# 10th Metaheuristics International Conference

## MIC 2013

### 5 – 8 August
### Singapore Management University

Exchange of new algorithmic developments, new research challenges, and in-depth experimental studies in Metaheuristics.

http://research.larc.smu.edu.sg/mic2013

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# MIC 2013 — Message From General and Program Co-Chairs

Singapore, a major hub in the Asia Pacific region well known for its multi-racial and multi-cultural society, is proud to host the 10th Metaheuristics International Conference. Singapore Management University (SMU) and the Living Analytics Research Center (LARC) are also delighted to be able to support the delivery of this event. The university and research center's location in Singapore, which itself has been promoting the development of leading-edge analytics techniques during the past several years, is the perfect place to host the conference. Our city will welcome conference attendees with the flag of the nation flying, in honor of Singapore's National Day on Friday, August 9. During your time here, the mood of the city will be bright and open, while celebrating its past history, current ethnic and linguistic breadth, advanced and productive economy, and its aspirations for continuing success in the future.

Down memory lane, the first Metaheuristics International Conference (MIC) took place in Breckenridge, Colorado, USA in 1995. Due to its success, the conference was established as a bi-annual event that gained further attraction and grew in size steadily. Today, MIC has a long-standing international tradition and is for many researchers and practitioners working in the field of metaheuristics one of the leading scientific events to exchange with colleagues and meet friends. This year MIC has a special reason to celebrate, as it has its 10th anniversary! Celebrate this special event with us!

Following the tradition, MIC2013 invited extended abstracts (up to 3 pages) as well as full papers (up to 10 pages) describing original yet unpublished scientific work related to metaheuristics. We received 86 submissions which have been reviewed by the Program Committee, finally yielding 25 accepted full papers and 34 extended abstracts that are scheduled to be presented at the conference. These contributions document that the field of metaheuristics is many-fold. While a substantial portion of the papers focuses on applications in transport optimization, there are many other application areas addressed, including network design, data analysis, scheduling, packing, and constraint satisfaction. From an algorithmic point-of-view, a broad range of techniques is considered, established metaheuristics are adapted, new variants proposed,

and in particular hybrid approaches where metaheuristics are applied in conjunction with other methods, e.g. from the field of mathematical programming, are becoming more and more popular.

This year, in celebration of the 10th anniversary, MIC 2013 specially invites colleagues working in related disciplines to join us; this cross-disciplinary interaction would hopefully sparkle new inter-disciplinary research collaborations. We organize special sessions on the interaction with Meta-Heuristics with Data Analytics, Constraint Programming, and Multi-agent Distributed Problem Solving. We also organize special sessions on emerging issues relating to Multi-Objective Optimization and Dynamic Vehicle Routing. We also organizing an industry workshop that bring academic and industry participants together in dialogue on supply chain analytics.

We are fortunate to attract four exceptional keynote speakers who cover a broad spectrum of timely topics in meta-heuristics, their applications, and their links with other disciplines. Professor Pablo Moscato, from the University of Newcastle, talks about "Personalized Information-based Medicine: Hugh challenges, massive opportunities, and some lessons learned.". Professor Steven Kimbrough, from the Wharton School at the University of Pennsylvania, presents a lecture on "Solution Pluralism, Deliberation, and Metaheuristics". Panos Pardalos, Distinguished Professor of Industrial and System Engineering at the University of Florida, talks about "Data Mining and Optimization Heuristics for Massive Networks". Finally, Michael Trick, the Harry B. and James H. Higgins Professor of Operations Research and Senior Associate Dean at the Tepper School of Business at Carnegie Mellow, lectures on "combining Optimization and Metaheuristics in Sport Scheduling". We would like to thank all of them for accepting our invitation and sharing their expertise at the MIC 2013.

MIC 2013 took two years to organize – from the time Singapore won the bid at MIC 2011 to be the venue for MIC 2013, to the completion on the catering and presentation space arrangements to assure that our participants will be comfortable. Our first thanks go to the many authors whose papers we reviewed and accepted. They are the "first creators" of quality, and what most

participants will perceive as "the best" that MIC has to offer this year. We also wish to recognize the members of MIC 2013's Program Committee, who did an outstanding job of reviewing papers. Their efforts made the construction of a conference program filled with innovative ideas and contributions of new knowledge possible. For this, we offer our sincere thanks.

Special thanks also goes to the SMU administrative support team: Angela Kwek, Alenzia Wong, Fong Soon Keat, and others, who have helped in extraordinary ways with the various logistics to make everything come together into a smooth and seamless package.

Several other institutional contributors offered additional notes of thanks. We wish to thank the following additional sponsors, who contributed in a generous way: DHL, Lee Foundation and MIS Asia.

Year in and year out, the authors, speakers, and attendees from academia and industry at this conference make it very special. We would like to offer our warm thanks to all the participants of MIC 2013 for contributing your newest and your best ideas in metaheuristics.

We further hope that MIC 2013 is able to provide an outstanding platform for the exchange of new ideas for our academic and industry colleagues. We hope the different national and cultural backgrounds, contrasting professional and academic profiles, and international and interdisciplinary perspectives that participants being to Singapore will create the optimum conditions for intellectual exchange.

Hoong Chuin Lau, Günther Raidl and Pascal Van Hentenryck

# Special Sessions

MIC 2013

## Metaheuristics and Big Data Analytics Chair:
**Vincent Cheng-Siong Lee,** Monash University, Australia

## Metaheuristics and Optimization/Constraint Programming Chair:
**Michael Trick,** Carnegie Mellon University, USA

## Dynamic Vehicle Routing Chairs:
**Victor Pillac,** NICTA, Australia
**Pascal Van Hentenryck,** NICTA, Australia

## Multi-Agent Distributed Problem Solving Chair:
**Haolan Zhang,** NIT, Zhejiang University, China

## Metaheuristics and Multi-Objective Optimization Chair:
**Xavier Gandibleux,** Université de Nantes, France

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**Tommaso Urli,** Università degli Studi di Udine, Italy

**Pascal Van Hentenryck,** NICTA, Australia

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**Juan G. Villegas,** Universidad de Antioquia, Colombia

**Jean-Paul Watson,** Sandia National Laboratories, USA

**David Woodruff,** University of California at Davis, USA

**Adilson Elias Xavier,** Federal University of Rio de janeiro, Brazil

**Mutsunori Yagiura,** Nagoya University, Japan

**Hao Lan Zhang,** NIT, Zhejiang University, China

# Keynote Speakers

| Keynote I - Data Mining and Optimization Heuristics for Massive Networks | | |
|---|---|---|
| 9:00am - 10:00am | 5th August, Monday | Ngee Ann Kongsi Auditorium |

### Panos M. Pardalos, University of Florida

### Abstract:

In recent years, data mining and optimization heuristics have been used to analyze many large (and massive) data-sets that can be represented as a network. In these networks, certain attributes are associated with vertices and edges. This analysis often provides useful information about the internal structure of the datasets they represent. We are going to discuss our work on several networks from telecommunications (call graph), financial networks (market graph), social networks, and neuroscience.

In addition, we are going to present recent results on critical element selection. In network analysis, the problem of detecting subsets of elements important to the connectivity of a network (i.e., critical elements) has become a fundamental task over the last few years. Identifying the nodes, arcs, paths, clusters, cliques, etc., that are responsible for network cohesion can be crucial for studying many fundamental properties of a network.

**Bio:** Panos M. Pardalos serves as Distinguished Professor of Industrial and Systems Engineering at the University of Florida. He is also an affiliated faculty member of the Computer and Information Science Department, the Hellenic Studies Center, and the Biomedical Engineering Program. He is also the Director of the Center for Applied Optimization. Dr. Pardalos is a world leading expert in global and combinatorial optimization. His recent research interests include network design problems, optimization in telecommunications, e-commerce, data mining, biomedical applications, and massive computing.

# Keynote Speakers

**MIC❂2❂13**

### Pablo Moscato, University of Newcastle
### Abstract:

A recent report from the McKinsey Global Institute highlights the top six disruptive technologies with highest economic impact: mobile internet, automation of knowledge work, Internet of Things, Cloud, Advanced robotics and Autonomous and near-autonomous vehicles. A close seventh is at the core of information-based medicine, next-generation genomics. These seven technologies account for an estimated value which is at least 28 trillion US dollars a year.

All of them share with Information-based Medicine the need of analyzing large datasets, with "Big Data" being the current buzzword. As such, the need of querying a large variety of digital data and the use of artificial-intelligence and optimization software to find novel insights is not considered a separate technology, but a omnipresent requirement across all technologies.

Personalized Medicine aims at putting the best interests of the patient/ individual, at the centre of all medical decisions, institutional practices, and/or drugs and treatments that necessarily be "tailored" to the individual profile. Clearly next-generation genomics is pertinent here, but the automation of knowledge work will also prove vital.

These two perspectives for the future of Medicine should contribute to each other. The novel technologies generate an ocean of data, but without strategic approaches for knowledge reuse they do not deliver for the promise. The

huge perceived challenges generally involve large optimization. However, the implicit challenge is the development of new mathematical models that contemporize the needs of personalized medicine, who aims at the best diagnostic and treatment, and Information-based Medicine, with the needs of institutions/governments that aim at delivering the best health policies while minimizing global intervention costs operating under budget constraints.

**Bio:** Australian Research Council Future Fellow Prof. Pablo Moscato is the founding co-director of the Priority Research Centre for Bioinformatics, Biomarker Discovery and Information-based Medicine (2006-) and the funding director of Newcastle Bioinformatics Initiative (2002-2006) of The University of Newcastle. He is also Chief Investigator of the Australian Research Council Centre in Bioinformatics.

Prof. Moscato has been working in Evolutionary Computation for 25 years, and in heuristic methods for Operations Research problems since 1985. His work and ideas have been highly influential in a large number of scientific and technological fields and his manuscripts have been cited more than 4,211 times (data from Google Scholar). The journal "Memetic Computing" is largely dedicated to a methodology he championed since early work with Mike Norman at Caltech in 1988 (memetic algorithms). He is one of Australia's most cited computer scientists.

In the past seven years he has introduced a unifying hallmark of cancer progression based on the changes of information theory quantifiers, developed a novel mathematical model and an associated solution procedure based on combinatorial optimization techniques to identify drug combinations for cancer therapeutics. He has also identified proteomic signatures to predict years in advance the clinical symptoms of Alzheimer's Disease among other `firsts'. His current fellowship supports him for four years (2012-2016) to develop memetic algorithms for multiobjective optimization problems in clinical bioinformatics for personalized and translational medicine.

**Keynote III - Solution Pluralism, Deliberation, and Metaheuristics**

| 8:30am - 9:30am | 7th August, Wednesday | Ngee Ann Kongsi Auditorium |
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**Steven Kimbrough, University of Pennsylvania**

**Abstract:**

We wish to challenge two verities in the MS/OR community as a way of promoting a conceptual shift regarding optimization and metaheuristics. The first verity, roughly, is that given a constrained optimization model the primary problem posed is to find an optimal solution to the model. We call this the *goal of optimization modeling* verity. The second, roughly, is that exactly optimal solutions (to optimization problems) are always preferred, but heuristically optimal solutions are acceptable if exactly optimal solutions are not available. We call this the *justification of heuristics* (in optimization) verity. Our challenges to these verities lie not in denying their truth so far as they go, but in denying that they have gone far enough.

The conceptual shift we propose may be described as *solution pluralism for deliberation with models*. In a nutshell: Given an optimization model, it is possible to define a set of *solutions of interest* (SoIs), which if well sampled would be valuable for deliberation for decision making (based on the model); further, while the problem of obtaining good samples of the SoIs is challenging, metaheuristics bid fair to be the favored approach and can be shown to be effective in many cases. Among the reasons why SoIs can usefully be defined is that, as is well known, constraints not based in logic often have somewhat arbitrarily chosen coefficient values and these constraints are amenable to adjustment if the increase in profit or decrease in cost is sufficiently large. The talk elaborates upon and illustrates these points.

**Bio:** Steven Kimbrough is a Professor at The Wharton School, University of Pennsylvania. His main research interests are in the fields of electronic commerce (and formal languages for business communication), knowledge and information management, and computational rationality. His active research areas include: computational approaches to belief revision and nonmonotonic reasoning, formal languages for business communication, evolutionary computation (including genetic algorithms and genetic programming), and information discovery in unstructured and semi-structured data bases (e.g., text). He was principal investigator for the U. S. Coast Guard's KSS (knowledge-based decision support systems) project, and co-principal investigator on the Logistics DSS project, which is part of DARPA's Advanced Logistics Program. He was most recently Principal Investigator in the NSF-funded project "Working Memory and Adaptive Choice Behavior."

| Keynote IV - Combining Optimization and Metaheuristics in Sports Scheduling | | |
|---|---|---|
| 8:30am - 9:30am | 8th August, Thursday | Ngee Ann Kongsi Auditorium |

**Michael Trick, Carnegie Mellon University**

### Abstract:

Sports scheduling has grown greatly in importance in recent years as more professional and amateur leagues move away from ad-hoc scheduling to optimization-based approaches. Real leagues, however, are generally of a size and structure that precludes straightforward modeling and optimization. Instead, techniques need to be developed that combine optimization with metaheuristic approaches. This has led to a variety of methods for real sports leagues, including large-neighborhood search, genetic algorithms with optimization-based crossovers, and Benders-guided greedy approaches. I will illustrate these methods with examples drawn from professional leagues, such as (U.S.) Major League Baseball, and university leagues. I will also outline the effect that better predictive modeling can have on finding schedules more profitable for the teams and leagues.

