University of Padova (Italy). The 2015 recipient of the *Omond Solandt Award* was AD Opt Technologies (Montreal, Canada). The *Award of Merit* recipient was Professor Tamas Terlaky, Lehigh University (USA), and the *Service Award* went to Bill Simms, Emeritus Professor, Royal Military College of Canada. Finally, the *2015 CORS Practice Prize* was awarded to Guoqing Zhang, Nooshin Nekoiemehr, Qiqi Zhang, Jérôme-Olivier Ouellet, Jean-François Pagé, Adam Dudar, Anqi Chen at the University of Windsor.

Meetings. The 57th Annual Conference of the Canadian Operational Research Society was held in Montreal from June 14 to 17, 2015, jointly with the 2015 INFORMS International Conference (CORS/INFORMS 2015).

Publications. CORS publishes the journal INFOR, a quarterly journal on *Information Systems and Operational Research*. In 2015, after more than 50 years of publishing under UT Press, CORS signed a publishing agreement with Taylor & Francis Publishing.



INFORMS Activities. INFORMS holds two major conferences each year: the Annual Meeting in Fall, which is mainly oriented towards academics, and the Analytics Conference in Spring for practitioners. INFORMS publishes 14 journals and has 4 programs directed at various members of the community.

Awards. The *Doing Good with Good OR - Student Paper Competition* First Place awardee for 2015 was Chenxi Zeng, Georgia Institute of Technology and Amazon Web Services; the *Daniel H. Wagner Prize for Excellence in Operations Research Practice* was jointly awarded to Eva K. Lee, and Fan Yuan, Georgia Institute of Technology, Bali Pulendran, Helder Nakaya, and Troy Quere, Emory University, Greg Burel, and Bernard Benecke, Centers for Disease Control and Prevention; the *George B. Dantzig Dissertation Prize* was given to Alexandre Jacquillat, Massachusetts Institute of Technology; the *George E. Kimball Medal* was awarded to Anne G Robinson, Verizon Wireless, and Jack Levis, UPS; the *George Nicholson Student Paper Prize* was awarded to Linwei Xin, Georgia Institute of Technology; the *Saul Gass Expository Writing Prize* was awarded to Martin A. Lariviere, Kellogg School of Management, Northwestern University; the *Frederick W. Lanchester Prize* was awarded to Michele Conforti, Università di Padova, Dipartimento di Matematica, Gerard P. Cornuejols, Carnegie Mellon University, Tepper School of Business, and Giacomo Zambelli, London School of Economics and Political Science, Department of Mathematic; the *INFORMS President's Award* was given to Jack Levis, UPS; the *INFORMS Prize* was awarded to Chevron; the *Prize for the Teaching of the OR/MS Practice* was given to Thomas W. Lucas, Naval Postgraduate School; the *Judith Liebman Award* was awarded to Kayse Maass, University of Michigan Student Chapter, Michael Prokle, University of Massachusetts Student Chapter, and Eghbal Rashidi, Mississippi State University Student Chapter; the *Moving Spirit Award for Chapters* was given to Daniel Reich, Ford Motor Company, and the *Moving Spirit Award for Fora* went to Dionne Aleman, Junior Faculty Interest Group; Magdalena Romero, Universidad Adolfo Ibanez, J. Massey Cashore, Cornell University, and Kyle Cunningham, SUNY Buffalo were awarded the *INFORMS Undergraduate Operations Research Prize*; Vašek Chvátal, Concordia University, Dept. of Computer Science & Software Engineering, and Jean Bernard Lasserre, CNRS, France, received the *John von Neumann Theory Prize*; the *UPS George D. Smith Prize* was given to Sauder School of Business, University of British Columbia - Center for Operations Excellence; Margaret L. Brandeau, Stanford University, Management Science and Engineering, received the *Philip McCord Morse Lectureship Award*; the *Case and Teaching Materials Competition* was won by Vera Tilson and Gregory Dobson, University of Rochester; and the F*ranz Edelman Award for the Achievement in Operations Research and the Management Sciences* was awarded to Syngenta. In addition, those inducted as INFORMS Fellows in 2015 included: C. Allen Butler (Daniel H. Wagner Associates, Inc), Gérard Cachon (University of Pennsylvania), Pinar Keskinocak (Georgia Institute of Technology), Eva K. Lee (Georgia Institute of Technology), Jack Levis (UPS), Pitu Mirchandani (Arizona State University), Benjamin Van Roy (Stanford University), and Rakesh V. Vohra (University of Pennsylvania).

Meetings. The two major meetings of INFORMS during 2015 were the 2015 INFORMS Conference on Business Analytics & Operations Research held April 12-14 in Huntington Beach, California, and the INFORMS Annual Meeting in Philadelphia, Pennsylvania, November 1-4. In addition, INFORMS held a joint conference with CORS (2015 CORS/INFORMS International Conference) in Montreal, Quebec, Canada, June 15-17.

Report of the Chair, Publications

Graham Rand <g.rand@lancaster.ac.uk>

The journals published by IFORS are an important component of what IFORS offers the worldwide OR community. They raise IFORS' profile amongst researchers and authors. They also provide an important revenue stream to enable IFORS to undertake a wide range of activities. In 2015 the net benefits received were $74,300 – with $34.3k from IAOR, published by Palgrave Macmillan, and $40k from ITOR, published by Wiley-Blackwell.

IFORS' member societies with a member-only section on their website are encouraged to consider providing access to the journals at a low cost per member. (For details, please contact Publications Chair.)

International Abstracts in Operations Research (IAOR)

Executive editor, K. Preston White, Jr. and editor Peter Whitehead are responsible for IAOR. IFORS' thanks are due to them for the great job they are doing. The 130,000th abstract was published in the second issue of 2015. The 2015 issues contained 3995 abstracts: the target is 4000 abstracts, 500 per issue. The issues were not all published on schedule, because of on-going problems with the Electronic Work Bench (EWB) that is a key part of the production process. The editors experienced a great deal of frustration, and worked extremely hard to produce the 2015 volume and get back on schedule.


