Newsletter

Operations Research Society of South Africa
Operasionele Navorsingsvereniging van Suid-Afrika

Nigeria

June 2005

FROM THE PRESIDENT'S DESK

By Wim Gevers (wg@sun.ac.za)
ORSSA President

Wim Gevers

Greetings to all my fellow Operations Researchers! I hope that you are well and that you are enjoying making a difference in your working community.

Of late the minister of Education has been in the news a number of times. Some of the comments that I have read in the press may give rise to some hope in terms of Mathematics education, but others also clearly show that the Department of Education has some difficult problems to solve – problems where we could potentially make a difference.

When one reads that Mathematics is going to be a compulsory subject for grade 12 at school, this does fill me with some excitement – are we going to give the whole population better mathematics training so that more scientists and engineers and all those professions where a good understanding of the logic of mathematics is needed, will be developed? At first this is the impression that is created, but then immediately one is careful to be too excited, since it seems as if the subject is going to be focused more on mathematical literacy. Is this going to replace standard Mathematics? If, so, will the pupils be required to do more than the minimum of six school leaving subjects – because, if not, we could be creating an illusion of persons trained in basic mathematics, but who are totally inadequately prepared for a further academic development where a solid foundations of mathematic is required.

A further matter of concern is the suggestion that the difference between standard and higher grades in subjects will disappear. What will the level of this mathematics education be? I fear not at the higher grade. In addition we have the dilemma of sufficient numbers of suitably qualified teachers who can teach Mathematics properly. So a first excitement about compulsory mathematics at matric level is soon squashed, and we may end up with a system where even fewer matriculants have a proper grounding in the subject that is fundamental to our discipline as well as many others. Perhaps we need to start preparing as a professional society to motivate our members to get involved on a voluntary basis with the education of scholars to ensure proper preparation for pursuing a career in which mathematical training is fundamental.

Another matter of concern, and that may be more of a challenge to the practicing OR community, is the regulation of tertiary education. Most of us will agree that student drop-outs are too high, but is this not often due to ill preparation at school and home for the liberties that a university life offers. In addition, prospective students often live in the illusion that they will be able to cope with university studies without studying hard. A good throughput is required – but that is primarily the responsibility of the student. It would be a sad day if academics in future, due to proposed limits on intake numbers and the need to get a high throughput, were to be forced to make university a glorified school. Students need to develop a work ethic and a desire for learning and learn to become self-starters – that to me is one of the traits of a good academic qualification.

I agree that a lot of Government money is being wasted when students drop out or take much longer than the minimum time to complete a degree. But does that not prompt a radical re-think about university funding? I think that most students do not have an idea of what a proper academic education costs – hence having to pay actual full fees based on full costing (in stead of government sponsored fees) may bring the point home that studying at a university is very expensive. If students were to receive the government funding directly, and if they were to fail the funding converted into a repayable loan, that may focus students more on the important academic side of life at university. These are but a few of some of the challenges that lie ahead.

I hope that many of our members at this stage are seriously considering participating in our annual conference which is presented as a joint conference with the Institute of Industrial Engineers. The theme is: Building towards growth and sustainability. Both growth and sustainability in the long run are crucially dependent on education. This theme needs sufficient attention from our profession in order to make our country flourish.

I hope to see many of you in Vanderbijpark at the end of August. To Marthi Harmse and the other members of the organizing committee I wish you all the best and look forward to see the outcome of your work in August. ♦

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Contributions and other forms of communication with the editor can also be conducted from the website at: **www.orssa.org.za**.

DISCLAIMER

Features

FROM THE EDITOR

Cobus Potgieter

We are part of Africa, a continent where we find people living with AIDS who fear to admit it and those living without it, who refuse to fear it. A member of the Sub-Saharan counties has decided to take steps towards fighting the ignorance with respect to AIDS among their people. Dr Maidamasa Aliyu of the Federal University of Technology in Yola is currently studying models to help predict the AIDS population of Nigeria. He informs us in this issue of the important progress that the Nigerian government has made in response to this threat.

Breaking news was the death of George Bernard Dantzig who was Professor at Stanford University for three decades. This issue also contains an obituary for the "father of linear programming," as he is known. He has been honoured widely for his major contribution to Operations Research.

A recent study of the status of OR in the UK was commissioned by the Engineering and Physical Sciences Research Council of the UK. A panel of OR academics and practitioners conducted the research and presented the council with a report including a full SWOT analysis. An abstract of this report appears in this issue of the newsletter. Although OR is much older and bigger in the UK, there are a lot that we, as ORSSA, can gain by studying their status.

In our book review we have a look at the ways of the ant. Hans Ittmann explains how an ant colony will always finds the shortest path around an obstacle and how this method can be simulated in optimisation algorithms.

After a long hard semester I hope you all can look back at what you have achieved and smile with satisfaction. And when you sit back to relax, forget about your duties for a while and enjoy the rest of the ORSSA newsletter.

Finally, I would like to wish our representatives at the 2005 IFORS Triennial in Hawaii the best of luck. I know they will enjoy their time.

Until next time,
Cobus

ODYSSEUS 2006

Third International Workshop on Freight Transportation and Logistics

Altea, Spain, May 23-26, 2006

www.uv.es/odysseus2006/

MEMBER PROFILE: YVONNE FLETCHER

By Cobus Potgieter (pottie@dip.sun.ac.za)

Yvonne Fletcher

Yvonne Fletcher was born on 17 September 1954 in Pietermaritzburg. She matriculated at Pietermaritzburg Girls' High and finished her BSc, BSc (Hons) and MSc in Mathematics at the University of Natal (currently the University of Kwazulu-Natal).

Over the years Yvonne has had the opportunity to work in industry as well as the academics world. Currently she is Mensurationist at SAPPI Forests where she has been since 1997.

After graduation, Yvonne started off as a Mathematics tutor and Additional Mathematics teacher. She went on to become a graduate assistant and later a temporary junior lecturer at the University of Natal. She also taught mathematics, statistics and FORTRAN at the Natal College for Advanced Technical Education (NCATE forerunner of the Natal Technikon).

In 1979 she and her husband moved to Umbogintwini, on the Kwazulu-Natal south coast, where she became involved with AECI, at first teaching BASIC to Plant Technicians, but after a while she was hired as Operations Research Officer. She started her work under Dave Evans who introduced her to ORSSA and she has been a member since.

During her time at AECI, Yvonne was part of a number of projects including the simulation of a carbide cooling floor, the development of a long and short term linear programming model of AECI's chlorine alkali and plastics industry and a long term linear programming model for their explosives industry.

Yvonne also helped design a database of clinical trials of new drugs, working closely with company statisticians at Roche, UK. In charge of gold mine planning systems and mine ventilation systems at Goldfields, she wrote her own graphics with a package that was FORTRAN compatible.

In 1984 Yvonne stopped working to take care of her young children. She started giving extra classes in Mathematics and Statistics to Wits University and Wits Technikon students over weekends.