**Bio:** Michael Trick is the Harry B. and James H. Higgins Professor of Operations Research and Senior Associate Dean at the Tepper School of Business, Carnegie Mellon. His research interests are in integer and constraint programming, with a particular emphasis on applications in scheduling and in social choice. In 2002, he was President of INFORMS, the 14,000-member U.S. based operations research society. In his consulting work, he has worked with the United States Postal Service, the U.S. Internal Revenue Service, and many sports leagues, including Major League Baseball, with which he has worked for more than 15 years on scheduling issues. He is the author of more than 50 publications and is the editor or co-editor of six volumes of refereed papers.

# Best Paper Nominations

| Paper No. | Contribution | Session |
|-----------|-------------|---------|
| 16 | The Capacitated Arc Routing Problem with Stochastic Service and Travel Times<br>Lu Chen, André Langevin, Michel Gendreau | 5th August, Mon 3:45 pm<br>Seminar Room 2.2 |
| 21 | Analysing Differences between Algorithm Configurations through Ablation<br>Chris Fawcett, Holger H. Hoos | 6th August, Tue 12:05 pm<br>Seminar Room 2.2 |
| 28 | A Memetic Algorithm for the Virtual Network Mapping Problem<br>Johannes Inführ, Günther Raidl | 7th August, Wed 10:00 am<br>Seminar Room 2.1 |
| 42 | Learning to Diversify in Complex Interactive Multiobjective Optimization<br>Dinara Mukhlisullina, Andrea Passerini, Roberto Battiti | 6th August, Tue 11:15 am<br>Seminar Room 2.1 |

## Tribute to Arne Lokketangen (1954 - 2013)

As one of many who had the privilege of knowing Arne Lokketangen, I will offer a few personal recollections of someone I came to regard a close and dear friend. Arne's special idiosyncrasies and eccentricities ingrained themselves in my mind as delightful complements to his qualities of enduring warmth and depth. Those of us who passed a bit of time in his presence will always be grateful.

Arne had a profound knack for turning his research productivity into a means to pursue another passion – a penchant to travel and learn about other people and places. Arne's group at the University of Molde in Norway received annual funds for attending professional meetings, allocated according to the quantity and quality of research projects the professors engaged in. Being responsible for an appreciable share of these research projects, Arne enjoyed an appreciable share of the allocation – sufficient to enable him to attend meetings around the world where he could sample widely varying experiences of history, art and local culture.

After an initial encounter spurred by common research interests, I quickly discovered this other side of Arne. He liked to conduct "expeditions" to find something unique within the locales he visited – an event, a panorama, an architectural novelty, a work of art or artisanship. He would take delight in finding culinary treats from a region and would arrange to carry or ship them back to his home in Norway. Once my wife Diane and I joined Arne on such an expedition in Chengdu, China, as he set out to find a high quality (edible) bird's nest so he could prepare Chinese bird's nest soup when he returned from his travels. On an expedition in Japan he scoured stores to find a good kit for making stylistic impressions and pen drawings. Some years later he surprised us during a visit we made to see him in Norway by showing us drawings he and his sons had done that we found remarkably artistic.

Arne was very much a "family man" and maintained an exceptionally warm relationship with his two sons, Marius and Erik. We benefited from his family orientation when he developed a mutually affectionate friendship with our daughter Lauren. Beginning when she was perhaps 7 years old, Arne would bring imaginative puzzles and intriguing games with him when he visited us in Colorado, and spent many long periods patiently explaining their workings to Lauren – and the rest of us! We would sometimes play Arne's games long after dinnertime, and memorably, when Lauren was about 13, the two of them stayed up playing a game called Talisman together until 2AM in the

morning. Arne had an endearing style of bantering as he played that he employed to accentuate their rivalry with humor.

As many who knew him will attest, Arne was also an outstanding chef. As a bonus to his visits to Colorado he would often bring along Norwegian delicacies and prepare them himself, while my wife and daughter stood by in fascination. On one occasion he brought reindeer meat with him, and the resulting feast led to an episode in Lauren's sixth grade elementary school class which Arne took pleasure in recounting to our mutual friends. The sixth grade teacher had chosen reindeer as a topic of discussion, and paused to ask if anyone in the class had ever seen one. Lauren managed to bring the class to a standstill when she said "No, I haven't seen one, but I've eaten one!"

A telling demonstration of Arne's mettle occurred in a shocking incident when he suffered a stroke in 2004 that deprived him of much of his ability to talk and his capacity to use his left hand. After recovering sufficiently to be released from the hospital, he refused to accept help in carrying out everyday tasks, and instead took charge of all aspects of caring for himself, including cooking and house cleaning. He repeatedly bumped into furniture and walls, and dropped items he attempted to pick up, but forced himself to continue. As a result, he started regaining his physical coordination and his speech at a remarkable rate. Within half a year he was back working with his students and within a year he was once again actively pursuing his research.

One of the last chances we had to see Arne was on a combined adventure involving two professional meetings – the first in Iceland and the second in the Ukraine. Arne knew Iceland well and took charge as our guide on a pre-conference "rental car expedition" during which he regaled us with information about the places we visited. We then joined up with his sons Marius and Erik in Norway and made our way to the Ukraine, where, in his customary manner, Arne excitedly called attention to the historical landmarks and special features of interest along the way

These snapshots give only pale glimpses of Arne's colorful and warm character, and his memory will always abide with us. My family and I are just a small part of the community of individuals he affected deeply. I know that many others who were his friends and colleagues in the metaheuristic and math programming world were similarly touched and uplifted by his presence. We are indeed fortunate that he walked among us.

# Conference Program
# (5th August 2013, Monday)

MI✶ 2✶13

| Time | Programme |
|------|-----------|
| 8:00 am | **Registration** |
| 8:30 am | **Opening**<br>Co Chairs Welcome and Introduction<br>Steven Miller, Vice Provost, Singapore Management University |
| 9:00 am | Chair:  Hoong Chuin Lau<br>Venue: Ngee Ann Kongsi Auditorium<br><br>**Keynote I: Data Mining and Optimization Heuristics for Massive Networks**<br>Panos M. Pardalos, Professor of Industrial and Systems Engineering University of Florida |
| 10:15 am | **Break** |
| 10:45 am<br>(Parallel Sessions) | Session Chair: Michael Trick<br>Venue: Seminar Room 2.1<br><br>**Special Session on Metaheuristics and Optimization/ Constraint Programming**<br><br>5.    Estimating the Runtime of Parallel SAT Local Search<br>        Alejandro Arbelaez, Charlotte Truchet, Philippe Codognet<br><br>7.    Optimization of the Arabic Keyboard Layout for Single-pointer Applications<br>        Abir Benabid Najjar<br><br>22.    Proximity Search<br>        Matteo Fischetti, Michele Monaci<br><br>57.    A Hybrid Constructive Algorithm for the Integrated Task and Shift Scheduling Problem<br>        Pieter Smet, Greet Vanden Berghe |

| | |
|---|---|
| **10:45 am (Parallel Sessions)** | Session Chair: Haolan Zhang<br>Venue: Seminar Room 2.2<br><br>**Special Session on Multi-Agent Distributed Problem Solving**<br><br>12. Modeling and Solving Multidimensional Optimization Problems with a Distributed Agent-based Matheuristic<br>Marc-André Carle<br><br>15. Multi-Agent Orienteering Problem with Time-Dependent Capacity Constraints<br>Cen Chen, Shih-Fen Cheng, Hoong Chuin Lau<br><br>31. A Novel Automated Data Warehouse Schema Generator for Large Volume Online Multimedia Data Processing<br>Dacheng Jiang, Chaoyi Pang, Kedong Ye, Hao Lan Zhang<br><br>50. Negotiation-based Scheduling of Interfering Job Sets on a Single Machine<br>Rene Ramacher, Lars Mönch |
| **12:30 pm** | **Lunch** |
| **2:00 pm (Parallel Sessions)** | Session Chair: Vincent Cheng-Siong Lee<br>Venue: Seminar Room 2.1<br><br>**Special Session on Metaheuristics and Big Data Analytics**<br><br>29. Solving Large p-Median Problems Using Hybridization of VNS and Exact Method<br>Chandra Ade Irawan, Said Salhi<br><br>37. Analyzing Dynamic Categorical Influence in Mobile Phone Social Networks<br>Siyuan Liu, Ramayya Krishnan |

| | |
|---|---|
| **2:00 pm (Parallel Sessions)** | 45.   Interacting Knapsack Problem in Designing Resource Bundles<br>        Truong-Huy D. Nguyen, Pradeep Varakantham, Hoong-Chuin Lau, Shih-Fen Cheng<br><br>Session Chair: Noor Hasnah Moin<br>Venue: Seminar Room 2.2<br>**Inventory Routing Problems**<br><br>1.   Variable Neighborhood Search for Inventory Routing Problem with Time Varying Demand<br>        Huda Zuhrah Ab Halim, Noor Hasnah Moin, Said Salhi<br><br>26.  Interactive Reference Point-Based Guided Local Search for the Bi-objective Inventory Routing Problem<br>         Sandra Huber, Martin Josef Geiger, Marc Sevaux<br><br>41.  Scatter Search for Production, Inventory, and Distribution Routing Problem<br>         Noor Hasnah Moin, Titi Yuliana |
| **3:15 pm** | **Break** |
| **3:45 pm (Parallel Sessions)** | Session Chair: Eric Taillard<br>Venue: Seminar Room 2.1<br><br>**New Algorithmic Techniques**<br><br>58.  Metaheuristic and Statistical Based Sampling<br>         Yoel Tenne<br><br>4.   Directed Continuous-GRASP for Global Optimization Problems<br>        Tiago Maritan Ugulino de Araújo, Lucídio dos Anjos Formiga Cabral, Roberto Quirino do Nascimento, Cláudio N. Meneses<br><br>51.  Multiple Local Neighbourhood Search for Extremal Optimisation<br>         Marcus Randall  Arne Løkketangen, Jianyong Jin |

| 3:45 pm (Parallel Sessions) | Session Chair: Michel Gendreau<br>Venue: Seminar Room 2.2<br><br>**Large and Variable Depth Neighborhood Search Approaches for Vehicle Routing**<br><br>16. The Capacitated Arc Routing Problem with Stochastic Service and Travel Times<br>Lu Chen, André Langevin, Michel Gendreau<br><br>34. The Generalized Consistent Vehicle Routing Problem<br>Attila A. Kovacs, Bruce L. Golden, Richard F. Hartl, Sophie N. Parragh<br><br>47. New Variable Depth Local Search for Multiple Depot Vehicle Scheduling Problems<br>Tomoshi Otsuki, Kazuyuki Aihara<br><br>38. A Solution Clustering based Parallel Metaheuristic for the Capacitated Vehicle Routing Problem<br>Arne Løkketangen, Jianyong Jin |
| **5:30 pm** | **End** |

# Conference Program
# (6th August 2013, Tuesday)

MIC 2013

| Time | Programme |
|------|-----------|
| **8:30 am** | Chair: Günther Raidl<br>Venue: Ngee Ann Kongsi Auditorium<br><br>**Keynote II: Personalized Information-based Medicine: Huge challenges, massive opportunities and some lessons learned**<br>Pablo Moscato, Professor of Electrical Engineering and Computer Science<br>University of Newcastle |
| **9:40 am** | **Break** |
| **10:00 am (Parallel Sessions)** | Session Chair: Xavier Gandibleux<br>Venue: Seminar Room 2.1<br><br>**Special Session on Metaheuristics and Multiobjective Optimization 1**<br><br>2.  A Penalty-based Multi-objectivization Approach Using Pareto Local Search<br>    Abdullah Alsheddy<br><br>10.  Active Learning of Pareto Fronts with Disconnected Feasible Decision and Objective Spaces<br>    Paolo Campigotto, Andrea Passerini, Roberto Battiti<br><br>19.  Analyzing Criteria Correlation to Minimize the Energy Consumption in WSN<br>    Christophe Duhamel, Lucas Moreira Guedes, Andréa Cynthia Santos, Axelle Alégoët |

| 10:00 am (Parallel Sessions) | Session Chair: Markus Wagner<br>Venue: Seminar Room 2.2<br><br>**Automated Algorithm Design and Parameter Tuning**<br><br>11.  Algorithm Selection and Tuning Challenges in Agent-based Optimization: An Empirical Study<br>Marc-André Carle<br><br>36.  FloTra: Flower-shape Trajectory Mining for Instance-specific Parameter Tuning<br>Lindawati, Feida Zhu, Hoong Chuin Lau<br><br>39.  Towards the Automatic Design of Metaheuristics<br>Marie-Eléonore Marmion, Franco Mascia, Manuel López-Ibáñez, Thomas Stützle |
|---|---|
| 11:15 am (Parallel Sessions) | Session Chair: Xavier Gandibleux<br>Venue: Seminar Room 2.1<br><br>**Special Session on Metaheuristics and Multiobjective Optimization 2**<br><br>42.  Learning to Diversify in Complex Interactive Multiobjective Optimization<br>Dinara Mukhlisullina, Andrea Passerini, Roberto Battiti<br><br>60.  Solving Multiobjective Quadratic Assignment Problem using Hybrid Genetic/Immune Strategy<br>Arnaud Zinflou, Caroline Gagné |

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| **11:15 am (Parallel Sessions)** | Session Chair: Celso Ribeiro<br>Venue: Seminar Room 2.2<br><br>**Algorithm Configuration and Test Case Generation**<br><br>6.    Heuristically Creating Test Cases for Program Verification Systems<br>      Bernhard Beckert, Thorsten Bormer, Markus Wagner<br><br>24.   Biased and Unbiased Random-key Genetic Algorithms: An Experimental Analysis<br>      Jose F. Goncalves, Mauricio G. C. Resende, Rodrigo F. Toso<br><br>21.   Analysing Differences between Algorithm Configurations through Ablation<br>      Chris Fawcett, Holger H. Hoos |
| **12:30 pm** | **Lunch** |
| **2:00 pm** | **Social Event - River Safari**<br><br>Pick-up Point (to River Safari): SMU Administration Building Level 1 Lobby, 2:00pm<br><br>Pick-up Point (back to SMU): Coach Bay, 6:00pm.<br><br>Note: Please kindly refer to page 115 for direction map |
| **6:00 pm** | **End** |