K. Preston White, Jr.


Peter Whitehead

International Transactions in Operations Research (ITOR)

Celso Ribeiro continues to do an excellent job as editor of ITOR. The impact factor for 2014, reported in 2015, doubled from 0.481 to 0.977. This placed ITOR 49th in the ranking for Operations Research & Management Science journals, out of 81. This is a remarkable achievement. The number of submissions has increased dramatically. The average acceptance ratio in the period is just over 20%. ITOR truly is an international journal, with an editorial board of 58 editors from 23 countries.


Celso Ribeiro

All issues were published ahead of schedule in 2014. Papers published by year have increased from 25 (2006) to 52 (2015), and pages printed by year from 584 (2006) to 1118 (2015). Full text downloads in 2014 were 45,199, up 11%.

The 2015 volume included three special issues on *Matheuristics, Decision Support Systems*, and *OR in Practice*, based on papers presented at the IFORS conference in Barcelona. Special issues in the pipeline include *Cutting and Packing, Improving Healthcare,* and *Optimization of Industrial Systems with Market Disruptions*.

Starting in 2016, a new purchasing option is available for institutional library customers, who can buy access to the complete Collection of Wiley-published journals, including journals new to Wiley and new subscription-journal launches. This new model runs alongside the range of options Wiley-Blackwell offers as part of Collections or as individual titles. It is expected that this new option will help to ensure stable revenues from difficult markets.

The current contract with Wiley-Blackwell ends in December 2016 and terms of contract are being revised.

Report of the Chair, IFORS website and IFORS News

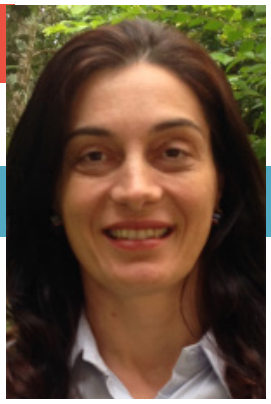
Elise del Rosario <elise.del.rosario@stepforward.ph>

Aiming to keep the OR international community abreast of OR issues and events in various parts of the world, quarterly electronic issues **IFORS News** appeared on schedule. Alerts were sent to the national societies as soon as the issues were uploaded to the IFORS website. Apart from the electronic version, hardcopies of the June issue (containing the IFORS 2014 Annual Report) were distributed during the EURO meeting in Glasgow.

Sue Merchant and *John Ranyard* had been successful in soliciting a wide variety of practical applications spanning warehousing, hospital, call center, and forestry logistics for ***OR Impact***. The ***Tutorials*** section offered equally diverse topics from, metaheuristics to inventory control, cloud computing to facilitated decision making. ***OR for Development*** provided an update of IFORS activities and events in the area. The AC took turns in writing the ***Editorials***. The ***Book Review*** by *Hans Ittmann* brought to readers' attention books on transport topics, a problem handling methodology and Alan Turing. ***Conferences*** brought to the readers various meetings all over the world while updates on IFORS activities were regularly shared. The newly-joined national OR societies of Norway and Tunisia were featured along with those of Lithuania and Turkey in the regular ***OR Society in Focus*** section. Apart from getting members to know the societies better, IFORS News paid homage to OR personalities who have made their mark in the field and in IFORS. The list of IFORS correspondents had continued to grow and be updated in 2015.

The **IFORS website (http://ifors.org)**, through webmaster *Ruel Tan*, continued efforts in bringing to members and visitors a site that is current through news and conference updates and monitoring of online activities. Member profiles were updated as necessary. Of course, the website carried the IFORS News and provided online resources, namely for *Educational Resources* and for *Developing Countries OR Resources*. Continued monitoring of access and improvement based on feedback were done throughout the year. The website continued maintaining its members-only section which logs the status of issues brought for a vote before the membership. For 2015, several society applications were were decided on by the membership through on line voting. Likewise, online voting of the IFORS 2020 host was facilitated through the website. The IFORS website also maintained microsites for the ICORD 2015 & 2016 as well as th EWG-ORD 2016.

Virtualization Optimization Problems in Computer Networks



Luciana S. Buriol <buriol@inf.ufrgs.br> Associate Professor, Institute of Informatics, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil

The amount of network flows transmitted through computer networks has increased dramatically in the last decade. Fast network infrastructure connections have enabled video streaming, online meetings and games, voice over IP and use of other large streams of data commonly available for use in people's daily activities and jobs. This has put pressure on network infrastructure and services to constantly provide even faster connections and respond to increasing and fluctuating demands. Considering technological advances and users' requirements, one area of research in Computer Networks has focused on providing mechanisms to move out of the *status quo* of the current computer network reality. This tutorial briefly introduces two new optimization problems that arise in this context.

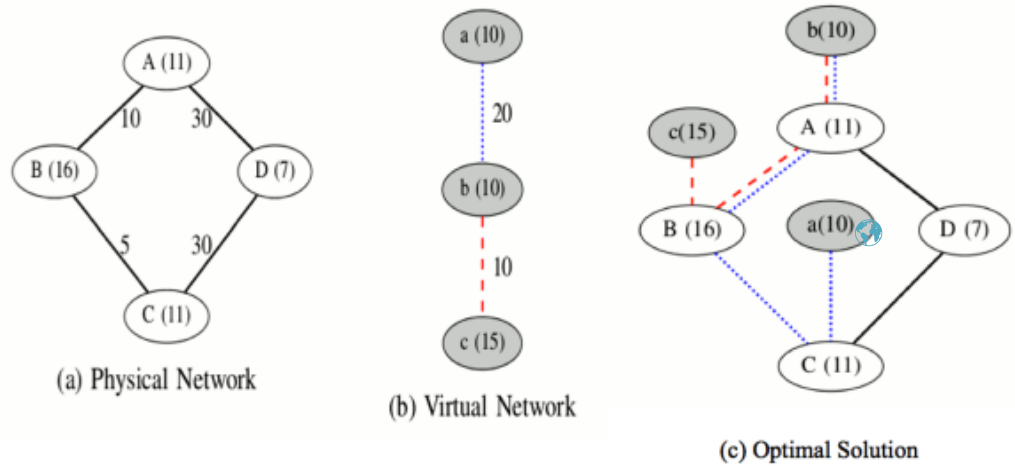


Figure 1 – Networks (a-b) are the input for the problem and the optimal solution is shown in (c).