Yvonne returned to the working force in 1997 as a research and development officer at the Radmaste Centre, a non-governmental organisation housed at Wits. One year later she applied for a job as Biometrician at SAPPI Forests and was offered the job of Mensurationist. She later found that the opening was advertised as Biometrician, because no-one applied for the original opening as no-one knew what a Mensurationist was.

When did you first become involved in OR and ORSSA?

I first became involved in OR in 1975, but I have been a member of ORSSA via corporate membership of AECI from November 1979. I only became a full member in 1982. I have been a member of Johannesburg chapter committee 1983-1984, and 1996-1997. I am currently trying to resurrect the Kwazulu-Natal chapter.

Why did you first become involved in OR and ORSSA?

I was doing my honours in Mathematics at the University of Natal, but attended half of the Mathematical Statistics (my other BSc major) honours classes – OR was one of these – at that time no degree in OR was offered (at any SA university I think, not just UN).

Why, according to you, is the proportion of ORSSA members in the industry that attend annual conferences so small?

They've generally got far too much to do. Also, many companies will not allow staff to attend conferences unless they're reading a paper themselves. Many people in industry just don't have the time (or inclination) to write papers; otherwise they'd be working in academic institutions if they were interested in publishing, and not in industry.

You are currently involved with the company SAPPI. Does SAPPI have an OR department or do they hire experts from outside to handle OR related problems?

No they don't have an OR section. Also do not use outside consultants. Many people at SAPPI do OR and often don't even realise they are. This seems to be the way things are going – staff hit a problem and approach it as best they can, often contacting academics (e.g. John Sessions, (USA), Karel Bezuidenhout (Agricultural Faculty, UKZN)) for help. Recently our GIS department together with our Harvesting Development Manager did some highly successful Network Analysis. The latter staff member and one of the GIS staff members visited John Sessions when they went to San Diego for an ESRI conference two years ago.

As you no doubt know, John Sessions was subsequently out here and visited SAPPI then. The upshot of this is that one staff member from our GIS section is now in the US doing an MSc under John with the help of a bursary and some assistance from SAPPI (he will obviously be expeccted to work for SAPPI for a number of years after his return).

What does SAPPI regard as the most important OR related subjects that OR practitioners should be trained?

I'm afraid I think this is of no relevance to SAPPI at all at present. I think the company will deal with this as the need arises and then staff will be sent on courses. For example, I am attending a short course in Microsoft Excel and Operations Research at UKZN next month.

Where in the industry should an OR practitioner be looking for job opportunities?

These days one seldom sees an advert for OR in the press. The best thing is to head for a job in Statistics and one will soon

bump into OR being practised in the company.

What is your message for young aspiring OR practitioners?

Once you get a job forget that you have any degrees and learn like hell as fast as you can. This is what I had to do when I started out on OR. Dave Evans was my boss in my first OR job at AECI. To me he will always be the person who taught me the most on OR. ♦

The IFORS Triennial 2005 Conference will bring operational researchers from around the globe together in one of the world's most beautiful locations. We invite you to join your colleagues for the pre-eminent international conference in our field, offering an intensive scientific program covering the full spectrum of topics in operational research.

The conference organizing and program committees together represent 17 countries and all five continents, bringing the research, applications and perspectives of their areas of the world to this truly international forum.

Sharing of ideas, knowledge and experience is the primary goal of the conference and of IFORS itself. These exchanges take place not only during the formal scientific program, but also informally in hallways, over cups of coffee and at social events. The IFORS Triennial 2005 technical program and many of the conference social events will be held at the Hilton Hawaiian Village Beach Resort & Spa.

The Institute for Operations Research and the Management Sciences (INFORMS) is proud to host IFORS 2005 in a spectacular location - Honolulu, Hawaii. We invite you to experience all the beauty of Hawaii while you participate in this premier OR meeting.

Visit: www.informs.org/Conf/IFORS2005/

TOM ROZWADOWSKI AWARD
(www.orssa.org.za)

ORSSA has awarded two prizes each year at the annual conference to recognise outstanding achievements in the field of Operations Research. These two prises are the Tom Rozwadowski Medal, and the Annual Student Award.

The Tom Rozwadowski medal is the Society's premier award and has been awarded on an almost annual basis since 1971. The medal is awarded for the best written contribution to Operations Research published by a member of the Society during the previous year. The nominating committee invites nominations or submissions for consideration for this award. The rules for the award and a nomination form visit the ORSSA website at www.orssa.org.za.

Tom Rozwadowski – The Man

Tom Rozwadowski was born in Poland on 10 January 1938. His ancestors, both on the paternal and maternal side, belonged to well known families of the Polish nobility, who served with distinction in various capacities in past centuries. Tom spent the war years in occupied Poland with his mother and elder brother, whilst his father fought with the Polish forces in Europe.

The family was reunited in 1945 in West Germany. They moved to England in 1947 and eventually settled in South Africa in 1948. Tom was educated in various colleges in the Cape Provinces where he matriculated at the Marist Brothers' St Joseph College in Rondebosch.

He obtained his BSc at the University of Cape Town in 1961 and then joined Leo Computer Bureaux in Johannesburg, where he worked until 1965. He obtained his BSc Honours (Mathematics) at the University of South Africa in 1965, and in the same year he joined Control Data (Pty) Limited in Johannesburg. After completing his MSc thesis at Wits University, he left for the USA to conduct research in the computer source at CDC Headquarters in Minneapolis. Before his untimely death, he was already preparing his PhD degree.

Tom was an "all rounder," his interest ranging from philosophy to computers to operations research. He spoke five languages fluently. At school, he excelled in sport, winning several athletics cups, and he was a keen rugby player. He enjoyed tennis up to the end of his life.

International Federation of Operational Research Societies

http://www.ifors.org/

THE SAS OPERATIONS RESEARCH STUDENT COMPETITION 2005

ORSSA annually hosts a student competition for Masters and Honours students. Tertiary institutions may nominate candidates, based on a written Operations Research project of approximately fourth year level. These projects are evaluated by a panel of experts, and then a cash prize is awarded to the winner at the annual conference in September of each year.

Objectives

The objectives of the competition are:
- to propagate the use of Operations Research (OR)
- to encourage the inclusion of project work in courses within the field of OR
- to bring the Operations Research Society of South Africa (ORSSA) to the attention of students and staff at universities

Prizes

Best Masters project: R5 000
Best Honours project: R4 000
At the judges' discretion the prizes may be shared.

Participation

Project work that has been undertaken for a Masters or Honours or Bachelor degree, or a Diploma or Certificate, in Operations Research or a related field of study during the 2004 academic year (graduation latest at mid-year 2005), may be entered. Candidates who have completed a project for a certificate, diploma or Bachelors degree will compete in the category for Honours-students. Only projects undertaken by individuals will be considered.