# Conference Program
## (7th August 2013, Wednesday)

| Time | Programme |
|---|---|
| **8:30 am** | Chair: Hoong Chuin Lau<br>Venue: Ngee Ann Kongsi Auditorium<br><br>**Keynote III: Solution Pluralism, Deliberation, and Metaheuristics**<br>Steven Kimbrough, Professor of Operations and Information Management<br>University of Pennsylvania |
| **9:40 am** | **Break** |
| **10:00 am (Parallel Sessions)** | Session Chair: Christophe Duhamel<br>Venue: Seminar Room 2.1<br><br>**Telecommunication Applications**<br><br>28. A Memetic Algorithm for the Virtual Network Mapping Problem<br>    Johannes Inführ, Günther Raidl<br><br>30. Clique and Independent Set Based GRASP Approaches for the Regenerator Location Problem<br>    Peter Jahrmann, Günther R. Raidl<br><br>52. Minimizing Energy Consumption on a Hop-constrained WSN using a Delay-constrained Mobile Agent<br>    Oberlan Christo Romão, André Gustavo dos Santos, Geraldo Robson Mateus |

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| **10:00 am (Parallel Sessions)** | Session Chair: Stefan Voss<br>Venue: Seminar Room 2.2<br><br>**Logistics Problems**<br><br>9.   A Hybrid Algorithm for the Vehicle Routing Problem with Backhauls and 3D Loading Constraints<br>Andreas Bortfeldt, Thomas Hahn, Lars Mönch<br><br>54. Integrated Timetabling and Vehicle Scheduling for Periods of Low Demand<br>Verena Schmid, Jan Fabian Ehmke<br><br>35. A Randomized Algorithm Based on Variable Neighborhood for the Strip Packing Problem<br>Stehpen C.H. Leung, Defu Zhang, Shibao Hong |
| **11:15 am (Parallel Sessions)** | Session Chair: Marcus Randall<br>Venue: Seminar Room 2.1<br><br>**Location and Assignment Problems**<br><br>13.  A Hybrid Algorithm for the Redundancy Allocation Problem<br>Marco Caserta, Stefan Voss<br><br>32.   A Matheuristic for the Leader-follower Facility Location and Design Problem<br>Yury Kochetov, Nina Kochetova, Alexandr Plyasunov<br><br>53.  Heuristics for Setting Directions in Urban Networks<br>Andréa Cynthia Santos, Christophe Duhamel, Christian Prins |

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|---|---|
| **11:15 am (Parallel Sessions)** | Session Chair: Victor Pillac<br>Venue: Seminar Room 2.2<br><br>**Special Session on Dynamic Vehicle Routing**<br><br>40.  On the Vehicle Routing Problem with Stochastic Demands and Duration Constraints: Formulations and a Hybrid Metaheuristic Approach<br>Jorge E. Mendoza, Louis-Martin Rousseau, Juan G. Villegas<br><br>27.  Improving Solutions for Dynamic and Stochastic Maritime Pick-up and Delivery Problems using Local Search<br>Lars Magnus Hvattum, Gregorio Tirado |
| **12:30 pm** | **Lunch (Not Provided)** |
| **2:00 pm (Parallel Sessions)** | Chair: Hoong Chuin Lau<br>Venue: Ngee Ann Kongsi Auditorium<br>**Industry Workshop on Supply Chain Analytics**<br>Time: 1:30 pm - 6:00 pm, registration starts at 1:00pm<br>(Please refer to page 38 for more details)<br><br>Session Chair: Nysret Musliu<br>Venue: Seminar Room 2.1<br>**Graph Problems and SAT**<br><br>3.  Variable Neighborhood Search for Extremal Graphs 27: Families of Extremal Graphs<br>Mustapha Aouchiche, Gilles Caporossi, Pierre Hansen<br><br>46. Construction Heuristics for the Maximum Cardinality Quasi-clique Problem<br>Andre B. Oliveira, Alexandre Plastino, Celso C. Ribeiro<br><br>33. A Penalty Function Approach to Max 3-SAT Problems<br>Christian Kofler, Peter Greistorfer, Haibo Wang, Gary Kochenberger |

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| **2:00 pm (Parallel Sessions)** | Session Chair: Alexander Hämmerle<br>Venue: Seminar Room 2.2<br><br>**Tabu and Variable Neighborhood Search for Vehicle Routing**<br><br>17. Metaheuristics for Time-dependent Multi-zone Multi-trip Vehicle Routing Problems with Time Windows<br>   Teodor Gabriel Crainic, Phuong Nguyen Khanh, Michel Toulouse<br><br>18. Comparing Multi Neighborhood Strategies for Rich Vehicle Routing Problems<br>   Ulrich Derigs, Markus Pullmann **(Cancelled)**<br><br>48. Characterizing Instances and Optimizing Algorithms for Vehicle Routing Problems<br>   Fritz Payr |
| **3:15 pm** | **Break** |
| **3:45 pm (Parallel Sessions)** | Chair: Hoong Chuin Lau<br>Venue: Ngee Ann Kongsi Auditorium<br>**Industry Workshop on Supply Chain Analytics**<br>Time: 1:30 pm - 6:00 pm, registration starts at 1:00 pm<br>(Please refer to page 38 for more details)<br><br>Session Chair: Andréa Cynthia Santos<br>Venue: Seminar Room 2.1<br><br>**Scheduling**<br><br>23. A Biased Random-key Genetic Algorithm for Job-shop Scheduling<br>   José Fernando Gonçalves, Maurício G. C. Resende, José Abílio Oliveira Matos<br><br>43. Applying Machine Learning for Solver Selection in Scheduling: A Case Study<br>   Nysret Musliu |

| 3:45 pm (Parallel Sessions) | 49. An Iterated Greedy Metaheuristic for the Job Shop Scheduling Problem with Blockings<br>Marco Pranzo, Dario Pacciarelli<br><br>Session Chair: Andreas Bortfeldt<br>Venue: Seminar Room 2.2<br><br>**Population Based Metaheurstics for Vehicle Routing**<br><br>44. An Enhancement of Edge Assembly Crossover for the Capacitated Vehicle Routing Problem<br>Yuichi Nagata, Isao Ono<br><br>14. The Multi Trip Vehicle Routing Problem with Time Windows and Release Dates<br>Diego Cattaruzza, Nabil Absi, Dominique Feillet, Olivier Guyon, Xavier Libeaut<br><br>25. Forming Transport Chains for Intermodal Freight Transport<br>Alexander Hämmerle, James I. M. Picken, Michael Huemer, Herbert Peherstorfer, Bernhard Fürst<br><br>59. Unified Solution Approaches for Vehicle Routing Problems<br>Thibaut Vidal, Teodor Gabriel Crainic, Michel Gendreau, Christian Prins |
|---|---|
| 5:30 pm | **End of Paper Session** |
| 6:00 pm | **Conference Banquet**<br>**The Legends Fort Canning Park, Lavender Ballroom**<br>Note: Please kindly refer to page 112 for direction map. |
| 10:00 pm | **End** |

# Conference Program
# (8th August 2013, Thursday)

MIC 2013

| Time | Programme |
|---|---|
| 8:30 am | Chair: Ee-Peng Lim<br>Venue: Ngee Ann Kongsi Auditorium<br><br>**Keynote IV: Combining Optimization and Metaheuristics in Sports Scheduling**<br>Michael Trick, Professor of Operations Research<br>Carnegie Mellon University |
| 9:40 am | **Break** |
| 10:00 am (Parallel Sessions) | Session Chair: Defu Zhang<br>Venue: Seminar Room 2.1<br><br>**Further Applications**<br><br>56. Generalized Quadratic Assignment Model for the PBX Telephone Migration Scheduling Problem: An Approach via GRASP with Path-relinking<br>Ricardo M. A. Silva, Mauricio G.C. Resende, Geraldo R. Mateus, Panos M. Pardalos, Diogo V. Andrade<br><br>55. A Modified Scatter Search Approach to Solve the DNA Fragment Assembly Problem<br>Ayon Sen, Tahmid-un-Nabi, Pritom Ahmed, Rezwana Reaz, A. S. M. Sohidull Islam, M. Sohel Rahman<br><br>8. Image Segmentation using Improved Fuzzy C-means Clustering Algorithm Initialized with Particle Swarm Optimization<br>Ahmed Nasreddine Benaichouche, Hamouche Oulhadj, Patrick Siarry |

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| **10:00 am (Parallel Sessions)** | Session Chair: Ibrahim Hassan Osman<br>Venue: Seminar Room 2.2<br><br>**Late Breaking Contributions Session**<br><br>Cardinality Constrained Portfolio Optimization Using Cuckoo Search<br>Ibrahim Hassan Osman, Karl Sawaya<br><br>Iterated Restricted Search Space: An Application for Solving a Location-Routing Problem<br>Patrick Soriano, José Eduardo Pécora Jr. and Angel Ruìz<br><br>Flying Elephants: A General Method for Solving Non-Differentiable Problems<br>Adilson E. Xavier and Vinicius L. Xavier |
| **11:30 am** | **Closing**<br>Venue: Ngee Ann Kongsi Auditorium |
| **12:30 pm** | **End of Conference** |

In conjunction with MIC, we will be organizing a half-day **Industry Workshop on Supply Chain Analytics** (supported by The Chartered Institute of Logistics and Transportation, Singapore). This workshop brings together academics, analytics executives and supply chain leaders offering unique insights into innovations that are driving success in organizations. We will discuss challenges and best practices for logistics and supply chain analytics, big data analytics, methods and tools, trends and visions in the use of analytics.

**Speakers** of the Workshop include the following:

### Government

1. Kelvin Wong, Executive Director (Logistics, Professional Services, International Organisations Program Office), Singapore Economic Development Board
   *Title: Analytics - How it applies to the Future of Singapore's Logistics Industry*

2. Rosina Howe, Group Director, Innovation & InfoComm Technology, Land Transport Authority, Singapore
   *Title: The Strategic Role of Big Data on Land Transport Planning*

### Academia

3. Stefan Voss, Chair and Professor, Institute of Information Systems, University of Hamburg, Germany
   *Title: Risk Management in Global Supply Chains - Hedging for the Big Bang?*

4. N. Viswanadham, INAE Distinguished Professor in Computer Science and Automation, Indian Institute of Science, Bangalore, India
   *Title: Ecosystem Aware Global Supply Chain Management*

**Industry**

5. Stephan Schablinski, Director, Sustainable Supply Chian Solutions, DHL
   *Title: Sustainable Supply Chains end-to-end - Opportunities and data challenges*

6. Andrew Lim Kwang Leng, Director of Corporate Innovation, Technology & Operational Development, Toll Global Logistics
   *Title: Data Analytics - @ Working Mode*

7. Gary J Smith, Regional ICS Director Asia Pacific, TNT Express ICS
   *Title: Enhancing Customer Outcomes: Intelligent Usage of Supply Chain Data*

8. Paul Bradley, Chairman and CEO, Caprica International
   *Title: Dynamic Value Networks and "Virtually Orchestrated Supply Chains"*

| Time | Programme Overview (Veune: Ngee Ann Kongsi Auditorium) |
|---|---|
| 1:00 pm | **Registration** |
| 1:30 pm | **Talks by Government and Academics** |
| 3:30 pm | **Coffee Break** |
| 4:00 pm | **Talks by Industry** |
| 6:00 pm | **Networking Banquet Dinner** (in-conjunction with MIC 2013) <br> The Legends Fort Canning Park, Lavender Ballroom <br> Note: Please kindly refer to page 112 for direction map |
| 10:00 pm | **End** |

| Special Session on Metaheuristics and Optimization/Constraint Programming | | |
|---|---|---|
| 10:45am - 12:30pm | 5th August, Monday | Seminar Room 2.1 |
| Session Chair: Michael Trick | | |

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|---|---|
| **Title** | Estimating the Runtime of Parallel SAT Local Search |
| **Paper No.** | 5 |
| **Authors** | Alejandro Arbelaez, Charlotte Truchet and Philippe Codognet |
| **Abstracts** | This paper presents a detailed analysis of the scalability and parallelization of local search algorithms for the Satisfiability problem. We propose a framework to estimate the parallel performance of a given algorithm by analyzing the runtime behavior of its sequential version. Indeed, by approximating the runtime distribution of the sequential process with statistical methods, the runtime behavior of the parallel process can be predicted by a model based on order statistics. We apply this approach to study the parallel performance of two SAT local search solvers, namely Sparrow and CCASAT, and compare the predicted performances to the results of an actual experimentation on parallel hardware up to 384 cores. We show that the model is accurate and predicts performance close to the empirical data. Moreover, as we study different types of instances (random and crafted), we observe that the local search solvers exhibit different behaviors and that their runtime distributions can be approximated by two types of distributions: exponential (shifted and non-shifted) and lognormal. |

| Title | Optimization of the Arabic Keyboard Layout for Single-pointer Applications |
|---|---|
| Paper No. | 7 |
| Author | Abir Benabid Najjar |

**Abstracts**  This paper introduces an ongoing project that aims to design an Arabic keyboard for applications that predominantly use single pointer input device. Such applications are available in mobile devices like Portable Data Assistant (PDA) and Smartphones, as well as in gaze controlled interfaces which constitute an on-growing mode of communication, especially for people with mobility impairment. We concentrate on the optimization of the key arrangement based on the movement time and character transition frequencies. We show that this optimization problem is a variant of the Quadratic Assignment Problem (QAP). We propose to solve it using Simulated annealing search which is one of the most effective metaheuristic approaches for the QAP. Experimental results show that the proposed layout improves the typing speed and outperforms the commonly used Arabic keyboard as well as the optimized keyboards proposed in the literature.