The fluctuating and increasingly dynamic demand scenario calls for a compatible infrastructure. Resource sharing and flexibility are two concepts that ground the architecture of next generation networks. Different kinds of resources can be shared, but *network virtualization* is a paradigm that was introduced about a decade ago and that is already being used in real world applications. Network virtualization allows multiple virtual networks to coexist on top of a single shared physical infrastructure. In this context, a major optimization challenge is to allocate the virtual networks in the physical substrate while making efficient mappings of nodes and links. A representative problem is stated below.

Virtual Network Embedding Problem (VNEP): Consider a given physical network and a set of virtual networks, each one composed of a set of links with bandwidth consumption, and nodes with resource consumption. The problem consists of allocating the virtual networks into the physical substrate, without violating node or link limits. Moreover, a virtual link can be mapped into a physical path, which can be composed of multiple links. The objective is to minimize the network bandwidth consumption while allocating all virtual networks. Figure 1 shows an input and a solution for the VNEP. This simple version of the problem that considers embedding only one virtual network, satisfying one type of resource consumption (values in the nodes) and bandwidth (link values) is already NP-Hard.

This problem has many variants that usually consider different security constraints and resource consumption. Moreover, the online version where VNs are allocated and removed dynamically is of practical interest. There are also multiple objective functions that can be considered, such as attending to the maximum number of virtual networks when physical resources are not enough to allocate all requests.

Virtualization provides some flexibility to the networks. However, *software-defined networks* is a new paradigm that was introduced to cope with virtualization for allowing more flexibility to operate and manage networks. *Software-Defined Networking* (SDN) is an emerging network architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. In SDNs, the network control is directly programmable because it is decoupled from forwarding functions. In addition, *Network Function Virtualization* (NFV) has been proposed as a networking paradigm which applies virtualization technologies that allow a middlebox implementation shift from specialized proprietary software to commodity servers located in nodes distributed across the network.

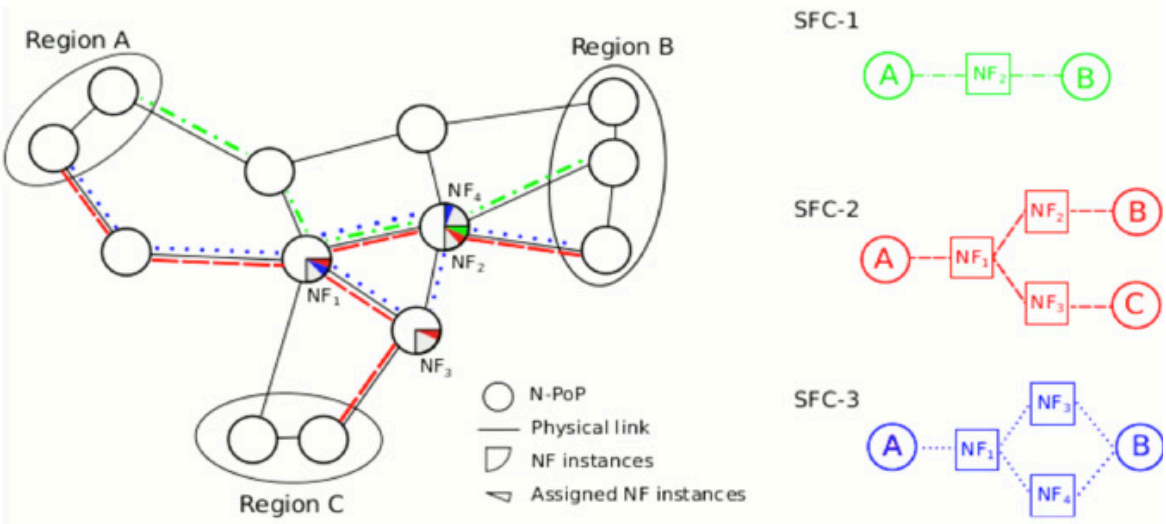


Figure 2: An input and solution for NFPCP: three SFCs from the right mapped into the physical substrate on the left [3].

Network flows are controlled by centrally managed and directly programmable software. This makes it possible to adjust network traffic flows dynamically to meet changing needs. The main advantages of implementing functions by software are gains in flexibility and cost savings, since middleboxes are difficult to deploy and maintain. However, this change requires removing the existing hardware and implementing new software. The number of function networks is about the same as routers, which are responsible for supporting security (e.g., firewalling and intrusion detection) and performance checking (e.g., caching and proxying). Optimization problems arise in this context, one of which is discussed below.

Network Function Placement and Chaining Problem (NFPC): Consider (Figure 2) a set of service function chaining requests, each one with a set of endpoints that have to be located in pre-defined regions, and each one representing different sequences of network functions, which have to be installed. It is also given a physical infrastructure, which will accommodate the SFCs, attending power processing and link bandwidth.

The VNEP and NFPCP are two representative problems, but there are other combinatorial optimization problems that arise in the context of SDNs. For these two particular problems, a few variants were already modeled as MIP problems, but it is currently a challenge to provide optimal or near optimal solutions for large networks. This is a research opportunity to work with problems that challenge scientists from both the optimization and computer networks areas. Basic references for the problems are [1-2] for VNEP, and [3-4] for NFPCP.

[1] Minlan Yu, Yung Yi, Jennifer Rexford, and Mung Chiang, "Rethinking Virtual Network Embedding: Substrate Support for Path Splitting and Migration", ACM SIGCOMM Computer Communication Review, 2008, 17-29.

[2] N.M.M.K. Chowdhury, Muntasir R. Rahman, Raouf Boutaba, "Virtual Network Embedding with Coordinated Node and Link Mapping", IEEE Conference on Computer Communications (INFOCOM) 2009, 783-791.

[3] Marcelo C. Luizelli, Leonardo R. Bays, Marinho Marcellos, Luciana S. Buriol, Luciano P. Gaspary, "Piecing Together the NFV Provisioning Puzzle: Efficient Placement and Chaining of Network Functions", IFIP/IEEE International Symposium on Integrated Network Management (IM), 2015, 98-106.

[4] Rami Cohen, Liane Lewin-Eytan, Joseph (Seffi) Naor, Danny Raz, "Near Optimal Placement of Virtual Network Functions", IEEE Conference on Computer Communications (INFOCOM) 2015, 1346-1354.