Guidelines

1.   Operations Research (OR)

Operations Research covers a wide range of topics and is applied in many other fields of study. It originated as a multidisciplinary field centred on mathematical modelling. In practice it often uses computer-based systems as an aid to decision making. Recent developments in OR are, for example, genetic algorithms and community OR. The complex business problems today often require integrating "hard" and "soft" OR approaches. Owing to the multidisciplinary nature of OR, it is recognised and accepted that many courses offered and projects undertaken within the field are the responsibility of courses or departments that do not include the name "Operations Research" in their title. They may, however, be included in courses or departments such as Management Science, Quantitative Management, Industrial Engineering, Decision Science, Statistics, Computer Science, Applied Mathematics or Mathematics. For the purpose of this competition, the judges will decide whether a particular project is acceptable as an OR project or not. Should you need guidance in this respect please approach the organiser of the competition listed below.

2.   Nature and extent of the project

Individual initiative is encouraged. Therefore, as few limitations as possible are placed on the nature, content and extent of the project. The project may be either practical or theoretical. Originality will weigh heavily in the judging.

3.   Report

The project should be submitted in the form of a written report. This should contain at least the following:
- a clear statement of the background and objectives of the project
- a description of the approach or methodology adopted
- a clear presentation of the results and conclusions
- a discussion of the actual or possible implementation
- references to the relevant literature
- in the case of a Masters entry the Thesis/ mini-thesis can be submitted.

It may also contain a literature survey and could be supplemented with suitable appendixes and computer disks.

Closing dates

1.   The "NOTICE OF INTENT TO SUBMIT A PROJECT" form must reach the organiser of the competition by 24 June 2005.

2.   The closing date for the submission of projects is 18 July 2005. Early submissions are welcome.

3.   The Executive Committee will make the results known by 28 August 2005.

Organiser and Contact Details

The organiser for the SAS Operations Research Student Competition is Mrs MJ Bester.

Please send all correspondence to:

> Mrs MJ Bester
> SAS OR Student Competition
> P O Box 5613
> Tygervalley
> Bellville
> 7536

Any enquiries should be addressed to Mrs MJ Bester:

Phone number: (021) 680 6357
Fax: (021) 680 6358
E-mail: orssa_wc@yahoo.com

For more information and to download the "NOTICE OF INTENT TO SUBMIT A PROJECT" form and the "PROJECT SUBMISSION" form please vistit the ORSSA website at www.orssa.org.za. Carefully note the closing dates for the respective submissions. ♦

HIV/AIDS CARRIER POPULATION GROWTH AND LIFE EXPECTANCY IN NIGERIA

By

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Introduction

The Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) have become critical issues in the global circle. It has been part of the discourse at a number of UN conferences including the Fourth World Conference on Women, International Conference on Population and Development, and the World Summit for Children. As the World Bank states, 'the HIV/AIDS epidemic is not only the most important public health problem affecting a large part of sub-Saharan Africa (SSA), but also an unprecedented threat to the region's development.'

The experience of the most affected countries in Central, East, and Southern Africa, where HIV/AIDS is resulting in gradual reduction in life expectancy, obliteration of skilled and productive workforces, high medical bills, rising number of children-headed households and AIDS Orphans, highlights the devastating impact of HIV on development. If truth be told, HIV/AIDS may indeed be described as a 'development crises'. Thus, HIV/AIDS deserves a central place in any discussion on development, particularly in Nigeria. From the first case recorded in Nigeria in 1986, HIV has spread to infect millions of Nigerians (CCA, 2001). HIV/AIDS' devastating effects is gradually eroding the developmental gains of past decades.

It is in the identification of HIV/AIDS' unique role in development, and considering that the prevalence of HIV/AIDS in Nigeria has crossed the critical epidemiological threshold of 5 percent, that this article focuses on the multiplicity and spread of HIV/AIDS infection in Nigeria, the national and international control efforts, and key challenges.

National and international control efforts

The first reported two cases of AIDS in 1986 instigated the Nigerian government to respond to HIV/AIDS formally, by establishing a National Expert Advisory Committee on AIDS (NEACA) with mandate to ascertain the magnitude of the HIV/AIDS challenge and advise government on the necessary interventions required. In general, HIV/AIDS control efforts in Nigeria can be discussed under three periods:

The era of denial and tentative actions (1986-1992) characterized by some degree of denial and scepticism as well as establishment of the initial implementation structure and action to combat epidemics; *The awareness era (1993-1998)* marked by increased information, education, communication and advocacy efforts, increased civil society organizations involvement in HIV prevention activities and more systematic data gathering and analysis, but little willingness by the top echelon of government to associate closely with the prevention effort; and, *The strategic expansion era (1999 to date).*

Important events in HIV/AIDS control in Nigeria, 1986-2004

YEAR	KEY EVENTS
1986-1992	**The era of denial and tentative actions**
1986	Official reporting of the first two cases of HIV/AIDS.
1986	Establishment of expert Advisory committee on AIDS (NEACA).
1987	Technical service Agreement (TSA) signed with the WHO under the Global programme on AIDS (now defunct and succeeded by UNAIDS).
1988	National AIDS Control program NACP set up as national coordination/implementation unit within the Federal ministry of Health, and replaced NEACA; National AIDS Committee (NAC) and five Technical advisory committees (TACS) established as advisory bodies to the NACP.
	States Aids Control Programs (SACPs) and the States Aids Committee established in all states of the federation and federal capital Territory Abuja.
	Implementation of the Short-term plan, which focused mainly on Blood Safety and General Awareness.

1990-1992	Medium Term plan I, Focused on decentralization of implementation of control efforts to local government associate\ons (LGAs).

AIDS integrated into primary health care (PHC) system.

Merging of AIDS Control programme with Sexually Transmitted Disease (STD) control programme to create the National AIDS and STD control programme (NASCP).

Military president launched National War Against AIDS (1991).

Civil society organisations' (CSOs) involvement in control programme commissioned.

1st HIV Sentinel Survey conducted (1991).

Nigeria initiated an Organisation of African Unity agenda on AIDS (1992).

1993-1998   The Era of Increased Awareness

Medium Term plan II, focused on Multi-sector involvement and increased Awareness.

Inadequate funding of response and withdrawal of international Donor support due to sanctions on Nigeria.

Increased Donors' support for CSOs' activities and resultant increased prominence and outputs of CSOs.

The HIV related death of Fela Anikulapo Kuti, one of Nigeria's greatest musical artists, in 1997 brought the reality of HIV/AIDS nearer home to many Nigerians.

1999   The Era of Strategic Expansion

1998/1999   Bridging plan: Focused on Expanded National Response to AIDS (Multi-sector/ Multi-disciplinary), Comprehensive Data Gathering and Analysis, intensive Advocacy at High political and general levels, intensive General and Targeted Education Sustained High performance by civil society organizations (non-governmental organisa-tions and community based organisations).