| Title | Proximity Search |
|---|---|
| **Paper No.** | 22 |
| **Authors** | Matteo Fischetti and Michele Monaci |

| **Abstracts** | Large-Neighborhood Search heuristics for general (possibly nonlinear) Mixed-Integer Programs (MIPs) define a neighborhood of the current incumbent by introducing invalid constraints into the MIP formulation, and use a black-box MIP solver to search the restricted problem. In this work we will address an alternative approach, aimed at making the search easier and at producing a sequence of improved feasible solutions. In particular, we replace the objective function of a 0-1 Mixed-Integer Convex Program by a "proximity" one, with the goal of enhancing the heuristic behavior of the black-box solver. Computational results on different implementations indicate that the approach can be very effective in quickly improving a given starting feasible solution. |

| | |
|---|---|
| **Title** | A Hybrid Constructive Algorithm for the Integrated Task and Shift Scheduling Problem |
| **Paper No.** | 57 |
| **Authors** | Pieter Smet and Greet Vanden Berghe |
| **Abstracts** | In general, personnel rostering deals with assigning either tasks or shifts to a set of (multi-)skilled personnel. The integrated problem of task and shift scheduling has rarely been discussed, while in practice, it is an often occurring problem for which an inefficient solution can lead to large operational expenses. We introduce the single day variant of the integrated task and shift scheduling problem. An exact decomposition approach already greatly improved the required calculation time to find an optimal solution compared to solving a mathematical model of the integrated problem. In this study we present a constructive matheuristic which iteratively solves heuristically delineated subproblems to optimality. Experimental results on a generated benchmark dataset show that the constructive matheuristic finds near-optimal solutions in very short calculation time. |

| Special Session on Multi-Agent Distributed Problem Solving | | |
|---|---|---|
| 10:45am - 12:30pm | 5th August, Monday | Seminar Room 2.2 |
| Session Chair: Haolan Zhang | | |

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|---|---|
| **Title** | Modeling and Solving Multidimensional Optimization Problems with a Distributed Agent-based Matheuristic |
| **Paper No.** | 12 |
| **Authors** | Marc-André Carle |
| **Abstracts** | This paper discusses opportunities of applying agent-based optimization methods to solve large-scale mixed-integer optimization problems with complex structures. We present the Collaborative Agent Teams (CAT) architecture, a matheuristic optimization framework that is designed for such problems. We discuss how to design the key components of a CAT solver for a particular multidimensional optimization problem: the problem representation, the design of agents and their job description. |

| Title | Multi-Agent Orienteering Problem with Time-Dependent Capacity Constraints |
|---|---|
| **Paper No.** | 15 |
| **Authors** | Cen Chen, Shih-Fen Cheng and Hoong Chuin Lau |
| **Abstracts** | In this work, we study of the multi-agent version of the Orienteering problem, where multiple customized routes need to be generated and assigned to different visitors (agents) that respect their respective preferences. The main challenge is that each agent seeks to maximize its own utility, and our goal is to generate routes for multi-agents simultaneously to maximize the overall utility gained while not violating congestion levels. We propose two propose two solution approaches: 1) a mixed integer linear program (MILP) that computes the exact solution; and 2) an effective sampled fictitious play algorithm that considerably reduces the computational time. |

| Title | A Novel Automated Data Warehouse Schema Generator for Large Volume Online Multimedia Data Processing |
| --- | --- |
| **Paper No.** | 31 |
| **Authors** | Dacheng Jiang, Chaoyi Pang, Kedong Ye and Hao Lan Zhang |
| **Abstracts** | A huge volume of user and media data has been generated during the daily operation in online media sites. In this circumstance, traditional database technology cannot fulfill the demand for the increasing data process capacity. In this paper a novel data processing model, i.e. Data Warehouse Schema Generator (DWSG), has been suggested to improve the data processing efficiency through utilizing snow model based on the dependency structure of dimension tables and dimensional hierarchy. The test-bed work has been conducted in Newvod Company (www.newvod.com), an online media company. |

| Title | Negotiation-based Scheduling of Interfering Job Sets on a Single Machine |
| --- | --- |
| **Paper No.** | 50 |
| **Authors** | Rene Ramacher and Lars Mönch |
| **Abstracts** | In this paper, we consider a single-machine scheduling problem where the jobs belong to two agents that have private objectives. The maximum lateness is used as the objective for each of the two agents. We propose an automated negotiation scheme based on a mediator that proposes contracts using variable neighborhood search (VNS). In addition, we propose an alternative memetic algorithm-based negotiation scheme. We show by preliminary computational experiments that the two metaheuristic-based schemes are able to determine solutions that are close to the Pareto frontier that is determined using full information. |

| Special Session on Metaheuristics and Big Data Analytics | | |
|---|---|---|
| 2:00pm - 3:15pm | 5th August, Monday | Seminar Room 2.1 |
| Session Chair: Vincent Cheng-Siong Lee | | |

| Title | Solving Large p-Median Problems Using Hybridization of VNS and Exact Method |
|---|---|
| Paper No. | 29 |
| Authors | Chandra Ade Irawan and Said Salhi |
| Abstracts | A hybridization of aggregation-based technique, Variable Neighborhood Search (VNS), and exact method is proposed to solve very large p-median problems. A multi-stage methodology where learning from previous stages is taken into account is used. Each stage consists of several sub-problems (aggregated problems) that are solved with a Reduced VNS to produce good feasible solutions. An efficient way to aggregate the data is proposed when allocating demand points to their nearest facilities. Within each stage, these feasible solutions are gathered to make up a new promising subset of potential facilities which is solved by VNS or exact method (CPLEX) depending on the size of the problem. This multi-stage process is repeated several times until a certain criterion is met. Large data sets up to 89,600 demand points with various values of p are used to assess the performance of the proposed approach. |

| Title | Analyzing Dynamic Categorical Influence in Mobile Phone Social Networks |
|---|---|
| Paper No. | 37 |
| Authors | Siyuan Liu and Ramayya Krishnan |

| Abstracts | Influence maximization is an interesting and well-motivated problem in social networks study. The traditional influence maximization problem is defined as finding the most "influential" vertices in a static social network. Though it is useful, in practice, most of social networks change along the time, e.g., mobile phone social networks. So, it is more important and useful to capture the vertices having the maximum influence over a period of time. In addition, we also take the influence of vertices in different categories into consideration. Thus, we name this new problem as Dynamic Categorical Influence Maximization (DCIM). Compared with identifying maximum influence vertices in a static single category social network, DCIM is much harder because we have to deal with large scale dynamically updated data with hidden evolving structures. In this work, based on the observations from real mobile phone social network data, we present a Probability Distribution based Search method (PDS) to tackle the DCIM problem. The extensive experiment results show that our methods outperform the existing ones. |
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| Title | Interacting Knapsack Problem in Designing Resource Bundles |
|---|---|
| **Paper No.** | 45 |
| **Authors** | Truong-Huy D. Nguyen, Pradeep Varakantham, Hoong Chuin Lau, Shih-Fen Cheng |
| **Abstracts** | Bundling of resources or services for the benefit of customers and service providers is a well studied problem in the literature. In this paper, we propose to formulate the bundle design problem as a generalized Knapsack problem, named Interacting Knapsack Problem (IKP). Unlike classical KP variants, in IKP the weight and value of each item are dependent on the items that it is bundled with, causing a form of intra-bundle interactivity. This formulation naturally models the group effect that is present in designing attraction bundles (passports) for Theme Park or City Tour, or channel bundles for Cable TV. Given the large data sets of consumers' behavior, we use graphical models to compactly represent the interacting profit and attractiveness of items in the IKP formulation. Preliminary numerical experiments provide some insights on three proposed approaches to solve IKP: integer programming, greedy bundling and local search approaches. |

| Inventory Routing Problems | | |
|---|---|---|
| 2:00pm - 3:15pm | 5th August, Monday | Seminar Room 2.2 |
| Session Chair: Noor Hasnah Moin | | |

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|---|---|
| **Title** | Variable Neighborhood Search for Inventory Routing Problem with Time Varying Demand |
| **Paper No.** | I |
| **Authors** | Huda Zuhrah Ab Halim, Noor Hasnah Moin and Said Salhi |
| **Abstracts** | We consider an inventory routing problem in which multi products are to be collected in multi periods from geographically dispersed suppliers where each supplier supplies a distinct product to the assembly plant. The inventory holding cost at the assembly plant is assumed to be product specific and a fleet of capacitated homogeneous vehicles, housed at a depot, transport products from the suppliers to meet the demand specified by the assembly plant in each period. The problem is formulated as a mixed integer programming problem and is solved to get the lower bound for each problem considered. We propose solution methods based on the Variable Neighborhood Search (VNS) where several heuristics are incorporated at various stages of the algorithm. The VNS adopts Giant Tour procedure for each period and the clusters are built using Dijkstra's algorithm. The algorithms are run on several problems and the results found are compared with the best integer solution obtained by CPLEX. CPLEX fails to give any significant solutions for large problems. |

| Title | Interactive Reference Point-Based Guided Local Search for the Bi-objective Inventory Routing Problem |
|---|---|
| **Paper No.** | 26 |
| **Authors** | Sandra Huber, Martin Josef Geiger and Marc Sevaux |
| **Abstracts** | Eliciting preferences of a decision maker is a key factor to successfully combine search and decision making in an interactive method. Therefore, the progressively integration and simulation of the decision maker is a main concern in an application. We contribute in this direction by proposing an interactive method based on a reference point-based guided local search to the bi-objective Inventory Routing Problem. A local search metaheuristic, working on the delivery intervals, and the Clarke & Wright savings heuristic is employed for the subsequently obtained Vehicle Routing Problem. To elicit preferences, the decision maker selects a reference point to guide the search in interesting sub-regions. Additionally, the reference point is used as a reservation point to discard solutions outside the cone, introduced as a convergence criterion. Computational results of the reference point-based guided local search are reported and analyzed on benchmark data in order to show the applicability of the approach. |

| Title | Scatter Search for Production, Inventory, and Distribution Routing Problem |
|---|---|
| Paper No. | 41 |
| Authors | Noor Hasnah Moin and Titi Yuliana |
| Abstracts | This paper proposes the use of Scatter Search metaheuristic to solve an integrated production, inventory, and distribution routing problem. The problem is based on a single production plant which produces a single product that is delivered to geographically dispersed customers by a set of homogenous fleet of vehicles. The objective is to construct a production plan and delivery schedule to minimize the total costs and ensuring each customer's demand is met over the planning horizon. We assumed that excess production can be stored at the plant or at customer's sites within some limits, but stockouts due to backordering or backlogging are not allowed. Computational testing on a set of randomly generated data is used to assess the effectiveness of our method. We generate the lower bound and best integer solution for the problem with CPLEX as a comparison for the Scatter Search method. The results show that Scatter Search gives better results than the best objectives generated by CPLEX for 12 out of 14 test instances. The gap for the remaining 2 instances is less than 1% when compared to the best integer solutions. |

| New Algorithmic Techniques | | |
|---|---|---|
| 3:45pm - 5:30pm | 5th August, Monday | Seminar Room 2.1 |
| Session Chair: Eric Taillard | | |

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|---|---|
| **Title** | Metaheuristic and Statistical Based Sampling |
| **Paper No.** | 58 |
| **Authors** | Yoel Tenne |
| **Abstracts** | Simulation-driven optimization problems are ubiquitous in engineering and science, and are often solved with metamodel-assisted algorithms. In such algorithms the metamodel approximates the computationally expensive simulation and provides predicted values at a lower computational cost. Such optimization algorithms rely on an initial sample to train a metamodel and to initialize the search, and therefore the initial sample can strongly impact the search effectiveness. Leveraging on the latter issue, this study compares the classical statistical-based sampling approach with the more recent metaheuristic-based sampling. To evaluate the merits of demerits of these two approaches, an extensive set of numerical experiments has been performed. Analysis shows that is was more effective to use metaheuristic-based sampling when the initial sample was large, and statistical sampling when the initial sample size was small. |

| Title | Directed Continuous-GRASP for Global Optimization Problems |
|---|---|
| **Paper No.** | 4 |
| **Authors** | Tiago Maritan Ugulino de Araújo, Lucídio dos Anjos Formiga Cabral, Roberto Quirino do Nascimento and Cláudio N. Meneses |
| **Abstracts** | Continuous-GRASP (C-GRASP) is a recent metaheuristic proposed to solve continuous global optimization problems under box constraints. Proposed by Hirsch et al. [7] the C-GRASP, an adaptation of Greedy Randomized Adaptive Search Procedure (GRASP) to the continuous domain, is simple to implement, derivative-free and widely applicable method. However, C-GRASP and other metaheuristics may be computationally costly due to their relative slow convergence to optimal solutions. To treat the slow convergence, in this paper we propose a method to direct the search on C-GRASP, called Directed Continuous-GRASP (DC-GRASP). The DC-GRASP combines the ability of C-GRASP to diversify the search over the search space with an efficient local search strategy to accelerate its convergence. We compare the DC-GRASP with C-GRASP and other metaheuristics from recent literature on a set of standard test problems whose global minima are known. The computational results show the efficiency and robustness of the method, as well as its ability to accelerate the convergence of C-GRASP. |

| Title | Multiple Local Neighbourhood Search for Extremal Optimisation |
|---|---|
| Paper No. | 51 |
| Authors | Marcus Randall |