OR IMPACT

Articles demonstrating direct benefits from implementing OR studies

Section Editors: Sue Merchant <suemerchant@hotmail.com>, **John Ranyard** <jranyard@cix.co.uk>

Shout-it-Now: Using Operations Research to Guide Innovation and Save Lives

Stephen Stafford <stephen.stafford@shoutitnow.org>

About Shout-it-Now. Shout-it-Now (S-N) is a South African not-for-profit organization that has contributed significantly to the South African health ministry's objective of stemming the rate of new HIV infections by strengthening community-based HIV counselling and testing (CBHCT), education, prevention and linkage to care services for youth and other key populations at high risk of acquiring HIV.

S-N's team of founders are a mix of technology, marketing and public health professionals who began the organization with a dream of designing a new approach to HIV testing. After careful analysis of conventional South African HIV counselling and testing services, they designed a radically different CBHCT system that could ultimately be scaled up to test one million South Africans a year.

The result is a high volume, high quality service that is extremely engaging to patients and cost effective for funders. Since 2007, S-N has provided its innovative services to more than 515,000 clients in a variety of community settings including schools, prisons and a range of community venues throughout Gauteng, Limpopo, Northwest and Western Cape provinces.

It is a highly scalable, modular HCT service delivered by 15-person teams that bring a new mix of technology and human support. Teams go out into communities most affected by HIV and set up mobile computer labs, register and track each client using biometrics (fingerprint), educate people about HIV/STIs/TB with on-line, interactive MTV style videos, provide high quality HIV counselling and testing. A toll-free Call Center operates out of S-N's headquarters in Cape Town to manage all referrals of clients identified as HIV positive or needing other care or support services. The Call Center allows for improved client care through targeted messaging and continuous follow-up, data centralization and quality assurance through audio recordings and audits.

Shout-it-Now issues each client a wrist band printed with a unique bar code that is scanned by employees as clients progress through each step of the testing process. This system preserves confidentiality and allows the program to track client flow and identify opportunities for quality improvement.

A Dedication to Innovation. One founding principle of Shout-it-Now is its commitment to innovation. The organization constantly re-evaluates each step of its operations to create the most efficient and effective HIV testing service for the benefit of its clients and its funders. Much of this monitoring and evaluation—especially as it relates to operations—was for years extremely time and labor intensive. Then, in 2014, Shout-it-Now's founder, Bruce Forgrieve, learned how other public health colleagues at the University of Cape Town (UCT) were using SIMUL8 simulation software. The scenarios they were able to experiment with saved time and money and greatly enriched the outcomes of their operations decisions.

Impressed with the results achieved by colleagues at UCT, Forgrieve contacted SIMUL8 and explained how expansion opportunities were challenging the organization to further improve efficiencies. >>

"I'm now a huge proponent of operations research. The tools we have learned have not only made our service more efficient but we are ultimately saving more lives and that is an invaluable innovation."

Bruce Forgrieve
Chairman and Founder
Shout-it-Now

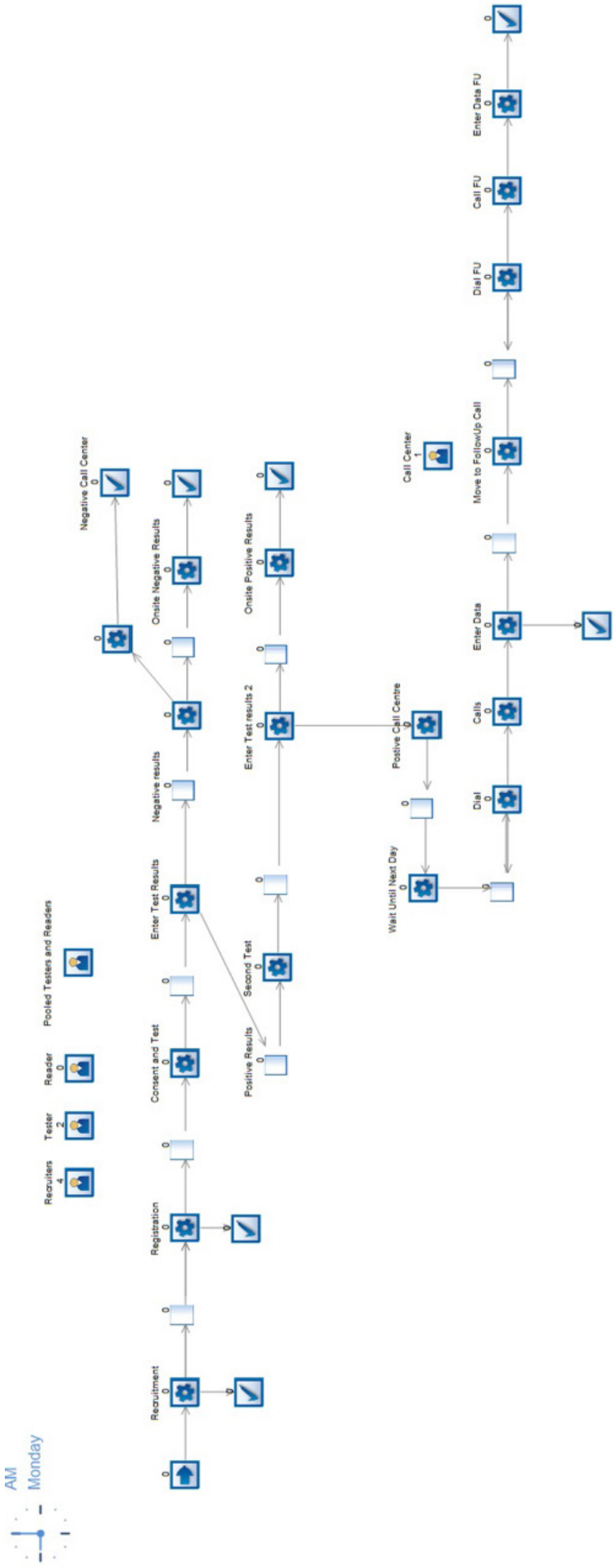
>> When SIMUL8 founder, Mark Elder, learned about Shout-it-Now and how the organization could use its software to improve its innovative HIV testing service in South Africa, he donated the software to the organization. Since then, SIMUL8 has been instrumental in eliminating bottlenecks and identifying task-shifting opportunities among S-N's employees, which has resulted in many more South Africans getting HIV tested by the Shout-it-Now teams each day.