The new democratic government identified HIV/AIDS control as one of the priorities in national development, and the president showed an indication to become personally involved in the control effort nationally and internationally.

2000   Presidential Committee on AIDS (PCA) and National Action founded.

Committee on AIDS (NACA) established to improve response and ensure multi-sector and multi-level participation.

2000   Increased collaboration among development partners.

Three-year interim Action Plan developed.

More resources allocated/mobilized.

Sentinel Survey conducted (2001).

Major achievements by the national HIV/AIDS control efforts

Vast efforts over the last decade have led to some major achievements in the national effort against AIDS in Nigeria. Documentation of the current HIV situation and trends in Nigeria led to a strengthened information base for counselling and program for management purposes. This information was used for high-level advocacy to policy-makers and opinion leaders resulting in increased political commitment and funding support for the programme.

A further important accomplishment was the increased awareness by the Nigerian population and their acceptance of the reality of HIV/AIDS as well as an increased openness in discussing HIV/AIDS. The establishment of a multi-sectored, multi-disciplinary response through the creation of the Presidential Committee on AIDS (PCA) and the founding of the National Action Committee on AIDS (NACA) were two of the most important steps in this process. The additional formulation of an Interim Action Plan (IAP) in collaboration with relevant sectors and stakeholders was a preparatory stage towards a comprehensive strategic national plan.

The broader understanding of the impact of HIV/AIDS led to resources being mobilized at grassroots level as well as nationally and from bilateral and multilateral international agencies.

Key Challenges

There exist a number of key challenges to effective HIV/AIDS control efforts in Nigeria at present. These challenges include political willingness at all levels and adequate funding of the programme has to be ensured on a continuous basis. The current policy formulation needs to be strengthened to involve relevant stakeholders, including states and CSOs. Among others, existing gaps and contradictions in the policy realm need to be addressed. These include the development of a clear regulatory framework and a mechanism in relation to announcements and verification of HIV cures, and a review of the breastfeeding policy to ensure its continued appropriateness in an age of spreading HIV/AIDS.

The government thoroughly needs to monitor media outputs to ensure that, despite their commercialisation, they do not become instruments for misinformation to the public about the nature and claims about HIV/AIDS cures, as well as ensuring that prevention messages are culturally appropriate

and sensitive. Continued information, education, and communication to sustain and improve the level of awareness of HIV/AIDS.

The various driving forces of HIV/AIDS epidemics in Nigeria should be addressed adequately, including poverty and provision of housing for civil servants. In order to accomplish this, an effective and transparent programme management should be integrated at various levels of government.

Conclusion

Ever since the first AIDS case was officially recorded in Nigeria, there has not been a sustained control effort from the government. Government efforts have swelled and diminished and with it funding and effectiveness of programmes. Fortunately, the last five years have seen a much improved attitude and some success in this regard, such that an environment for the response may now be described as more enabling and conducive with respect to AIDS prevention.

However, with 5.75 percent sero-prevalence in 2001 (sentinel survey, 2001), Nigeria has become one of the first few "large populations" in the world to cross the 5 percent epidemiological consequential mark beyond which the epidemic enters an explosive phase. Projections based on a markovian model has indicated that, except if control measures are introduced immediately, the number of people living with AIDS in Nigeria may well increase to over six million by 2010.

Failure to tackle the HIV/AIDS problem immediately and across the board will result in a situation where the very insignificant developmental attainment that Nigeria has made over the last few decades would be erased. Thus, Nigeria's state of affairs with regards to HIV/AIDS is more important than ever before, and time is of the essence. The Interim Action Plan provides a good strategic basis for action, and should be thoroughly implemented to produce the desired results. With the current level of political will, and the helpfulness and support of development partners, the implementation of the Interim Action Plan may just change the face of HIV/AIDS control in Nigeria for good and forever.

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(Tom Rozwadowski Medal – Continued from page 4)

In the operations research field, he was a specialist in optimisation techniques, whilst also having a good knowledge of inventory control, game theory, simulation and dynamic programming. Some of the work he did at Leo included the design and supervision of a full-scale PERT suite; the writing of a series of programs embodying several linear programs to optimise order batching and paper cutting for a large paper mill; a system for controlling the production of glass work; and a study on the use of computers for real time control of traffic.

As a computer man he was quite capable of writing the best part of twelve volumes of a tender all by himself in a month!

He was the driving force behind the establishment of an operations research group in Johannesburg and a member of the group which founded the Operations Research Society of South Africa.

He would tackle anything that came his way and would not give it up until some results had been achieved. His interest on how to measure the performance of computers prompted him to produce a paper (1966) in which he examined the question from a macroscopic point of view. Thus he gave criteria to assess the performance of CPU, of I/O processors, of the software and the computer throughput.

However, in 1970 he reopened the question, asking himself what a computer actually does; what instruments would one use to measure the work done by a computer; what mathematical model would one use to assess the performance from the microscopic point of view? Tom used the concepts of information theory, such as uncertainty and entropy, and gave the clues to the performance indicator for a computer.

The same pattern of development took place with his interest in gold mining. In 1963, he developed a computer program for JCI that performed all the required calculations to evaluate the present value of any fully specified mining policy. In addition, in 1966, he helped to develop a computer-based management game of a gold mine to try out the various possible types of decisions encountered in mining operations.

In 1970 he had produced a massive thesis in which, using advanced operations research techniques, such as the decomposition method in linear programming and the Lagrangian multiplier in the case of dynamic programming, he had developed a mathematical model to provide truly optimum solutions to the long term mining problem, taking into account such variables as taxation and uncertainty.

His results were such that where no capital expenditure was involved, the present value was maximised and, where capital expenditure was involved, the present value was a maximum subject to an adequate return on capital.

The Father of Linear Programming Dies

By Barry List, Director of Marketing and PR, INFORMS
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George B. Dantzig, 90, a mathematician who devised a formula that revolutionized planning, scheduling, network design and other complex functions integral to modern-day business, industry and government, died May 13 2005 at his home in Palo Alto, California after brief illness. Dr. Dantzig was known as the father of linear programming and as the inventor of the "simplex method," an algorithm for solving linear programming problems.

"George Dantzig stands as a tall founding pillar of operations research," said Richard C. Larson, President of INFORMS and Professor at MIT.

"He was the first to formulate the general linear programming problem and to investigate its mathematical properties. This led him to invent the Simplex Method and to develop algorithmic refinements that enabled its reduction to practice. These seminal contributions helped to create the field of mathematical optimisation as one of the two or three most important domains of operations research. His many other contributions to mathematical modelling and optimisation helped to lay the groundwork for many to follow — both in applications and theory. He will be remembered with respect and admiration by all of us."

In recognition of his work, President Gerald R. Ford in 1975 presented Dantzig the nation's highest science award, the National Medal of Science. He received numerous other awards, as well, including what is now the INFORMS John von Neumann Theory Prize.