| Abstracts | Extremal optimisation (EO) uses a somewhat unusual mechanism to transform one solution into another. This consists of computing a probabilistic worst solution component value, and changing it to a random value. While simple and avoiding problems with premature convergence, it is mostly incompatible with combinatorial problems, particularly those requiring permutations as solution structures. This paper demonstrates that standard local search operators (e.g., 1-opt, 2-opt and 3-opt – used singly or from a neighbourhood) can be readily integrated into the canonical EO framework, without compromising the integrity of the original algorithm. The idea, in some senses may be viewed as a quasi-memetic algorithm. In particular, the primary purpose of this paper is the application and analysis of multiple local search operator neighbourhoods. Issues of solution component ranking techniques and methods for generating local transition operator endpoints are also examined. The difficult and under used asymmetric travelling salesman problem is employed to test these concepts. Results indicate that the simultaneous use of local search operators provides for improved performance over operators used individually. |
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| Large and Variable Depth Neighborhood Search Approaches for Vehicle Routing | | |
|---|---|---|
| 3:45pm - 5:30pm | 5th August, Monday | Seminar Room 2.2 |
| Session Chair: Michel Gendreau | | |

| | |
|---|---|
| **Title** | The Capacitated Arc Routing Problem with Stochastic Service and Travel Times |
| **Paper No.** | 16 |
| **Authors** | Lu Chena, André Langevin and Michel Gendreau |
| **Abstracts** | Despite numerous publications dealing with efficient scheduling methods for the capacitated arc routing problem (CARP), very few addressed the inherent stochastic and dynamic nature of service and time parameters. This paper studies a CARP with both stochastic travel times and stochastic service times, which is motivated by a road network monitoring service application. The problem is formulated as a chance-constrained programming model. A stochastic programming model with recourse is also proposed to take into account the recourse costs in case of route failure. The problem is solved by an adaptive large neighborhood search algorithm. The computational experiments that were performed demonstrate the effectiveness of the algorithm. |

| Title | The Generalized Consistent Vehicle Routing Problem |
|---|---|
| Paper No. | 34 |
| Authors | Attila A. Kovacs, Bruce L. Golden, Richard F. Hartl and Sophie N. Parragh |
| Abstracts | The consistent vehicle routing problem (ConVRP) takes customer satisfaction into account by assigning one driver per customer and by bounding the variation in the arrival times over a given planning horizon. In the generalized ConVRP, each customer is visited by a limited number of drivers and the variation in the arrival times is penalized in the objective function. The vehicle departure times may be adjusted to obtain stable arrival times. Additionally, customers are associated with AM/PM time windows. In contrast to work done on the ConVRP, we do not use the template concept to generate routing plans. Our approach is based on a flexible large neighborhood search that is applied to the entire solution. Several destroy and repair heuristics are available to remove customers from the routes and to reinsert them at better positions. Arrival time consistency is improved by a simple 2-opt operator that reverses parts of particular routes. A computational study is performed on ConVRP benchmark instances and on instances that are adapted for the generalized problem. The results show that the proposed algorithm performs well on different variants of the ConVRP. By experimenting with different input parameters we examine the trade-off between travel cost and customer satisfaction. |

| Title | New Variable Depth Local Search for Multiple Depot Vehicle Scheduling Problems |
|---|---|
| Paper No. | 47 |
| Authors | Tomoshi Otsuki and Kazuyuki Aihara |

**Abstracts**

The multiple depot vehicle scheduling problem (MDVSP) is a well-known and important NP-hard problem in transport scheduling. In this study, we first provide an original interpretation of the search space of the MDVSP. Next, we present a novel local search algorithm which utilizes pruning and deepening techniques in the variable depth search framework. Computational results using well-known test cases show that our method achieves better results than other local search based methods do by an average of at least 23.9%, and exhibits the best short-term performance among the state-of-the-art methods.

| Title | A Solution Clustering based Parallel Metaheuristic for the Capacitated Vehicle Routing Problem |
|---|---|
| **Paper No.** | 38 |
| **Authors** | Arne Løkketangen and Jianyong Jin |
| **Abstracts** | In recent years, cooperative parallel metaheuristics have increasingly been used for solving a variety of difficult combinatorial problems. Such parallel metaheuristics usually use multiple processes (threads) working simultaneously on available processors, with varying degrees of cooperation, to solve a given problem instance. It has been demonstrated that such parallel algorithms are capable of both speeding up the search and improving the robustness (ability of providing equally good solutions to a large and varied set of problem instances) and the quality of the solutions obtained. A solution clustering approach can be used in this framework to implicitly identify common features of solutions and collect search history information, which then provide a good basis for selecting promising search areas for intensification and less explored areas for diversification. We aim to adopt Greedy Randomized Adaptive Search Procedure (GRASP) and Path Relinking for developing a solution clustering based parallel metaheuristic. Due to its computational difficulty and practical importance, the capacitated vehicle routing problem is selected for examining the effectiveness of the proposed algorithm. Full computational results on a portfolio of large testcases from the literature will be presented at the conference. |

| Special Session on Metaheuristics and Multiobjective Optimization 1 | | |
|---|---|---|
| 10:00am - 11:15am | 6th August, Tuesday | Seminar Room 2.1 |
| Chair: Xavier Gandibleux | | |

| Title | A Penalty-based Multi-objectivization Approach Using Pareto Local Search |
|---|---|
| Paper No. | 2 |
| Authors | Abdullah Alsheddy |
| Abstracts | In this paper, a new multi-objectivization approach is proposed for solving single-objective optimization problems (SOOP). It translate a SOOP into a multi-objective optimization problem (MOOP) by defining an additional penalty-based objective to the primary objective of the target SOOP, and then applies Pareto Local Search to solve the resulted MOOP. Therefore, PLS helps local search to escape local optima. The application of the new approach to the TSP confirms the potential of this approach, showing a very competitive performance to GLS. |

| Title | Active Learning of Pareto Fronts with Disconnected Feasible Decision and Objective Spaces |
|---|---|
| **Paper No.** | 10 |
| **Authors** | Paolo Campigotto, Andrea Passerini and Roberto Battiti |
| **Abstracts** | |

The Active Learning of Pareto fronts (ALP) algorithm [1] learns an analytical model of the Pareto front from a training set of approximated Pareto-optimal vectors. The training Pareto-optimal vectors are obtained by solving different scalarized instances of the original multi-objective optimization problem (MOP). In order to minimize the computational effort (measured as number of evaluations of the MOP objective functions), informative training objective vectors are selected by applying active learning principles. The experimental results reported in [1] show that ALP outperforms the state-of-the-art MMEA and NSGA-II algorithms over widely-used bi-objective optimization benchmarks, including a set of four well-known MOPS with disconnected Pareto front. However, the benchmarks considered in the experimental comparison have connected feasible decision and objective spaces.

This paper highlights a possible generalization of ALP to tackle MOPs where the feasible decision and objective spaces are disconnected. To validate the ALP extension, the formulation of a well-known MOP is modified to obtain disconnected feasible decision and objective spaces. We are not aware of established benchmark problems in the literature with this feature. Our contribution can also be considered a first attempt to fulfill this lack, in the spirit of simulating real-world optimization tasks.

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|---|---|
| **Title** | Analyzing Criteria Correlation to Minimize the Energy Consumption in WSN |
| **Paper No.** | 19 |
| **Authors** | Christophe Duhamel, Lucas Moreira Guedes, Andréa Cynthia Santos and Axelle Alégoët |
| **Abstracts** | A Wireless Sensor Network (WSN) is an effective tool to gather data on an area. However, its lifetime is often an issue due to the limited battery installed on each sensor. Several works have addressed the optimization of the lifetime with two main criteria: minimizing the number of clusters or minimizing the highest energy consumed by a sensor. We propose to analyze the correlation between these criteria. First by defining an energy consumption model which depends on the energy consumed for each activity (sensing, sending a message, receiving a message and processing data). Then, a bi-objective formulation is proposed and the Pareto front is computed by using a NSGA-II evolutionary algorithm and a simulated annealing. Preliminary results seem to show those criteria are correlated on a set of instances and under the current energy consumption scenario.. |

| Automated Algorithm Design and Parameter Tuning | | |
|---|---|---|
| 10:00am - 11:15am | 6th August, Tuesday | Seminar Room 2.2 |
| Session Chair: Markus Wagner | | |

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|---|---|
| **Title** | Algorithm Selection and Tuning Challenges in Agent-based Optimization: An Empirical Study |
| **Paper No.** | 11 |
| **Authors** | Marc-André Carle |
| **Abstracts** | Agent-based optimization methods are increasingly being seen as effective and robust strategies to solve complex and large-scale optimization problems. However, one faces an important challenge when designing an agent-based approach for a particular problem: which algorithms should each agent use and how should its behavior be set? This study investigates the effectiveness of traditional algorithm selection and parameter tuning strategies in the context of Collaborative Agent Team (CAT) architectures. |

| Title | FloTra: Flower-shape Trajectory Mining for Instance-specific Parameter Tuning |
|---|---|
| Paper No. | 36 |
| Authors | Lindawati, Feida Zhu and Hoong Chuin Lau |
| Abstracts | The performance of a heuristic algorithm is highly dependent on its parameter configuration, yet finding a good parameter configuration is often a time-consuming task. In this paper we propose FloTra, a Flower graph mining for graph search Trajectory pattern extraction for generic instance-specific automated parameter tuning. This algorithm provides efficient extraction of compact and discriminative features of the search trajectory, upon which problem instances are clustered and the corresponding optimal parameter configurations are computed. Experimental evaluations of our approach on the Quadratic Assignment Problem (QAP) show that our approach offers promising improvement over existing parameter tuning algorithms.<br><br>In this work, we introduce FloTra, a technique to uncover important patterns from search trajectory graph for generic instance-specific automated parameter tuning. FloTra is an extension of CluPaTra and SufTra that overcomes their limitation on descriptiveness. FloTra constructs a graph representation of search trajectory and conducts a graph pattern mining to discover specific and important patterns in search trajectory. Using these patterns, FloTra then clusters the Instances and computes a corresponding optimal parameter configuration for each cluster. We have applied our approach on QAP and SCP and show that FloTra gives an encouraging improvement for the overall performance. |

| Title | Towards the Automatic Design of Metaheuristics |
|---|---|
| **Paper No.** | 39 |
| **Authors** | Marie-Eléonore Marmion, Franco Mascia, Manuel López-Ibáñez and Thomas Stützle |
| **Abstracts** | We propose here a practical, unified structure that encompasses many metaheuristics. The proposed structure is unified because it integrates several metaheuristics into a single structure from which we can not only instantiate each of them, but also generate new, complex combinations and variants. Moreover, the structure is practical since we propose a method to instantiate actual algorithms for practical problems in a semi-automatic fashion. |

| Special Session on Metaheuristics and Multiobjective Optimization 2 | | |
|---|---|---|
| 11:15am - 12:30pm | 6th August, Tuesday | Seminar Room 2.1 |
| Chair: Xavier Gandibleux | | |

| Title | Learning to Diversify in Complex Interactive Multiobjective Optimization |
|---|---|
| Paper No. | 42 |
| Authors | Dinara Mukhlisullina, Andrea Passerini and Roberto Battiti |
| Abstracts | Many real-world problems have a natural formulation as Multiobjective Optimization Problems (MOPs), in which multiple conflicting objectives need to be simultaneously optimized. A popular approach to deal with the resulting complexity consists of interacting with the Decision Maker (DM) during optimization, progressively focusing towards her preferred area in the decision space. In BC-EMO, an evolutionary MOP approach based on a "learning while optimizing" strategy, machine learning techniques are used to interactively learn an approximation of the DM utility function, which guides the search for candidate solutions. While extremely effective in early focusing towards the most promising search directions, the algorithm suffers from a lack of diversification in dealing with complex MOP problems: a premature convergence often returns suboptimal solutions. In this paper we address the problem by introducing improved diversification strategies both at the evolutionary level and in DM preference elicitation. Substantial improvements are obtained on challenging benchmark problems with complex Pareto-optimal sets and non-linear DM utility functions. |

| Title | Solving Multiobjective Quadratic Assignment Problem using Hybrid Genetic/Immune Strategy |
|---|---|
| **Paper No.** | 60 |
| **Authors** | Arnaud Zinflou and Caroline Gagné |
| **Abstracts** | GISMOO (Genetic Immune Strategy for Multiple Objective Optimization) is a hybrid Pareto algorithm for solving multiobjective problems. The performance of this approach was assessed using a classical combinatorial multiobjective optimization benchmark: the multiobjective 0/1 knap-sack problem (MOKP) and two-dimensional non-constraint multiobjective problems (ZDT). This paper shows that GISMOO algorithm can also solve efficiently the multiobjective quadratic assignment problem (mQAP). A comparison of the performance is carried out using well-known published algorithms and proves an advantage for GISMOO. |

| Algorithm Configuration and Test Case Generation | | |
|---|---|---|
| 11:15am - 12:30pm | 6th August, Tuesday | Seminar Room 2.2 |
| Session Chair: Celso Ribeiro | | |