Making Shout-it-Now More Effective. To meet the goal of testing large numbers of people with a high quality service delivered in a cost effective manner, Shout It Now needed a solution to model their processes and identify bottlenecks, enabling them to create a highly efficient service. In the early days of the project, Excel spreadsheets were used which proved to be extremely difficult, time-consuming and ineffective for communicating plans and getting buy-in from staff.

Prior to using SIMUL8, S-N had a system that collected a range of data including the arrival times of each patient and the appointment duration. While this system allowed running reports and calculating averages, it did not help improve processes. What was needed was a way to use this data to drive decisions and improvements, leading to the use of operations research.

One bottleneck that was identified was the lack of personal computers for the volume of patients seeking HIV education and testing services. This slowed down the counselling stage and therefore impacted the entire process. In addition to video-based education about HIV, the computers are used to deliver an interactive risk assessment, and it was found that people are more inclined to give honest answers to questions about their sex life via a computer, rather than in person. Therefore, it was critical to have enough computers prior to the counselling stage. It was also found that having additional computers prior to patients being seen by a counsellor could speed up the entire process. The computers were used to ensure all personal data were captured beforehand, freeing the counsellor's time to focus on the patient's risks, based on the information presented in their risk profile.

A bottleneck was also identified at the registration desks where there was limited staff to cope with service demand at peak times. To solve this, a second registration desk was opened after two hours at a site to prevent lines from forming at the desks.



Shout-it-Now uses SIMUL8 software to experiment with system improvements at every stage of the process from initial registration to ongoing cal l center follow up for HIV positive clients.

Use of SIMUL8 enabled operations and management teams to fine-tune the process: to identify exactly how it had to be configured, and how it had to evolve throughout the day to meet performance objectives. A culmination of small process changes created a big impact. A more robust, reliable and efficient testing process has enabled the organization to exceed the targets set by its funders.
Shout-It-Now operations team is continuing to work on exciting new developments to increase the number of patients being tested and treated for HIV. Together with SIMUL8 consultants, it is using SIMUL8 to refine a new SMART process that is more than doubling the number of patients served without adding resources.

This is a significant milestone and highlights the importance simulation brings to process improvement. The achievements of Shout-it-Now were recently recognized by the World Health Organization (WHO) for best practices in HIV counselling, testing and care for adolescents.

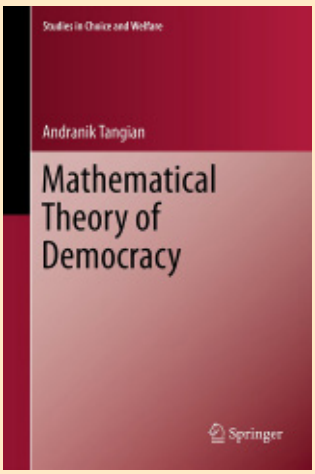
Each Shout-it-Now team is comprised of 10 HIV test counselors, each with their own tent and computer.

BOOK REVIEW

The Mathematics of Electing Leaders

Hans W. Ittmann, University of Johannesburg <hittmann01@gmail.com>

The generally-accepted definition of democracy highlights the principle of representative government. However, that was not always the case. Over a number of millennia, democracy as a concept evolved and it certainly did not follow a straight path. From the Athenian period where the selection of officials by lot was a characteristic distinction of democracy (Aristotle 340BC), the gist of the concept has altered totally. In 2004, the United Nations declared that essential elements of democracy include: "the right to take part in the conduct of public affairs, directly or through freely chosen representatives, to vote and to be elected at genuine periodic free elections by universal and equal suffrage". The **Mathematical Theory of Democracy** deals with the selection of representatives who make decisions on behalf of the citizens of a country. While presenting an in-depth history of democracy, the book delves into the mathematical principles underlying democratic theory i.e. the mathematical theories of voting and election rules, in a systematic and comprehensive manner.



Mathematical Theory of Democracy by Andranik Tangian, 2013, Springer-Verlag, Berlin, pp. 615, ISBN: 978 364 238 7234, EURO 229.00 (Hardcover).

The book consists of three parts: history, theory and applications with an Appendix containing computational formulas and statistical tables. The first part outlines "Athenian democracy," giving a historical perspective on the establishment of democracy which culminated in Aristotle's mathematical model of government types. The republican period in "Ancient Rome" is then described with strong emphasis on the writings of Pliny the Younger as he was seen as the pioneer of strategic thinking in voting institutions. Through his analysis, he foresaw the emergence of the mathematics of multi-alternative choice and strategic voting. During the early Middle-Ages, there was a sort of revival of democracy in the Venetian and Florentine Italian medieval city-republics. It was during this period that Llull, considered to be the first, started to look at election from a mathematical perspective.

Chapter 4 in the history part covers the Age of Enlightenment with ideas around democracy of Montesquieu and Rousseau being outlined. Rousseau still associated selection by lot with democratic rule. The ideas of these two influenced the thinking around mathematics in elections by redirecting selection by lot to election voting. Borda, Condorcet and Laplace were some of the main authors. Borda developed "a method for election", fairly simple although some of his thinking and methodology is still being used today. Laplace justified the Borda method while Condorcet developed a social choice theory. A number of theorems, with proofs, are included as well as one dealing with the convergence of the Borda and Condorcet methods.

The final chapter on history, following the American and French revolutions during which the concept of representative government was pushed strongly, discusses some of the limitations of representative democracies. This is done both in a mathematical sense with results such as Arrow's Impossibility Theorem, and in a more general sense, using recent examples of wars that compromise the democratic idea.

Part two is devoted to the development of theory, which is aimed at improving the performance of representative democracy by reconsidering the election principles and the use of voting. The focus is on representative bodies and how well they reflect popular views on a range of issues. Three indices are defined and applied, namely, representativeness, popularity and universality. For an issue (or question), *representativeness* is defined as the size of the group represented by the representative. The *popularity* of the representative, in turn, is the average (over a number of issues) size of the group whose opinion is represented, where the importance of issues could be weighted. Finally, *universality* is the frequency in which the representative's view on issues (or questions) coincides with that of a majority. Ultimately, an election method not based on voting but on indexing of candidates with respect to the electorate's political profile is proposed. Clearly, this reflects how well public decision making echoes the opinions of the electorate.