Dantzig's vision of modelling economic systems became the most widely used technique of its kind for the efficient allocation of resources in industry and government.

Before Dantzig's research, economists trying to "optimise" the way they assigned staff and other resources had only disappointing mathematical tools that fell short of successfully solving real-world problems.

His contribution was the development in 1947 of linear programming. His formulation of linear programs as mathematical models for efficient allocation of resources and his development of a unique algorithm – the Simplex Method – to solve them was a seminal event in the development of mathematical programming as a scientific method for optimally managing resources.

"Dantzig's numerous accomplishments span the field of operations research and management science," said John R. Birge, who studied with Dantzig. Dr. Birge is Professor of Operations Management and Neubauer Family Faculty Fellow at the University of Chicago Graduate School of Business and a former president of INFORMS. "He extended the domain of mathematics from descriptive models to transformational tools by introducing the concept of an objective to improve the systems in which we work and live. Each of us has benefited from the advances that his work made possible. We will continue to feel his influence for many years to come."

The invention of the computer coincided with his research and became a signification coincidence. When it awarded Dantzig an honorary doctorate in 1976, the University of Maryland issued a statement, writing "His development of linear programming in 1947, occurring almost simultaneously with the development of the first computers, led to an explosion of economic, environmental, and statistical applications. As an example, the iron and steel industry has used a Dantzig programming method to evaluate iron ores, explore the additional of coke ovens, and select products. The Federal Energy Administration is using his method to evaluate energy policy alternatives, and linear programming has also been used or suggested for use to control water and air pollution…"

His work led to the growth of operations research in the 1950s. Operations research, known as the "science of better," is the discipline of applying advanced analytical methods to help make better decisions.

Dantzig contributed to the development of many other areas of operations research, including all major areas of mathematical programming, quadratic programming, complementary pivot theory, convex programming, stochastic programming, and game theory.

Like a fictional character in the film "Good Will Hunting," the young George Dantzig once solved a problem on a blackboard that had stumped veteran mathematicians.

As a graduate student at the University of California Berkeley in 1939, he arrived late in class one day and copied two problems from a blackboard. After struggling with what he thought was a difficult homework assignment, he submitted his work to the eminent statistician Jerzy Neyman. Six weeks later on a Sunday at 8 AM, Neyman excitedly awoke Dantzig to say he had written an introduction to Dantzig's paper. It turned out that Dantzig had found solutions to two famous, previously unsolved statistical problems. ♦

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Operational Research in the UK

Presented by Engineering and Physical Sciences Research Council (EPSRC), Economic and Social Research Council (ESRC) and Operational Research Society (ORS)

A review of work in Operational Research (OR) in the UK was commissioned by the Engineering and Physical Science Research Council (EPSRC) in conjunction with the Economic and Social Research Council (ESRC) and the OR Society, to complement the recent International Review of Mathematics. Here are some take outs from this report. More information on this and the report including the full SWOT analysis is available for download at www.epsrc.ac.uk.

Introduction

The Engineering and Physical Sciences Research Council (EPSRC) invited an international review panel to "assess the standing, potential and quality of research in Operational Research (OR) at British universities." The panel met on March 4 and 5, 2004 in London. On March 5 it discussed the position of OR with representatives of 12 British universities. In the morning session the discussion focused on issues concerning the research policy of individual institutions, while the afternoon was devoted to a review of ten cross cutting themes in OR). The information provided by EPSRC on the focus fields of OR in the various institutions, combined with the meeting with OR researchers and practitioners enabled the panel to draw a reasonably sharp picture of the strengths, weaknesses, opportunities and threats as they pertain to British OR.

Strengths

Internationally the UK is recognised and respected as the birthplace of OR. The Operational Research Quarterly, now known as the Journal of the Operational Research Society (JORS), was the first journal in the field and still has a strong international visibility.

The UK has a large and very active OR community, with a balanced representation of universities, businesses and governmental agencies. The OR Society is thriving with a membership of around 3000 researchers and practitioners. In contrast, the OR societies in comparable European countries have fewer than 500 members. OR seems to be fully accepted in the UK as a part of the business culture. OR groups are thriving in larger firms, consultancies and governmental agencies (although they do not all use the 'OR' label). The existence of these groups is an important factor in helping OR groups within universities to maintain strong ties with application areas. Generally speaking, in no other country in the world is the orientation of OR towards applications so strong as in the UK. OR researchers in the UK have made and are making significant world-class contributions to the solution of many important and challenging industrial and governmental problems. As such, OR in the UK still reflects the essence of what OR was in its infancy during the Second World War: an interdisciplinary approach to tackle relevant strategic, tactical and operational problems in which a quantitative approach can contribute to better understanding of the problem and in obtaining solutions.

OR still has a fairly strong position in the curricula of Business Schools, but substantially less in Engineering and Mathematics Departments in the UK. The Masters programmes in OR also involve significant project work related to practical industrial or business problems. MSc students are highly sought after by industry, governmental agencies and commercial firms. A high percentage of OR practitioners in industry have degrees at the level of MSc or PhD. This is certainly a strength, although to some extent this is contradictory in the context of a research review, since the primary declared aim of most, if not all, of the MSc programmes is the provision of high-calibre OR practitioners for employment in industry, commerce and the public sector, rather than being a supplier of potential academic staff.

The national OR research agenda maintains a healthy balance between transition to new or 'hot' topics and a continued emphasis on 'classical' OR.

The British OR community is internationally visible through publications in a wide range of international journals. Many papers are published in specialised journals of one sort or another, although the visibility of British OR researchers in the non-British international flagship journals, such as Operations Research and Management Science, could be substantially higher taking the healthy state of OR in the UK into account.

Weaknesses

Although the emphasis on applied OR is remarkably strong in the UK, a gap can still remain between the output of a successful research project and what is needed for direct use by industry. Some institutions are successfully bridging this gap, but in others the organisational structure needed to build and maintain successful bridges seems to be lacking. Only a few OR departments seem to have a clear research strategy in this respect.

As noted above, the appreciation of OR by industry in the UK is high. Numerous active contacts are evident with industry and commercial institutions. However, many of these contacts are of a local nature and conducted on a project-by-project basis; they do not, therefore, necessarily generate the sort of long-term relationships that would be most productive. The preferred relationship would have major companies (in both manufacturing and service industries) willing to invest substantially in scientific research in OR on a more long-term basis. The situation in other European countries and the US shows that this is not a mission impossible for OR. Possible avenues include sponsored chairs or strategic alliances between universities and major companies or consultancies.

INTERNATIONAL SUCCESS STORY - DENMARK UTILITY, COPENHAGEN ENERGY, HOLDS THE BALANCE

Electricity must be used the moment that it is produced otherwise the surplus product will effectively go up in smoke. The balance between production and consumption must be maintained on a daily basis. Denmark utility, Copenhagen Energy, has got the balance right.