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|---|---|
| **Title** | Heuristically Creating Test Cases for Program Verification Systems |
| **Paper No.** | 6 |
| **Authors** | Bernhard Beckert, Thorsten Bormer, and Markus Wagner |
| **Abstracts** | The correctness of program verification systems is of great importance, as they are used to formally prove that safety- and security-critical programs follow their specification. This correctness needs to be checked and demonstrated to users and certification agencies. One of the contributing factors to the correctness of the whole verification system is the correctness of the background axiomatization, which captures the semantics of the target program language. We present an optimization framework for the maximization of the proportion of the axiomatization that is used ("covered") during  testing of the verification tool. We show how test cases for regression tests can be created based on existing ones, as the initial creation of test cases is a very time consuming process. Our study shows that the combination of different heuristics leads to a diverse set of test cases, which in turn increases the axiomatization coverage. This translates into a significant increase in trust in the program verification system. |

| Title | Biased and Unbiased Random-key Genetic Algorithms: An Experimental Analysis |
|---|---|
| **Paper No.** | 24 |
| **Authors** | José F. Goncalves, Mauricio G. C. Resende and Rodrigo F. Toso |
| **Abstracts** | We study the runtime performance of three types of random-key genetic algorithms: the unbiased algorithm of Bean (1994); the biased algorithm of Goncalves and Resende (2011); and a greedy version of Bean's algorithm on 12 instances from four types of covering problems: general-cost set covering, Steiner triple covering, general-cost set k-covering, and unit-cost covering by pairs. Experiments are run to construct runtime distributions for all heuristic/instance pairs. For all pairs of heuristics, we compute probabilities that one heuristic is faster than the other on each of 12 instances. The experiments show that, in 11 of the 12 instances, the greedy version of Bean's algorithm is faster than Bean's original method and that the biased variant is faster than both variants of Bean's algorithm. |

| Title | Analysing Differences between Algorithm Configurations through Ablation |
|---|---|
| **Paper No.** | 21 |
| **Authors** | Chris Fawcett and Holger H. Hoos |

| **Abstracts** | Developers of high-performance algorithms for hard computational problems increasingly take advantage of automated algorithm configuration tools, and consequently often create solvers with many parameters and vast configuration spaces. However, there has been very little work to help these algorithm developers answer questions about the high-quality configurations produced by these tools, specifically about which parameter changes contribute most to improved performance. In this work, we present an automated technique for answering such questions by performing ablation analysis between two algorithm configurations. We perform an extensive empirical analysis of our technique on five scenarios from propositional satisfiability, mixed-integer programming and AI planning, and show that in all of these scenarios more than 95% of the performance gains between default configurations and configurations obtained by using automated configuration tools can be explained by modifying the values of a small number of parameters (1–4 in the scenarios we studied). |
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| Telecommunication Applications | | |
| --- | --- | --- |
| 10:00am - 11:15am | 7th August, Wednesday | Seminar Room 2.1 |
| Session Chair: Christophe Duhamel | | |

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| **Title** | A Memetic Algorithm for the Virtual Network Mapping Problem |
| **Paper No.** | 28 |
| **Authors** | Johannes Inführ and Günther Raidl |
| **Abstracts** | The Virtual Network Mapping Problem arises in the context of Future Internet research. The core idea is the introduction of virtual networks to the Internet to be able to improve its functionality in a non-disruptive way. This also enables the creation of specialized networks which directly provide functionality required by some application classes. The challenge of fitting all the virtual networks (and the resources they require) into a physical network is the Virtual Network Mapping Problem. In this work, we introduce a Memetic Algorithm that significantly outperforms the previously best algorithms for this problem. We also offer an analysis of the influence of different problem representations and in particular the implementation of an uniform crossover for the Grouping Genetic Algorithm that may also be interesting outside of the Virtual Network Mapping domain. |

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|---|---|
| **Title** | Clique and Independent Set Based GRASP Approaches for the Regenerator Location Problem |
| **Paper No.** | 30 |
| **Authors** | Peter Jahrmann and Günther Raidl |
| **Abstracts** | We consider the Regenerator Location Problem (RLP) in optical fibre communication networks: As optical signals deteriorate in dependence of the distance from the source, regenerator devices need to be installed at a subset of the network nodes so that no segment of any communication path without an intermediate regenerator exceeds an allowed maximum length. The objective is to place a smallest possible number of regenerators in order to satisfy this condition. We propose two new construction heuristics based on identifying and exploiting cliques and independent sets of the network graph. These strategies are further extended to Greedy Randomized Adaptive Search Procedures (GRASP) that also include new destroy and recreate local search phases. Excellent results are obtained in an experimental comparison with a previously described GRASP. |

| Title | Minimizing Energy Consumption on a Hop-constrained WSN using a Delay-constrained Mobile Agent |
|---|---|
| **Paper No.** | 52 |
| **Authors** | Oberlan Christo Romão, André Gustavo dos Santos and Geraldo Robson Mateus |

**Abstracts**    Wireless Sensor Networks (WSNs) have emerged as an attractive and challenging research field. One of the main challenges lies in the constrained energy resources available to sensor nodes: sensors are usually deployed in inhospitable environments and in large quantities, which turns difficult or impossible to replace or to recharge their batteries. A possible way to save energy is to use a mobile agent to collect the data moving through the WSN. But this approach increases the messages delivery delay. In this work we use a communication forest, where the roots of the trees are cluster heads sensors visited by the mobile agent; the other sensors transmit their information to the cluster heads using one or more hops. We introduce a hybrid approach using GRASP to select the cluster heads, and constructive heuristics with local search to define the communication forest and the mobile agent route, in order to minimize the total energy consumption within a limited delay. Results are presented for WSN with up to 80 sensors with different limits for the mobile agent route length, to control the delivery delay of messages. The optimality of instances with 20 and 30 nodes was confirmed by solving a Mixed-Integer Linear Programming formulation.

| Logistics  Problems | | |
|---|---|---|
| 10:00am - 11:15am | 7th August, Wednesday | Seminar Room 2.1 |
| Session Chair: Stefan Voss | | |

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|---|---|
| **Title** | A Hybrid Algorithm for the Vehicle Routing Problem with Backhauls and 3D Loading Constraints |
| **Paper No.** | 9 |
| **Authors** | Andreas Bortfeldt, Thomas Hahn and Lars Mönch |
| **Abstracts** | In this contribution, we extend the vehicle routing problem with backhauls (VRPB) to an integrated routing and three-dimensional loading problem. A hybrid metaheuristic algorithm for the extended problem is proposed and some preliminary computational results are reported. The results clearly show the benefits of taking into account the load constraints. |

| Title | Integrated Timetabling and Vehicle Scheduling for Periods of Low Demand |
|---|---|
| **Paper No.** | 54 |
| **Authors** | Verena Schmid and Jan Fabian Ehmke |
| **Abstracts** | Planning of public transportation services includes several steps that are usually performed in a sequential manner. However, this might lead to suboptimal solutions where small shifts of trips could result in savings in the subsequent vehicle scheduling step. Hence we consider an integration of timetabling and vehicle scheduling for periods of low demand. In this presentation we introduce a mathematical model and sketch our solution approach, which is based on a hybrid metaheuristic. In our proposed solution approach, the problem is decomposed in a routing and scheduling component. A real-world data set consisting of lines, trips and departure time windows allows for evaluation of the performance of the integrated solution approach. |

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| **Title** | A Randomized Algorithm Based on Variable Neighborhood for the Strip Packing Problem |
| **Paper No.** | 35 |
| **Authors** | Stehpen C.H. Leung, Defu Zhang and Shibao Hong |
| **Abstracts** | The strip packing problem has a lot of applications. This paper proposes a randomized algorithm based on variable neighborhood search for tackling the strip packing problem. The presented algorithm can be seen as a hybrid metaheuristic, because it combines an improved heuristic algorithm with a variable neighborhood search. Different neighborhoods are constructed. Computational results on a diverse set of problem instances show that the proposed algorithm is very competitive with current state-of-the-art algorithms. |

| Location and Assignment Problems | | |
|---|---|---|
| 11:15am - 12:30pm | 7th August, Wednesday | Seminar Room 2.1 |
| Session Chair: Marcus Randall | | |

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|---|---|
| **Title** | A Hybrid Algorithm for the Redundancy Allocation Problem |
| **Paper No.** | 13 |
| **Authors** | Marco Caserta and Stefan Voss |
| **Abstracts** | In this paper a hybrid algorithm for the Redundancy Allocation Problem is presented. The problem is the allocation of redundant components within series-parallel systems. We present an algorithm that deals with the classical formulation, where at least one component per subsystem must be included in the final configuration, as well as the k-out-of-n formulation, in which at least k components per subsystem must be included in the final network configuration. We propose a three-phase scheme in which the Cross Entropy Method, the Corridor Method and a Dynamic Programming-based scheme are effectively intertwined. Computational results on well-known benchmark instances are presented, proving the effectiveness and robustness of the proposed algorithm. |

| Title | A Matheuristic for the Leader-follower Facility Location and Design Problem |
|---|---|
| **Paper No.** | 32 |
| **Authors** | Yury Kochetov, Nina Kochetova and Alexandr Plyasunov |

| **Abstracts** | Two players, a leader and a follower, open facilities and compete to attract clients from a given market. Each player has a budget and maximizes own market share. Each client splits own demand probabilistically over all opened facilities by the gravity rule. The goal is to find the location and design of the leader facilities to maximize his market share. We present a matheuristic for this game based on the best response strategy. Computational results for the discrete games are discussed. |

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|---|---|
| **Title** | Heuristics for Setting Directions in Urban Networks |
| **Paper No.** | 53 |
| **Authors** | Andréa Cynthia Santos, Christophe Duhamel and Christian Prins |
| **Abstracts** | The complexity of metropolitan urban areas raises new challenges to manage and to adapt the urban network transportation, among them several optimization problems have emerged. This work addresses tactical problems of setting directions in urban networks for minimizing travel distance, but also to act as deterrent policy. We propose hybrid metaheuristics based on Iterated Local Search (ILS), i.e. Evolutionary LS (ELS) and Relaxed ELS (RELS). Preliminary experiments have been performed on real and simulated instances. |

| Special Session on Dynamic Vehicle Routing | | |
|---|---|---|
| 11:15am - 12:30pm | 7th August, Wednesday | Seminar Room 2.2 |
| Chair: Victor Pillac | | |

| Title | On the Vehicle Routing Problem with Stochastic Demands and Duration Constraints: Formulations and a Hybrid Metaheuristic Approach |
|---|---|
| Paper No. | 40 |
| Authors | Jorge E. Mendoza, Louis-Martin Rousseau and Juan G. Villegas |
| Abstracts | The vehicle routing problem with stochastic demands (VRPSD) consists in designing transportation routes of minimal expected cost to satisfy a set of customers with random demands of known probability distributions. In this research we present two strategies to deal with route duration constraints in the VRPSD. To solve the resulting problem, we proposed a greedy randomized adaptive search procedure (GRASP) with a post optimization procedure. The GRASP component uses a set of randomized route-first, cluster-second heuristics to generate starting solutions and a variable neighborhood descent (VND) procedure to carry on the local search phase. The post optimizer selects the best possible routes to assemble the final solution from the set of all routes found in the local optima reached by the GRASP. We discuss extensive computational experiments analysing the cost of considering route duration constraints on the VRPSD. In addition, we report state-of-the-art solutions for a established set of benchmarks for the classical VRPSD. |

| Title | Improving Solutions for Dynamic and Stochastic Maritime Pick-up and Delivery Problems using Local Search |
|---|---|
| **Paper No.** | 27 |
| **Authors** | Lars Magnus Hvattum and Gregorio Tirado |
| **Abstracts** | Heuristics for stochastic and dynamic vehicle routing problems are often relatively simple, in part due to the high computational burden resulting from having to consider stochastic information in the form of scenarios. In this work, three existing heuristics are extended by three different local search variations: a first improvement descent using stochastic information, a tabu search using stochastic information only when updating the incumbent solution, and a tabu search using stochastic information when selecting moves based on a list of moves determined through a proxy evaluation. |

| Graph Problems and SAT | | |
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| 2:00pm - 3:15pm | 7th August, Wednesday | Seminar Room 2.1 |
| Session Chair: Nysret Musliu | | |

| Title | Variable Neighborhood Search for Extremal Graphs 27: Families of Extremal Graphs |
| --- | --- |
| Paper No. | 3 |
| Authors | Mustapha Aouchiche, Gilles Caporossi and Pierre Hansen |
| Abstracts | The AutoGraphiX system, for interactive and/or automated graph theory, discovers conjectures of algebraic or structural form. In this paper, we focus on the later, i.e. families of extremal graphs for a series of relations between pairs of 20 selected graph invariants. There are 1520 cases, leading to 47 families. They include many classical families but also some apparently new ones (bags, bugs,...). Five ways to exploit them in order to enhance the performance of AutoGraphiX are studied and illustrated by examples. |

| Title | Construction Heuristics for the Maximum Cardinality Quasi-clique Problem |
|---|---|
| **Paper No.** | 46 |
| **Authors** | Andre B. Oliveira, Alexandre Plastino and Celso C. Ribeiro |
| **Abstracts** | Given a graph G=(V,E) and a positive threshold greater than or equal to one, the maximum cardinality quasi-clique problem amounts to finding a maximum cardinality subset C* of the nodes in V such that the density of the graph induced in G by C* is greater than or equal to the threshold. This problem is NP-hard, since it admits the maximum clique problem as a special case. It has a number of applications in data mining, e.g. in social networks or phone call graphs. We propose and improve construction heuristics for the maximum cardinality quasi-clique problem and develop computational experiments comparing three main groups of construction heuristics: greedy constructive heuristics, reconstruction heuristics, and pattern-based hybrid heuristics. |

| Title | A Penalty Function Approach to Max 3-SAT Problems |
|---|---|
| **Paper No.** | 33 |
| **Authors** | Christian Kofler, Peter Greistorfer, Haibo Wang and Gary Kochenberger |
| **Abstracts** | We consider a penalty function approach for the solving of the Max 3-SAT problem. The algorithm introduced is a multi-start approach that makes use of elite-solution techniques derived from scatter search. More precisely, it is based on the so-called adaptive memory projection metaphor. In this paper we review the literature in that field, explain the metaheuristic proposed and present some results on the basis of a DIMACS test set. |

| Tabu and Variable Neighborhood Search for Vehicle Routing | | |
|---|---|---|
| 2:00pm - 3:15pm | 7th August, Wednesday | Seminar Room 2.2 |
| Session Chair: Alexander Hämmerle | | |

| Title | Metaheuristics for Time-dependent Multi-zone Multi-trip Vehicle Routing Problems with Time Windows |
|---|---|
| Paper No. | 17 |
| Authors | Teodor Gabriel Crainic, Phuong Nguyen Khanh and Michel Toulouse |
| Abstracts | We propose a tabu search meta-heuristic for the Time-dependent Multi-zone Multi-trip Vehicle Routing Problem with Time Windows. Two types of neighborhoods, corresponding to the two sets of decisions of the problem, together with a strategy controlling the selection of the neighborhood type for particular phases of the search, provide the means to set up and combine exploration and exploitation capabilities for the search. A diversification strategy, guided by an elite solution set and a frequency-based memory, is also used to drive the search to potentially unexplored good regions and, hopefully, enhance the solution quality. Extensive numerical experiments and comparisons with the literature show that the proposed tabu search yields very high quality solutions, improving those currently published. |