In Chapter 8, using an example, it is shown how the indices of representation can be empirically applied to the case of the 2009 German Bundestag election. The position taken by 5 parties over 30 policy issues are compared with the results of opinion polls. This is analysed for all issues and the view of the voters compared using the popularity and universality indices as determined from the positions taken by the parties. Findings show that: voters tend to vote inconsistently in elections with respect to their own opinion profiles; party manifestos play almost no role in how they vote; and voters appear to be influenced by traditions and candidate charisma.

A number of additional methods are developed towards "truly democratic elections". As John F Kennedy said, "Democracy is never a final achievement. It is a call to an untiring effort".

The third part of the book comprising four chapters, is devoted to further applications. These range from applications such as planning public opinion polls with no cyclic majorities, collective multi-criteria decisions where travel alternatives for an outing needs to be considered for one and several travel alternatives, to stock exchange prediction applications and traffic control problems. The range of applications demonstrates the versatility of the methodology that is developed by the author. The book has several appendices, mostly covering technical material such as Chebyshev's Inequality, the Beta Distribution, Multinomial Sums, Probability Tables, and statistical significance.

This is an impressive book covering a wide range of fields around the concept of democracy, its history, limitations, and strengths from the mathematical, historical and philosophical perspectives. The author is able to explain how various societies, over several millennia, handled the issue of electing and selecting their representatives in different forums - ranging from basic and simplistic philosophical approaches to quantifying real life situations through mathematical models – all with the ultimate objective of ensuring fair and equitable representation for as many different groupings, or factions of a population as possible.

Elections affect every citizen of a country. The International Foundation for Electoral Systems (IFES) monitors elections held worldwide. Recently, Wales, Scotland and Northern Ireland held their elections 5th May 2016 while the Philippines had theirs four days after, followed by Australia in July 2. All countries have electoral systems with some kind of strong quantitative foundation. Many of these can be traced back to what is covered in the Mathematical Theory of Democracy.

IFORS NEWS

CORS: A Story of Success in Unity

The 400-member strong Canadian Operational Research Society (CORS), a.k.a. Sociéte canadienne de recherche opérationnelle (SCRO), is the national Canadian professional society for operational researchers. Established in 1958, CORS is one of the oldest OR societies and is one of the first members of IFORS. The Society brings together OR professionals through annual conferences held across Canada and activities such as: special interest groups, regional section activities, traveling speakers programs, student paper competitions, and student financial support.

CORS logo features the three founding OR groups of Montreal, Ottawa, and Toronto.

Beginnings. CORS was formed in April 1958, just a year after the inaugural IFORS Oxford Conference of 1957 and a year before the 1959 formulation of the IFORS statues. CORS formally joined IFORS in July 1959.

CORS history can be traced back to 1957, when the Operations Research Society of Toronto was the only OR society in Canada, despite a substantial amount of OR work being done in Montreal and the existence of an active group of military OR professionals associated with the Defence Research Board in Ottawa. Thus, at that time, OR people outside of Toronto became members of either the Operations Research Society of America (ORSA) or The Institute of Management Sciences (TIMS). One of the IFORS founders Sir Charles Goodeve, a prominent Canadian in war-time Britain and then-Director of the British Iron and Steel Research Association, was concerned about this state of affairs and requested Dr. Omond Solandt to exert efforts towards forming a national OR Society for Canada. In the meantime, Dr. Hopkins of the Ottawa group suggested that a Canadian Section of ORSA be formed, a proposal opposed by the Toronto and Montreal groups.

CORS Presidents at the 2008 CORS Conference in Quebec City.

On February 11, 1958, Dr. Solandt held a meeting in Montreal among the three Canadian factions. Participating were: the Toronto group consisting of Dr. D.B. DeLury, Dr. J. Kates, Dr. A.E. Paull, and E.E. Sorensen; the Montreal group of P.J. Robinson, Dr. P.J. Sandiford, Dr. O.M. Solandt, and P.B. Wilson ; and the Ottawa group of Dr. J.W. Abrams, Dr. N. Hopkins, C.E. Law, Dr. G. Lindsey, and Dr. W. Petrie. Discussions and preferences were exchanged, leading to an agreement to adopt a set of proposals for the establishment of a national Canadian society. Dr. Solandt was elected provisional chairman and the tasks of drafting proposals for a constitution, fees, membership, affiliation, among others, were assigned. On April 14, 1958 the inauguration meeting was held in Toronto.

- CORS President Fredrik Odegaard with the coveted Rivett Cup; named in recognition of gift donated by Pat Rivett (Program Chair, 1960 IFORS Triennial Conference).

To honour the Society's historical beginnings, the triangle in the CORS logo represents each of the three founding OR groups: Montreal, Ottawa, and Toronto.

Publications. CORS is the governing body of the academic journal INFOR, an ISI-listed journal published quarterly through Taylor & Francis. INFOR publishes articles focusing on operations research/management science, operations management, analytics, and information systems. All IFORS members are invited by CORS and the INFOR Editorial Board to submit papers on the development of theory and methodology, as well as the practice and implementation of OR/MS and IS. CORS also publishes The CORS Bulletin, a quarterly newsletter of the Society and related activities. Links to both journals can be found on the CORS website www.cors.ca

Communities within CORS are organized by region, student level, and subject matter. Atlantic, Calgary, Edmonton, Kingston, Montreal, Ottawa, Québec, Saskatoon, Southwest Ontario, Toronto, Vancouver, and Winnipeg comprise the regional sections. Student chapters are established in Québec, Toronto, and Waterloo. Special interest groups are a new addition to CORS, and currently consist of the Forestry, Health Care Operational Research (HCOR), and the Queueing Theory SIGs. Each SIG organizes annual student paper or student presentation competitions to recognize outstanding contributions and performance by student members. All communities are open to CORS members.