It is extremely rare for there to be a major power failure in Denmark. However, when it does happen – as it did in September 2003 when the whole of Eastern Denmark and Southern Sweden went black – there are repercussions.

On that occasion, a fault at a Swedish power station and a breakdown at a switching station resulted in an over-supply of electricity. This caused the massive power failure.

In 2004, Elkraft, which has the overall responsibility for electricity supply in Eastern Denmark, appointed Copenhagen Energy as a balance partner. Its function, along with Elkraft's other 15 balance partners, is to predict the next day's consumption of electricity hour by hour to ensure that the balance between production and consumption is maintained. Everyday, the partners must report the planned production and consumption for the following day.

Annually Copenhagen Energy handles up to three terawatt hours, equivalent to three billion kilowatt hours or 10 percent of Denmark's annual electricity consumption.

There is always equilibrium in the plan that is drawn up for the following day's electricity production and consumption because balance partners are not permitted to report anything other than the precise consumption to match their purchase of electricity from Elkraft.

Advanced system

When Copenhagen Energy became a balance partner, it did so with an advanced SAS system for forecasting electricity demand. The company conducted a wide range of tests on historical data and tried out parallel forecasting before implementing the solution. Each time, the outcome was impressively close to the actual figures.

Prior to that, much time was devoted to developing a flexible model that is able to take a variety of factors into consideration. New inputs regarding movements in population and even the weather are constantly being added to this model. In the same way, once-off events are easily added to the calculation model, for instance, when there are public holidays, large cultural and sporting events, and any other parameters that could affect energy consumption.

The solution was up and running within two months. The SAS solution is faster, better and less expensive than the previous system. Forecasting accuracy has already doubled and Copenhagen Energy expects the costs in connection with precise predictions to be reduced by up to 50 percent. This is a major cost saving.
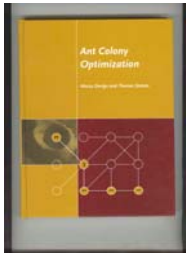
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BOOK REVIEW

By Hans Ittmann (hittmann@csir.co.za)

Ant Colony Optimization by Marco Dorigo and Thomas Stützle, 2004. The MIT Press, Cambridge, Massachusetts, The USA. 305pp. $40.00 or £25.95.

Most of the readers of this newsletter must surely have been exposed to the following from Proverbs chapter 6: verses 6-8: "Go to the ant, thou sluggard; consider her ways, and be wise. Which having no guide, overseer, or ruler, Provideth her meat in the summer, and gathereth her food in the harvest." Biologists have taken these words very literally and have studied the behaviour of ants in detail. We have all observed ants in nature and specifically colonies of ants that are frantically moving about collecting food and bringing whatever they can find back to the nest. Although the behaviour seems to be frantic there are definite patterns in these movements. Ants exhibit complex social behaviours and these have attracted the attention of scientists. One of the most surprising behavioural patterns exhibited by ants is their ability to find what we call shortest paths. It is these observations that have inspired computer scientists (operations researchers?) to develop algorithms that can be used to solve optimization problems. Fascinating stuff and over the last number of years one has seen more and more journal articles that refer to ant colony optimization. With the publishing of *Ant Colony Optimization* the authors present a whole range of successful algorithmic techniques developed over the last ten to fifteen years on the basis of ant behaviour.

How does this work? How do we get from ant colonies to "ant algorithms" to solve optimization problems? The highly co-ordinated behaviour of real ants may be exploited to coordinate populations of artificial agents that collaborate to solve computational problems. Throughout the book the authors explain what happens in real life and then moves from there to how they have used it in constructing algorithms for the artificial agents. In this review we endeavour to explain the ant behaviour, first through some examples, and then only do we mention aspects of the book itself.

From nature it turns out that ants coordinate their activities via stigmergy, a form of indirect communication mediated by modifications of the environment. (Stigmery was originally defined as "stimulation of workers by the performance they have achieved.") Some of the early research and insight that biologists gained was that most of the communication among individual ants, or between individuals and the environment, is based on the use of chemicals produced by the ants. These chemicals are called pheromones. This "communication" is therefore almost something related to smelling the chemicals. Particularly important for the social life of some ant species is trail pheromones. This is a specific type of pheromone that some species of ants use to mark paths on the ground, (for example, paths from food sources to the nest). By sensing the

pheromone trails those ants looking for food, foragers, can follow the path to the food discovered by other ants and what is more they seem to "select" the shortest path! However this does not always hold.

One of the first experiments conducted to illustrate the pheromone trail-laying and trail-following behaviour of ants was conducted by biologists in the late eighties, early nineties. This was the so-called "double bridge" experiment connecting a nest of ants and a food source. Initially the bridge had two equal length branches and although in the initial phase random choices occurred, eventually all the ants used the same branch. Why did this occur? There is initially no preference and ants select any branch with the same probability. Yet, because of random fluctuations, a few more ants will select one branch over the other. Now because of the pheromone deposited by ants while walking, a larger number of ants on a branch results in a larger amount of pheromone on that branch. This larger amount of pheromone attracts more ants to that branch and ultimately the ants converge to the single branch. In the next stage of the experiment the one branch of the bridge was made twice as long as the other branch. What happened is that the ants all converged to the shorter branch basically because of the fact that the pheromone started to accumulate faster on this branch. Therefore real ants are capable of finding a shortest path from a food source to the nest without using visual cues. Also, they are capable of adapting to changes in the environment, (for example finding a new shortest path once the old one is no longer feasible due to a new obstacle). The following four figures illustrate this. First ants are moving on a straight line which connects a food source to the nest:

Figure 1: Ants following the path between the ants' nest and food source

As we have indicated the ants deposit a certain amount of pheromone while walking, and each ant probabilistically prefers to follow a direction rich in pheromone rather than a poorer one. An unexpected obstacle now interrupts the initial path:
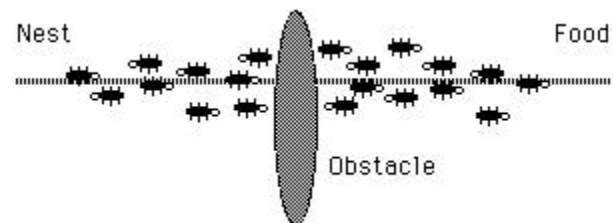

Figure 2: Obstruction blocking the path between the nest and the food source

In this situation we can expect half the ants to choose to turn right and the other half to turn left. The very same situation can be found on the other side of the obstacle:
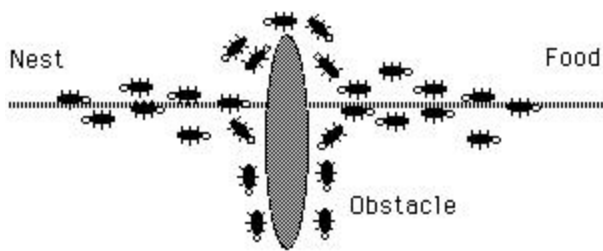