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|---|---|
| **Title** | Comparing Multi Neighborhood Strategies for Rich Vehicle Routing Problems **(Cancelled)** |
| **Paper No.** | 18 |
| **Authors** | Ulrich Derigs and Markus Pullmann |
| **Abstracts** | In this paper we report the results of an extensive computational study on a variety of rich vehicle routing problems in which two fundamentally different paradigms or strategies of applying (the same set of) different neighborhoods are assessed with respect to effectivity (solution quality) and efficiency (speed). We especially compare the structured approach known from variable neighborhood search where neighborhoods are applied in some fixed sequential order with an approach where neighborhoods are applied concurrently chosen at random. Since all approaches are implemented using the same basic modules differences can be attributed to this strategic difference. We can show that, first, the application of large neighborhoods are essential for quality, and, second, that the concurrent strategy outperforms the sequential strategy. |

| | |
|---|---|
| **Title** | Characterizing Instances and Optimizing Algorithms for Vehicle Routing Problems |
| **Paper No.** | 48 |
| **Authors** | Fritz Payr |
| **Abstracts** | In ongoing work, we find that Empirical Performance Models, introduced 2012 by Hutter et al. [3], allow unprecedented insights into the "mechanics" of vehicle routing algorithms. The results will allow incrementally improved characterization of instances, and the development of new algorithms that take better advantage of instance features. |

| Scheduling | | |
|---|---|---|
| 3:45pm - 5:30pm | 7th August, Wednesday | Seminar Room 2.1 |
| Session Chair: Andréa Cynthia Santos | | |

| Title | A Biased Random-key Genetic Algorithm for Job-shop Scheduling |
|---|---|
| Paper No. | 23 |
| Authors | José Fernando Gonçalves, Maurício G. C. Resende and José Abílio Oliveira Matos |
| Abstracts | This paper presents a local search, based on a new neighborhood for the job-shop scheduling problem, and its application within a biased random-key genetic algorithm (BRKGA). Schedules are constructed by decoding the chromosome supplied by the genetic algorithm with a procedure that generates active schedules. After an initial schedule is obtained, a local search heuristic, based on an extension of the graphical method of Akers (1956), is applied to improve the solution. The new heuristic is tested on a set of 205 standard instances taken from the job-shop scheduling literature and compared with results obtained by other approaches. The new algorithm improved the best known solution values for 57 instances. |

| Title | Applying Machine Learning for Solver Selection in Scheduling: A Case Study |
|---|---|
| **Paper No.** | 43 |
| **Authors** | Nysret Musliu |

| Abstracts | We investigate the automated algorithm selection for a workforce scheduling problem that is solved by two different approaches. The solver based on constraint programming techniques has several advantages and it has been used successfully in the industry. However, this algorithm can not solve very large instances in a reasonable amount of time. The metaheuristic solver overcomes this limitation and is able to find solutions even for huge real world instances. We apply machine learning algorithms to select the best suited solver for a particular instance based on problem features. The preliminary experimental results on application of different learning techniques are presented. |
|---|---|

| Title | An Iterated Greedy metaheuristic for the Job Shop Scheduling Problem with Blockings |
|---|---|
| **Paper No.** | 49 |
| **Authors** | Marco Pranzo and Dario Pacciarelli |
| **Abstracts** | In this paper we consider a job shop scheduling problem with blocking (zero buffer) constraints. This scheduling problem is receiving an increasing interest in the recent literature and arises when no buffer is available between machine to accommodate the jobs. Namely we consider two variants of the problem and solve them with an Iterated Greedy (IG) algorithm. The IG is a metaheuristic based on the repetition of a destruction phase, which removes part of the solution, and a construction phase, in which a new solution is obtained by applying an underlying greedy algorithm starting from the partial solution. Comparison with recent published results shows that the iterated greedy outperforms other state-of-the-art algorithms on benchmark instances. Moreover it is conceptually easy to implement and has a broad applicability to other constrained scheduling problems. |

| Population Based Metaheuristics for Vehicle Routing | | |
|---|---|---|
| 3:45pm - 5:30pm | 7th August, Wednesday | Seminar Room 2.2 |
| Session Chair: Andreas Bortfeldt | | |

| Title | An Enhancement of Edge Assembly Crossover for the Capacitated Vehicle Routing Problem |
|---|---|
| Paper No. | 44 |
| Authors | Yuichi Nagata and Isao Ono |
| Abstracts | In our previous work, we proposed a powerful memetic algorithm (MA) for the capacitated vehicle routing problem (CVRP). One important component of this MA is an crossover operator called edge assembly crossover (EAX), which was originally designed for the traveling salesman problem (TSP) and was adapted to the CVRP. In this paper, we further improve EAX by incorporating the nature of the CVRP into the basic procedure of EAX. The MA with the new EAX variant improves the performance of our previous MA and outperforms leading algorithms for the CVRP. The proposed MA found four new best-known solutions for well-studied benchmark problems. |

| Title | The Multi Trip Vehicle Routing Problem with Time Windows and Release Dates |
|---|---|
| **Paper No.** | 14 |
| **Authors** | Diego Cattaruzza, Nabil Absi, Dominique Feillet, Olivier Guyon and Xavier Libeaut |
| **Abstracts** | In this paper the Multi Trip Vehicle Routing Problem with Time Windows and Release Dates is introduced. The problem is particularly interesting in the City Logistics context, where trucks deliver merchandise to depots located in the outskirts of the city. Goods continuously arrive during the day becoming available for final distribution after the working day has started. This introduces the concept of release dates associated with merchandise. In this paper, a set of instances is introduced and a hybrid genetic algorithm is proposed to solve the problem. |

| Title | Forming Transport Chains for Intermodal Freight Transport |
|---|---|
| **Paper No.** | 25 |
| **Authors** | Alexander Hämmerle, James I. M. Picken, Michael Huemer, Herbert Peherstorfer and Bernhard Fürst |
| **Abstracts** | Our work-in-progress is motivated by the practical problem of a freight forwarder forming intermodal transport chains in order to satisfy a set of transport requests. With intermodality we refer to the fact that (a) a transport chain may encompass multiple modes of transport (e.g. road, rail and barge), and (b) transport is containerized. The formation of transport chains has to consider the optimization of certain criteria, like transport cost and throughput time, hence the freight forwarder is confronted with a multi-objective optimization problem. In order to solve the problem we follow two approaches: (a) ant colony optimization, and (b) mixed integer programming. Both approaches use utility functions to handle multi-objective optimization. Computational results are obtained with four real-world test cases provided by Austrian freight forwarding companies.The benchmarks with Pareto optimal solutions calculated with mixed integer programming show good performance from ACO. |

| | |
|---|---|
| **Title** | Unified Solution Approaches for Vehicle Routing Problems |
| **Paper No.** | 59 |
| **Authors** | Thibaut Vidal, Teodor Gabriel Crainic, Michel Gendreau and Christian Prins |
| **Abstracts** | A new component-based heuristic framework and a Unified Hybrid Genetic Search (UHGS) are proposed to address a large range of vehicle routing variants, with multiple attributes, in a generalist way. The proposed UHGS relies on problem-independent local searches, genetic operators, solution encoding and advanced diversity management methods. Adaptive assignment, sequencing, and route-evaluation components are used to make the interface with problem-specific knowledge. Extensive computational experiments on 26 prominent VRP variants, 39 benchmark instance sets, and a total of 1008 instances demonstrate the remarkable performance of UHGS, which matches or outperforms the current best problem-tailored algorithms extracted from more than 180 articles, revealing that generality does not necessarily alter effectiveness for the considered families of problems. |

| Further Applications | | |
|---|---|---|
| 10:00am - 11:15am | 8th August, Thursday | Seminar Room 2.1 |
| Session Chair: Defu Zhang | | |

| | |
|---|---|
| **Title** | Generalized Quadratic Assignment Model for the PBX Telephone Migration Scheduling Problem: An Approach via GRASP with Path-relinking |
| **Paper No.** | 56 |
| **Authors** | Ricardo M. A. Silva, Mauricio G. C. Resende, Geraldo R. Mateus, Panos M. Pardalos and Diogo V. Andrade |
| **Abstracts** | This paper proposes a mathematical formulation for the PBX telephone migration scheduling problem (PBX-TMSP) based on the generalized quadratic assignment problem (GQAP). This problem was introduced by Andrade and Resende (2006) from a real situation involving a client organization of AT&T company. Andrade and Resende (2006) presented a greedy randomized adaptive search procedure (GRASP) for this real PBX-TMSP instance. In this paper, we adapt the GRASP with path-relinking (GRASP-PR) heuristic for GQAP, introduced by Mateus et al. (2011), for the PBX-TMSP problem. Computational experiments demonstrate the effectiveness and efficiency of the GRASP-PR heuristic (Mateus et al., 2011) for this real problem. |

| Title | A Modified Scatter Search Approach to Solve the DNA Fragment Assembly Problem |
|---|---|
| **Paper No.** | 55 |
| **Authors** | Ayon Sen, Tahmid-un-Nabi, Pritom Ahmed, Rezwana Reaz, A. S. M. Sohidull Islam and M. Sohel Rahman |
| **Abstracts** | One of the critical challenges faced by computational biologists is the DNA Fragment Assembly problem where we are given a set of DNA fragments and have to reconstruct a complete DNA sequence from them. This problem is NP-hard. As a result, it is not easy to obtain accurate solutions. In this paper, we propose a modified version of Scatter Search metaheuristic algorithm to solve the DNA Fragment Assembly problem and present our experimental results that show that our algorithm outperforms state of the art algorithms in terms of both total overlap count and contig count for larger DNA sequences. |

| Title | Image Segmentation using Improved Fuzzy c-means Clustering Algorithm Initialized with Particle Swarm Optimization |
|---|---|
| **Paper No.** | 8 |
| **Authors** | Ahmed Nasreddine Benaichouche, Hamouche Oulhadj and Patrick Siarry |
| **Abstracts** | In this paper, we propose an improvement method for image segmentation using the fuzzy c-means clustering algorithm (FCM). This algorithm is widely experimented in the field of image segmentation with very successful results. However, the use of this method in image segmentation problem still has some inconvenients (local minimum trap, absence of local or spatial information in the segmentation criterion, Euclidean distance). The local minimum trap problem is resolved using the particle swarm optimization algorithm as an initialization step. The FCM segmentation criterion is also improved by taking into account the spatial and local informations in the image and the use of Mahalanobis distance to reduce the influence of the geometrical shape of the different classes. The proposed method was evaluated on several synthetic and simulated MRI images and compared to six FCM-based segmentation |

| Late Breaking Contributions Session | | |
|---|---|---|
| 10:00am - 11:45am | 8th August, Thursday | Seminar Room 2.2 |
| Session Chair: Ibrahim Hassan Osman | | |

| Title | Cardinality Constrained Portfolio Optimization Using Cuckoo Search |
|---|---|
| Authors | Ibrahim H. Osman and Karl Sawaya |
| Abstracts | This paper presents a new heuristic method for solving the cardinality portfolio optimization problem with constraints on the number of assets to invest in. Adding the cardinality constraint makes the problem NP-complete, hence it is not solvable to optimality by simplex algorithms. As a consequence, heuristics and meta-heuristics approximate methods become the only optimization tools which provide good solutions in a reasonable time frame. Recently, a new meta-heuristic algorithm called Cuckoo Search (CS) was introduced by Yang and Deb (2009) to provide significant improved results to continuous optimization problems. To the authors' knowledge, this paper presents the first application of the CS algorithm to the cardinality portfolio optimization (CPO) problem. Our implementation involves a master solver, CS, to explore the cardinality search space using Levy flights, and a slave solver, (a simple algorithm solver), to find the optimal allocation of investment weights for a chosen set of assets. There are two main contribution of the paper. First, it introduces a new mapping between the continuous search space and the sequencing search space to guide the search of solution space.<br><br>(continue on next page) |

**Abstracts (cont)**

Second, the solution quality contribution demonstrated by the experimental results that were obtained by the hybrid algorithm (mataheuristic) for a set of benchmark data set from the literature. The results compare favorably to previously published results with new found solutions. Further research directions are also reported.

| Title | Iterated Restricted Search Space: An Application for Solving a Location-Routing Problem |
|---|---|
| Authors | Patrick Soriano, José Eduardo Pécora Jr. and Angel Ruìz |

**Abstracts**

Despite recent advances in both heuristic and implicit enumeration methods, exploring the whole solution space for large scaled problems remains, in most of practical cases, intractable. Indeed, enumeration and heuristic methods share their ability to thoroughly explore limited regions of the solution space. However, for different reasons they both fail to do it efficiently when the size of the solution space increases as in the case of most of real-life problems. Therefore, most of the research efforts in the last ten years have been concentrated in increasing the robustness of solution methods. In particular, the idea of hybridizing two or several methods has been brought in to address what we call the intensification/ diversification dilemma.