Awards and Prizes. In conjunction with the annual conference, CORS bestows four awards and prizes in recognition of exemplary and seminal contribution to OR and CORS. Named after a well-known Canadian in wartime OR and past CORS President, The Harold Larnder Prize is awarded annually to an individual who has achieved international distinction in operational research. The prize winner delivers the Harold Larnder Memorial Lecture, on a topic of general interest to operational researchers. Notable past recipients include former IFORS Presidents Bill Pierskalla (1993), Andres Weintraub (2000), and Thomas Magnanti (2008). In recognition of the founder and inaugural President of CORS, The Omond Solandt Award is given to an organization, private or governmental, that is deemed to have made an outstanding contribution to operational research in Canada. The Award of Merit and Service Awards are internal awards in recognition of outstanding contribution to CORS. Notable recipient of both awards include former IFORS President Peter Bell (Service Award 1987; Award of Merit 2007).

Conferences. CORS held its first annual conference in Montreal 1958. The upcoming 2017 IFORS/CORS conference in Quebec City will be CORS' 59th annual conference, and its third joint IFORS conference; the two previous IFORS/CORS conferences were held in Toronto (1962) and in Vancouver (1996). CORS held four joint conferences with INFORMS (most recently in Montreal 2015), as well as with Mitacs, MOPGP, and ORSA, and co-located with CPAIOR in 2016. CORS conferences are held in diverse locations across Canada, from Vancouver

CORS President Corinne Macdonald with 2010 Harold Larnder Award recipient Professor John D.C. Little.

on the Pacific coast to Halifax and St. John's on the Atlantic coast, from Calgary and Edmonton in the west to historic Québec City in the east, and from picturesque Banff to major urban centres of Toronto and Montreal.

IFORS 2017. A unique 59th Canadian Operational Research Society Annual Conference is in store for its members, who will be joined by the international community for the IFORS 2017! With its rich history and active community, CORS invites the global OR community to visit beautiful Québec City and the many other spectacular sights of Canada. Bienvenue!

OR for Development Section

Queue Assessment in A Public Hospital Using Data Envelopment Analysis

K.A. Safdar <safdarka@aston.ac.uk>, **A.Emrouznejad** <a.emrouznejad@aston.ac.uk>, **P.K.Dey** <p.k.dey@aston.ac.uk>

Fig 1: Excessive Waiting for Patients in DevelopingCountries

Queuing time is an important efficiency criterion in any service industry, including Healthcare. The situation is much worse in developing countries, such as Pakistan, due to the absence of appointment systems; resulting in painfully long wait times for patients. Additionally, overloaded health systems, dearth and inadequate distribution of human and other resources, and cumbersome procedures for patients lead to overwhelming queues in large busy public hospitals in urban areas. Moreover, appointment systems are not currently implementable due to various issues such as low education levels, unpredictable public transport resulting in uncertain travelling times for patients residing in nearby towns/villages and unreliable communication facilities (post/internet). The current study presents a novel application of the OR technique Data Envelopment Analysis (DEA) to assess and improve the queue system just as it is, within the Outpatients' department (OPD) in a busy public hospital of Pakistan, where all patients are walk-in.

Real-time queuing data was collected within a busy Specialist OPD at the designated hospital in Pakistan, for a sample of 161 patients. Preliminary observations indicated that the inadequate scheduling of personnel is the most critical issue leading to excessive queues. Hence, the DEA model has been constructed with number of personnel as an 'output', to determine the 'exact' requirement at a given time. This information is crucial since it indicates 'how many' doctors are needed 'when' in a rapidly changing queue situation given the absence of appointments. Additionally, the wait times of patients and length of queue were added as inputs, where the latter was considered as a measure of overload in the system. >>

Inputs	DEA Model (Patients as units of analysis)	Outputs
Wait time		Current number of doctors
Length of queue		

Table 1: Proposed DEA Model for Queue Assessment

>> Patients were considered as units of analysis, that is, to determine the required number of doctors corresponding to wait time and length of queue for'each' individual patient.

The DEA analytical results indicate that 4 doctors with wait time varying between 1 to 1.5 hours and length of queue between 12 and 16, represent a fully efficient (100% efficiency level in DEA) or an 'ideal' situation. Although this situation might not be achievable all the time, this target can act as a guideline for which the administrators can aim. The results of other units in the sample demonstrated that excessively high wait times or length of queue, or both, with extreme variability in the arrival pattern of patients due to absence of appointments, lead to extremely high target number of personnel during busy times. In some cases, the wait time was a high 3 to 4 hours (with length of queue of nearly 30 to 50), resulting in a drastic increase in the target number of Specialists, ranging between 9 and 13 (as shown in Table 2 and Fig 3).

Equipped with information regarding the required number of personnel, the administrators can take immediate action by increasing staff availabilitywhen the queue is massive by reassigning personnel from less urgent jobs to the OPD. Consequently, the wait times of subsequent patients and overload in the system can be minimized, along with optimal staff scheduling as synchronized with the current queue situation.

The proposed DEA model for queue assessment provides detailed information as it assesses the queuing of each patient separately, which is critical given the variability in the arrival pattern of patients in the absence of appointments.

The DEA model is generic and has the potential to be applied in similar public hospitals in other developing countries, where appointment systems do not exist.