Figure 3: Ants finding a route around the obstacle on their path

Those ants which choose, by chance, the shorter path around the obstacle will more rapidly reconstitute the interrupted pheromone trail compared to those which choose the longer path. Hence, the shorter path will receive a higher amount of pheromone in the time unit and this will in turn cause a higher number of ants to choose the shorter path. Due to this positive feedback (autocatalytic) process, very soon all the ants will choose the shorter path:
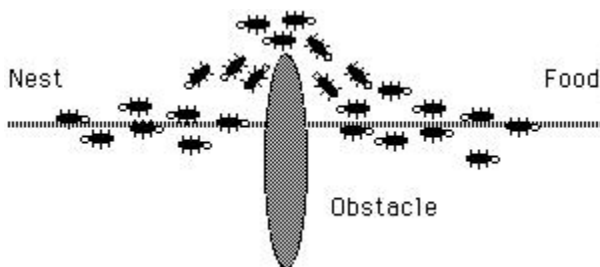
Figure 4: The shortest route sustains

The most interesting aspect of this autocatalytic process is that finding the shortest path around the obstacle seems to be an emergent property of the interaction between the obstacle shape and ants' distributed behaviour. Although all ants move at approximately the same speed and deposit a pheromone trail at approximately the same rate, it is a fact that it takes longer to contour obstacles on their longer side than on their shorter side, which makes the pheromone trail accumulate quicker on the shorter side. It is the ants' preference for higher pheromone trail levels which makes this accumulation still quicker on the shorter path. If the longer contour is now made shorter than the shorter one, the colony is trapped on the "longer" contour. This is basically because of the slow evaporation of pheromone, the high pheromone concentration and the autocatalytic behaviour continues to reinforce the "longer" contour. Things then do become more complex.

In developing ant colony optimization (ACO) algorithms the above behavioural patterns of ants are used in different kinds of ways to devise and design heuristics to address optimization

problems. The introductory chapter of the book outlines the basic philosophy of ant colony optimization. It explains how artificial ants are created and, as a start, illustrates the use of these in minimum cost paths. Various algorithmic intricacies are outlined. In chapter 2 the ACO metaheuristic is the focus point. A metaheuristic refers to a master strategy that guides and modifies other heuristics to produce solutions that are normally generated in a quest for local optimality. Numerous successful implementations of the ACO metaheuristic are available and have been applied to many different combinatorial optimization problems. These include problem types such as routing (eg. traveling salesman), assignment (e.g. quadratic assignment), scheduling (e.g. job shop), subset (e.g. multiple knapsack) and others. Chapter 3 is devoted to ACO algorithms for the travelling salesman problem. Parallel implementations are also discussed.

In chapter 4 ACO theory is touched on, while chapters 5 and 6 are dedicated to NP-hard problems and data network routing respectively. In the latter case the AntNet algorithm is dealt with in a fair bit of detail. In all three these chapters substantial detail about the ant algorithms and specific applications are presented. One will have to spend quality time on these to firstly understand them all properly, especially if the aim is to implement these, and, secondly, to get to grips with the different approaches followed. In the final chapter, chapter 7, a summary is provided of current know-how about ACO, while the authors give a short overview of the current main research trends in the field. In the latter case the following are highlighted within the context of ACO: dynamic, stochastic and multi-objective optimization problems as well as parallelization. Reference is made of other models inspired by foraging, path marking, brood sorting, division of labour and cooperative transport.

At the end of each chapter some bibliographical remarks are presented as well as important things to remember and some computer exercises. This is very useful and can assist students, as well as those who want to work themselves into this field, substantially. At the end of the final chapter a number of relevant websites are listed while relevant conferences and journals are also mentioned.

I believe *Ant Colony Optimization* is a very useful book if one is interested in ant algorithms, and heuristics and metaheuristics in general. To get full value from the book one will have to spend quality time in going through the full contents. In this sense one will have to familiarize oneself with heuristics and metaheurisitcs in this context. This is essential reading for those working in optimization, but also for those that find the interface between biology and technology fascinating. ♦

Nominations Open for the Election of Fellows of ORSSA

In September 2004 the constitution of ORSSA was amended to allow for an additional category of membership to the Society, namely that of *Fellow of ORSSA*. The constitution reads as follows on this matter:

"The Executive Committee may, at its discretion, reclassify the membership of a *Full Member* of the Operations Research Society of South Africa to that of a *Fellow* of the Operations Research Society of South Africa. The Executive Committee will be guided by the following considerations in this regard:

• The individual will be invited by the Executive Committee to become a fellow.

• The individual should be a long standing full member of the society.

• The individual
    o should have served the society in an exemplary manner for a considerable period of time,
    or
    o should have served the science and profession of Operations Research over a considerable period of time.

• The Executive Committee may consider any other evidence that it finds relevant in order to assess an individual's contribution to the practice of Operations Research."

At the e-meeting of the Executive Committee of ORSSA in March 2005 it was decided that the following rules and guidelines be adopted for the process of nominations of full members of ORSSA for consideration of this distinction:

• A Nomination Subcommittee of the Executive Committee, consisting of the President, the Secretary and two other Executive Committee members, shall oversee the process of nominations, shall research thoroughly all nominations received and shall make recommendations to the full Executive Committee, in the form of a shortlist of candidates.

• The full Executive Committee shall decide, by means of a closed vote, which candidates to invite to become Fellows of ORSSA from the shortlist provided by the Nomination Subcommittee. Individuals not duly nominated via the Nomination Subcommittee will not be considered by the Executive Committee as candidates with respect to the election of Fellows of ORSSA.

• Any member of ORSSA may nominate a full member of ORSSA for consideration of this distinction, by submitting the following documentation to the Chairperson of the Nomination Subcommittee:
    o Full names and contact details of the nominator.
    o Full names and contact details of a seconder.
    o Full names and contact details of the nominee.
    o A comprehensively motivated list of reasons for the nomination.
    o An updated Curriculum Vitae of the nominee.

• The Nomination Subcommittee shall prepare citations for all candidates elected by the Executive Committee, and the election of Fellows of ORSSA shall be announced by the President at an Annual Conference of ORSSA.

Nominations are now requested for this distinguished class of membership of ORSSA, and should be submitted by August 1st, 2005 to:

Jan van Vuuren
Chairperson: Election of Fellows Nominations Subcommittee

Department of Applied Mathematics
University of Stellenbosch
Private Bag X1
Matieland
7602

Email: vuuren@sun.ac.za
Fax: (021) 808 3778 ♦

(Tom Rozwadowski Medal – Continued from page 8)

He did not consider the question closed, and was suggesting the use of simulation techniques to try out short-term tactics in mining operations, coupled with further and more sophisticated usage of linear and dynamic programming for the long-term planning.