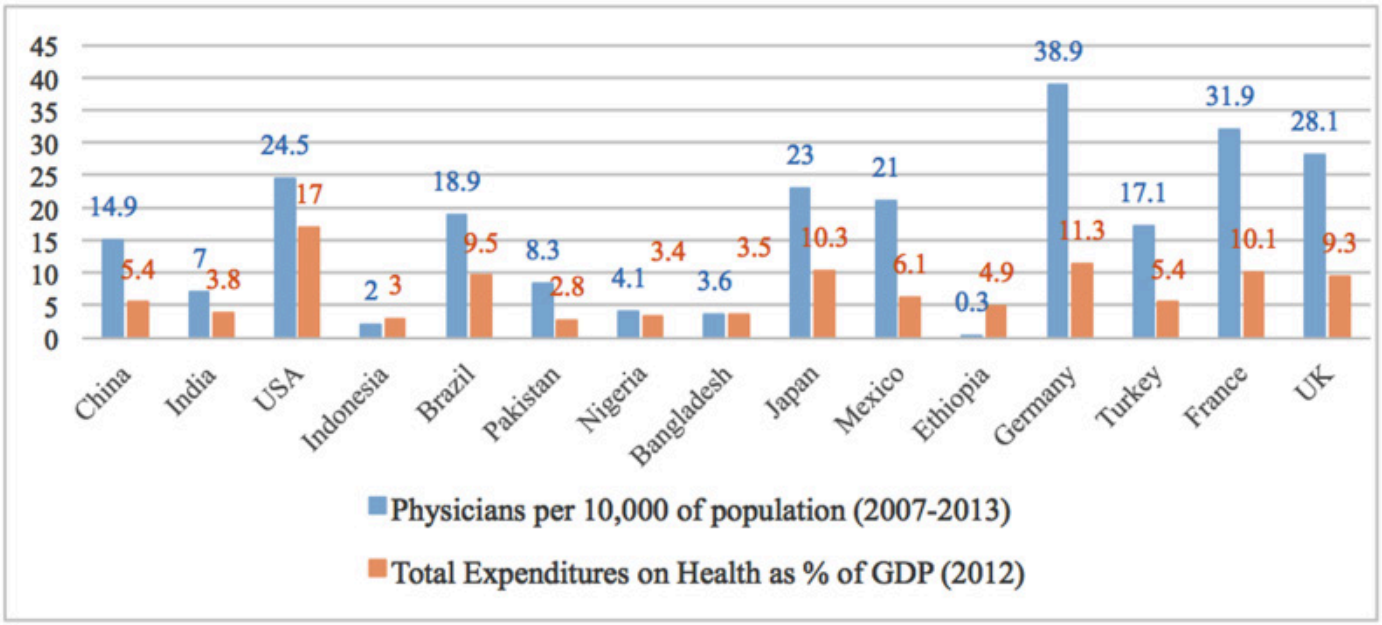


Fig 2: Poor Health Statistics in Developing Countries (Source: World Health Statistics Report 2015)

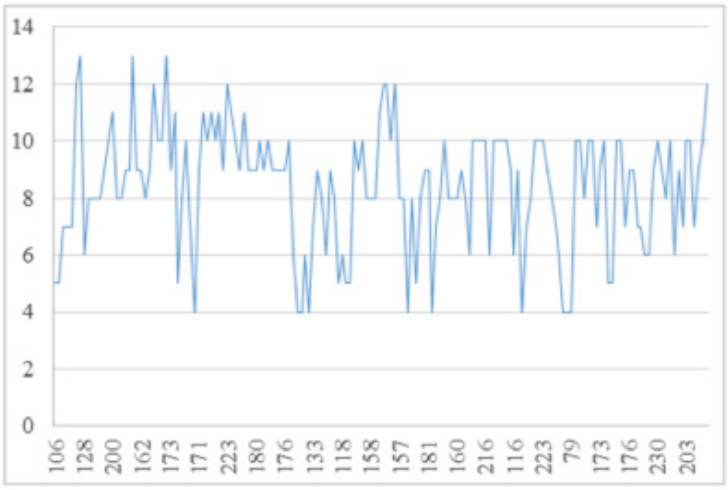


Fig 3: Variability in the 'required' number of Specialists against different wait times

Wait time Category (mins)	Required Number of Specialists
60-90	4 to 5
90-120	5 to 6
120-150	5 to 8
150-180	8 to 10
180-210	9 to 10
210-240	10 to 13

Table 2: Required number of Specialists (on average) for different wait time and length of queue categories

IFORS Funds Regional Summer/Winter Schools in OR

The International Federation of Operational Research Societies (IFORS) values Summer and Winter schools for their fostering of discussions on foundational, interdisciplinary, and applied topics related to Operations Research, thereby assisting young OR professionals in the pursuit of OR careers and providing them with a network that can help them in the future. IFORS invites its regional groupings to put forward Proposals for Organising Summer/Winter Schools in Operations Research. These Schools will attract financial support from IFORS.

Along this line, IFORS shall provide a maximum of USD 10,000 sponsorship per school. Only one School per region per year will be eligible for the support. In considering the amount of sponsorship per school, IFORS shall take into account the number of schools to be sponsored per year and the proposal presented. Preference will be given to schools hosted in countries, which are IFORS members.

The proposal should: ensure that the program will attract highly qualified students with some research experience in Operations Research; include student presentations in its program, ideally with feedback and mentoring processes for the students; aim to attract participants from at least five countries; present financial projections (including sponsorships and income) and amount of support requested; and include an endorsement from the (ALIO, APORS, EURO, INFORMS/CORS) Regional President.

Applications must be received either by June 1st, or December 1st for Schools to be held at least four months after the application date. Applicants will be notified of decision on the proposal within 30 days after the chosen deadline. Proposals must be sent to secretary@ifors.org.

Rönnqvist Bares Call for 2017 IFORS Prize Paper Submissions

The 2017 Chair of the IFORS Prize Competition, Mikael Rönnqvist, announced that the IFORS Prize will again be awarded during the 21st Triennial conference on "OR/Analytics for a better world" to be held in Quebec City, Canada from 17-21 July 2017.

Awarded at the close of the IFORS Triennial Conference, it carries with it a grand prize of US$ 4,000 and a runner-up prize of US$ 2,000. Conference registraton fee will be waived for one author of each of the 8 finalist papers. Finalist papers are also automatically considered for publication in the publication *International Transactions in Operational Research* (ITOR).

Authors are reminded that the paper must describe a practical OR application and have been aimed at helping development in developing countries. The work should demonstrate how the researchers have assisted a specific organization in its decision-making processes with regard to education, health, and other basic services, water supply, technology, resource use (physical or financial), infrastructure, agriculture, industry, or environmental sustainability, and how the researchers have helped the organization improve performance within local constraints and limited resources. It should also demonstrate original features in methodology or implementation

The paper should include some description of the application's social context and its impact on the decision making process or on the organization for which it was conducted. Where appropriate, the relevance of the country's state of development to the study should be addressed. A stress on developmental issues will be an important factor in the judging. Papers of a purely technical nature, or those, which have no relevance in the developmental context, will not be considered.

For judging criteria and other submission details, please go to http://ifors.org/web/2017-ifors-prize-details-announced/. Other inquiries should be sent directly to the Prize Chair:

Prof. Mikael Rönnqvist (e-mail:mikael.ronnqvist@gmc.ulaval.ca),Professor of Department of Mechanical Engineering, Université Laval, Quebec City, Canada

Important Dates follow:
Last date of submission of the full paper: **November 30, 2016**
Finalists will be notified by: **February 28, 2017**
Date of oral presentation: **July 17, 2017**

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