On Monday, 12 October 1970, the news was circulated at Control Data South Africa that a telex had arrived during the weekend from the USA giving the announcement of Tom's death. Later the details became available. Tom and his family had gone to spend the weekend a few miles outside Minneapolis, apparently to give a talk on South Africa in a Catholic Church at Annadale, Minnesota. They had been put up for the night in a cottage as guests of the church. The gas central heating had a leaking pipe and the next morning Tom, his wife and their two children were all found asphyxiated.

All those who knew Tom will remember him for never refusing a helping hand to anybody in need of it. When Tom turned his head to listen to the problems put to him, there was always a twinkle in his eyes; there was the serene smile of a man who was at peace with himself, and with the rest of the world. ♦

Nominations Open for ORSSA Recognition Awards

At the e-meeting of the Executive Committee of ORSSA in March 2005 it was decided that the Society may, at its discretion, make *recognition awards* to individuals who have served the profession of Operations Research in an exemplary fashion. The Executive Committee has adopted the following rules and guidelines in this regard:

- A Nomination Subcommittee of the Executive Committee, consisting of the President, the Secretary and two other Executive Committee members, shall oversee the process of nominations for ORSSA recognition awards, shall research thoroughly all nominations received and shall make recommendations to the full Executive Committee, in the form of a shortlist of candidates for such awards.

- The full Executive Committee shall decide, by means of a closed vote, to which candidates on the shortlist provided by the Nomination Subcommittee to make recognition awards. Individuals not duly nominated via the Nomination Subcommittee will not be considered by the Executive Committee for recognition awards.

- Any member of ORSSA may nominate an individual (who may or may not be a member of ORSSA) for consideration of a recognition award, by submitting the following documentation to the Chairperson of the Nomination Subcommittee:
    o Full names and contact details of the nominator.
    o Full names and contact details of a seconder.
    o Full names and contact details of the nominee.
    o A comprehensive motivation for the nomination.
    o An updated Curriculum Vitae of the nominee.

It is the intention of the Executive Committee that recognition awards should remain a prestigious distinction, and should be reserved only for outstanding achievements and/or contributions, typically over a long period of time.

- The Nomination Subcommittee shall prepare citations for all candidates receiving recognition awards, and such awards shall be presented by the President at an Annual Conference of ORSSA.

Nominations for ORSSA recognition awards are now open, and should be submitted by August 1st, 2005 to:

Jan van Vuuren
Chairperson: ORSSA Recognition Awards Subcommittee
Department of Applied Mathematics
University of Stellenbosch
Private Bag X1
Matieland
7602

Email: vuuren@sun.ac.za
Fax: (021) 808 3778 ♦

Opportunities

OR in the UK is the longest and still one of the leading such traditions in the world. This is a legacy that instils pride and sense of accomplishment within and among the British and world OR communities.

OR researchers within the universities have open access to many agencies in the public sector and groups within private companies that can be sources of important research problems and applications. Such joint interests provide a healthy base to establish long term sponsoring relationships with some major players.

Threats

Taking the RAE funding system as given, it seems realistic to conclude that those OR groups that are in university departments whose research performance is below the international standard will have few chances to progress to world-class status in the foreseeable future.

Combined with the observation that there are relatively many OR groups in the UK, varying much in size and research activity and usually embedded in larger departments, the conclusion seems inevitable that, in the long run, this situation is unlikely to be stable.

The age distribution of academic OR researchers does not look very healthy. This threat is intensified by the observation that the PhD pipeline for potential fresh replacements is not well filled. In particular, there appears to be minimal interest among UK undergraduates in undertaking a PhD in OR as the precursor to an academic career.

Faculty position salaries at all ranks are not competitive in the international market and good career ladders are lacking for most beginners and mid-level faculty within UK universities. ♦

Universität Bremen

Operations Research 2005 (OR 2005)
International Conference on Operations Research

September 7 - 9, 2005
University of Bremen, Bremen, Germany

Contact: Prof. Dr. H.-D. Haasis,
            haasis@uni-bremen.de

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PREAMBLE

The fields of Industrial Engineering (IE) and Operations Research (OR) have a lot in common. Amongst other things, both use scientific methods to improve the way in which decisions are made in business and industry, in government and society. This, together with the economies of scale benefits utilised, has lead the Vaal Triangle Chapter of the Operations Research Society of South Africa (ORSSA) and the Southern African Institute for Industrial Engineering (SAIIE) to host a joint conference. The chapter is indebted to Sasol Ltd. who will be the main sponsor for this event.

Conference theme for discussion:
Building towards growth and sustainability in SA

GUEST SPEAKER

Our guest speaker is Prof. Alexis Tsoukiàs, President of the Association of European Operational Research Societies (EURO). Prof. Tsoukiàs will give a historical perspective on the profession of the Operations Researcher and the Industrial Engineer and the challenge that sustainability represents for our methodology, theory and practice. He will also give a presentation on constructing meaningful and useful indices, analysing how indices from the human development index to the pollution index are constructed and how Multiple Criteria Decision Analysis can help. A practical case concerning quality evaluation will be discussed.

Prof. Tsoukiàs is the research director at the Centre National de la Recherche Scientifique (CNRS) within LAMSADE, Université Paris Dauphine. He has taught numerous courses at various institutions (for more informationon on Prof Tsoukiàs visit http://www.lamsade.dauphine.fr/~tsoukias).

KEYNOTE SPEAKER

The keynote speaker representing our main sponsor, Sasol Ltd., is Jannie van der Westhuizen. He will address the topic of sustaining substantial profit growth through innovative practices by referring to a Sasol case study.

Jannie van der Westhuizen is Group General Manager of Sasol Limited, responsible for Sasol Mining, Group Human Resources and Group Information Management. He is also a member of the Group Executive Committee, the International Executive Committee and the Southern African Executive Committee. In addition, he is a director of several Sasol Subsidiary Boards. Having been the Managing Director of Sasol Mining for five years he became General Manager, Sasol Limited in 2002.

IMPORTANT DATES

3 June 2005:	Deadline for submission of abstracts
20 June 2005:	Notification of acceptance of abstracts
1 July 2005:	Deadline for early-bird registration
11 August 2005:	Deadline registration and payment

CONFERENCE REGISTRATION

Full conference:		Early bird	Normal fee
Non-Members	Non-speaker	R2 400.00	R2 900.00
	Speaker	R2 000.00	R2 500.00
Members	Non-speaker	R2 000.00	R2 500.00
	Speaker	R1 600.00	R2 100.00
Full-time students (members only)		R1 000.00	R1 500.00

Day attendance – per day (excluding functions and visits):

Non-members	R1 600.00
Members	R1 200.00
Full-time student (members only)	R 800.00

Accompanying persons:

Welcoming function	R 170.00
Social event (Day 2)	R 170.00
Gala dinner	R 260.00

A 20% surcharge will be payable on all fees received after 11 August 2005.

General & Registration Enquiries:
Ms Petra Lawson
Tel & fax +27 (0)16 910 3442
E-mail dvdpal@puk.ac.za