The distributed approach here presented proposes a framework for the design of efficient search algorithms where the main idea is to separate the problem to solve into at least two subproblems which will be linked in a hierarchical manner. Specific solving methods will be designed for each of these subproblems. Collaboration mechanisms allow the exchange of information between the two solving methods, which are applied alternatively for a fixed number of times or until the allotted searching time is expired.

| | |
|---|---|
| **Abstracts (cont)** | The idea of hybridizing is also encompassed. Each method solves a different part of the problem, and the interactions between the two methods lead to better, hopefully the optimal, solutions. This chapter elaborates on the main concepts underlying the distributed framework and illustrates its implementation on the location routing problem, a well known yet difficult to solve problem. Our preliminary numerical results show the excellent performance of the approach when compared to the results reported in the literature. |

| **Title** | Flying Elephants: A General Method for Solving Non-Differentiable Problems |
| --- | --- |
| **Authors** | Adilson E. Xavier and Vinicius L. Xavier |

| **Abstracts** | Flying Elephants (FE) is a generalization and a new interpretation of the Hyperbolic Smoothing approach. The article introduces the fundamental smoothing procedures. It presents a general review of successful applications of the approach for solving a select set of five important problems, such as: geometric distance, covering, clustering, Fermat-Weber and hub location. For each problem it is presented the original non-smooth formulation and the succedaneous completely differentiable one. Computational experiments for all related problems obtained unprecedented results, which exhibited a high level of performance according to the different criteria of consistency, robustness and efficiency. For each problem it is also presented some results to illustrate the performance of FE. |
| --- | --- |

# Conference Venue

**MIG 2013**

The conference will be held within the Singapore Management University (SMU) campus - **School of Accountancy Level 2, Ngee Ann Kongsi Auditorium and Seminars Rooms** (please refer to SMU campus map on page 106). Purpose-built over 4.5 hectares of prime Singapore land, SMU's campus is the first of its kind designed, integrated and constructed in the heart of a fully developed cityscape.
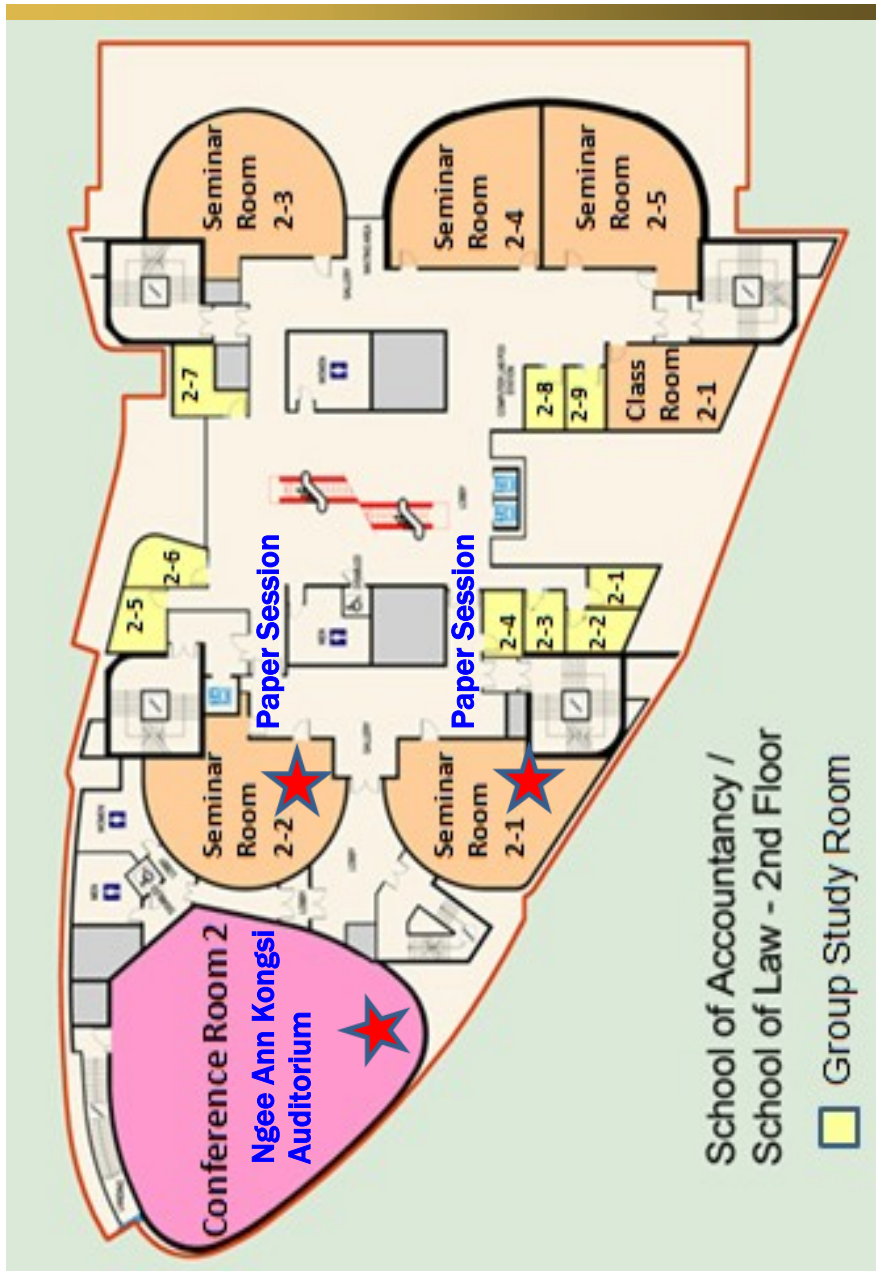
Surrounded by museums, theatres, educational institutions, art galleries, cafés, restaurants and a range of retail outlets, planning and development of the SMU campus involved a broad spectrum of professional, community, civic and public groups who together were intent are on creating a unique city campus directed towards the challenges of the new millennium, and yet connected to the historical origins of this important district. The campus comprises six buildings — the six schools, the Li Ka Shing Library and the Administration Building.

The buildings between Bras Basah and Stamford Roads are fronted by trees, with the park landscape of the Campus Green right in the centre, and have glazed facades shaded by a veil of plants growing at each storey.

The campus has porous structures that engage the surroundings with open courtyards and free-flowing walkways and allow for an easy and natural integration with activities of the city. The campus design and structure reflect and support the character of SMU's curriculum and its style of teaching.

# SMU Campus Map

MIC 2013

**Legend:**
- MRT
- Taxi Stand
- Bus Stop
- P SMU Carpark
- P Carpark
- Drop Off
- Concourse

**Conference Reception & Lunch**

**Conference Venue**

**Conference Banquet**

Bugis MRT

Carlton Hotel

CHIJMES

Victoria Street

Bras Basah Road

SMU Administration Building

NTUC Income Centre

6

Cathedral of the Good Shepherd

Queen Street

Singapore Art Museum

Waterloo Street

Bras Basah Road

University Square

Stamford Road

4

Lee Kong Chian School of Business

Victoria Street

City Hall MRT

3

Plaza by the Park

Bencoolen Street

1

Bras Basah MRT

Concourse

Campus Green

Li Ka Shing Library

Concourse

Visitor Centre

Stamford Road

Stamford Road

Rendezvous Hotel

Bras Basah Road

School of Economics
School of Social Sciences

Bencoolen Street

School of Information Systems

Stamford Road

5

School of Accountancy
School of Law

Stamford Road

Fort Canning Tunnel

Canning Link

SMU Gallery

Prinsep St

SMU Residences @ Prinsep

Orchard Road

YMCA

Fort Canning Road

2

Dhoby Ghaut MRT

National Museum of Singapore

Fort Canning Rise

Fort Canning Walk

Fort Canning Park

# MIC 2013

**MRT (train) stations near to SMU:**

1. Bras Basah Station, Circle line
Exit the station at the concourse (basement 1) and follow the overhead signage to reach the School of Accountancy (approximately 5 minutes)

2. Dhoby Ghaut Station, North-South line
Leave the station at exit A and walk past School of Economics/Social Science, School of Information System and Li Ka Shing Library to reach the School of Accountancy (approximately 10 minutes)

3. City Hall Station, East-West line
Leave the station at exit A and walk towards to the School of Business to reach the School of Accountancy (approximately 10 minutes)

*view next page for train map

**Bus services near to SMU:**

4. Victoria Street. Bus stop number 04151
(Bus services: 130, 133, 145, 197, 851, 960)

5. SMU, Stamford Road. Bus stop number 04121
(Bus services: 7, 14, 16, 36, 77, 106, 111, 124, 128, 131, 147, 14E, 162, 166, 167, 171, 174, 175, 190, 502, 700, 857, NR7, 162M, 174E, 502A, 502B, 700A)

6. NTUC Income Centre, Bras Basah Road. Bus stop number 04179 (Bus services: 7, 14, 16, 36, 77, 106, 111, 128, 131, 14E, 162, 167, 171, 175, 502, 518, 587, 590, 598, 700, 857, NR7, 162M, 502A, 502B, 518A, 518B, 700A)

MIC 2013

Kranji NS7

Woodlands NS9

Semba NS1

Marsiling NS8

Admiralty NS10

Yew Tee NS5

Bukit Panjang LRT BP

Ten Mile Junction BP14

Senja BP13

Segar BP11

South View BP2

Teck Whye BP4

Bukit Panjang BP6

Jelapang BP12

Fajar BP10

Bangkit BP9

Choa Chu Kang NS4 BP1

Keat Hong BP3

Phoenix BP5

Petir BP7

Pending BP8

Bukit Gombak NS3

Mar

Caldecott CC17

Brad

Botanic Gardens CC19

Toa Payoh

Bukit Batok NS2

Pioneer EW28

Lakeside EW26

Jurong East NS1 EW24

Farrer Road CC20

Novena NS20

2

Joo Koon EW29

Boon Lay EW27

Chinese Garden EW25

4

Holland Village CC21

Newton NS21

Orchard NS22

Clementi EW23

Littl

Dover EW22

Somerset NS23

8

Buona Vista EW21 CC22

one-north CC23

Kent Ridge CC24

Commonwealth EW20

Dhoby Ghaut NS24 NE6 CC1

2

Queenstown EW19

Chinatown NE4

Clark Quay NE5

Haw Par Villa CC25

Redhill EW18

Pasir Panjang CC26

Tiong Bahru EW17

Labrador Park CC27

Outram Park EW16 NE3

Telok Blangah CC28

Tanjong Pagar EW15

HarbourFront NE1 CC29

** sentosa express

6

9

Marina Bay NS27

**FOOTNOTE:**
- * Denote stations which are currently not in operation along existing lines.
- ** Please board the Sentosa Express at VivoCity Lobby, Level 3

# MI✺2✦13

wang

NS13 Yishun 🚌

Thanggam SW4
Fernvale SW5            SW3 Kupang*
                        SW2 Farmway

NS14 Khatib            SW1 Cheng Lim*

Layar SW6
Tongkang SW7
Renjong SW8

NS15 Yio Chu Kang 🚌

🚌 Sengkang NE16 STC

Buangkok NE15

NS16 Ang Mo Kio 🚌

🚌 Hougang NE14

ymount         Lorong Chuan
CC16           CC14

Kovan NE13

NS17 CC15
Bishan 🚌

ddell NS18

Serangoon 🚌
NE12 CC13

NS19

Woodleigh
NE11

CC12 Bartley

Potong Pasir
NE10

CC11 Tai Seng

Boon Keng
NE9

CC10 MacPherson

Farrer Park
NE8

Aljunied          🚌 Eunos          🚌 Bedok
EW9               EW7               EW5

e India
NE7

EW8 CC9          EW6
Paya Lebar       Kembangan

**1**

EW10
Kallang 🚌

EW4 Tanah Merah

Bras
Basah
CC2

EW11
Lavender

CC8 Dakota

Expo
CG1

**3**

EW12
Bugis

CC7 Mountbatten

CG2

🛫 🚌 Changi
Airport

Esplanade
CC3

CC6 Stadium

NS25 EW13
City Hall

CC5 Nicoll Highway

NS26 EW14
Raffles Place

**3**

CC4 Promenade

CE1 Bayfront

7️⃣
NE17 PTC Punggol 🚌
                    PE7 Damai
                    PE6 Oasis
                    PE5 Kadaloor
Cove PE1
Meridian PE2              PE4 Riviera
Coral Edge PE3
                    🚌 Punggol LRT PG
SE1 Compassvale
SE2 Rumbia

Ranggung SE5

Kangkar SE4      SE3 Bakau
                    🚌 Sengkang LRT SK

🚌 Pasir Ris 1️⃣
EW1

🚌 Tampines EW2

Simei EW3

CE2

🔟 5️⃣

## Legend

| | | |
|---|---|---|
| 🚌 North South Line | NS |
| 🚌 East West Line | EW |
| 🚌 North East Line | NE |
| 🚌 Circle Line | CC |
| 🚌 Bukit Panjang LRT | BP |
| 🚌 Sengkang LRT | SK |
| 🚌 Punggol LRT | PG |
| ⭕ Interchange Station | |
| 🚌 Bus Interchange Station | |

# Conference Reception, Lunches and Banquet

**MIC 2013**

| Conference Reception & Lunches (University Lounge, Level 6 SMU Admin Building) | |
|---|---|
| Sunday, 4th August 2013 (Reception) | 5:00 - 9:00 pm |
| Monday, 5th & Tuesday 6th August (Lunches) | 12:30 - 2:00 pm |



Conference Reception will be held at the University Lounge, Level 6 SMU Admin Building. The University Lounge is an ideal venue for networking. It includes a self-serve bar, a snooker table, a foosball table, and reading enclaves in the midst of a modern, comfortable lounge settings

(Please kindly refer to the site map on page 111 for the conference reception location).

| Conference Banquet (The Legends Fort Canning Park, Lavender Ballroom) | |
|---|---|
| Wednesday, 7th August 2013 | 6:00 - 10:00 pm |



Conference banquet will be held at The Legends Fort Canning Park, Lavender **Ballroom.** The banquet site is within walking distance from the conference venue at SMU.

(Please kindly refer to the map on page 112 for the conference banquet location).

OFFICE

CONFERENCE HALL 1

Office

Dining Rm

Function Rm

KITCHEN

CORRIDOR 2

MALE WC

FEMALE WC

LIFT LOBBY 1

CORRIDOR 1

U-Lounge

**University Lounge (Conference Reception)**

# The Legends Fort Canning Park, Lavender Ballroom

MICE 2013
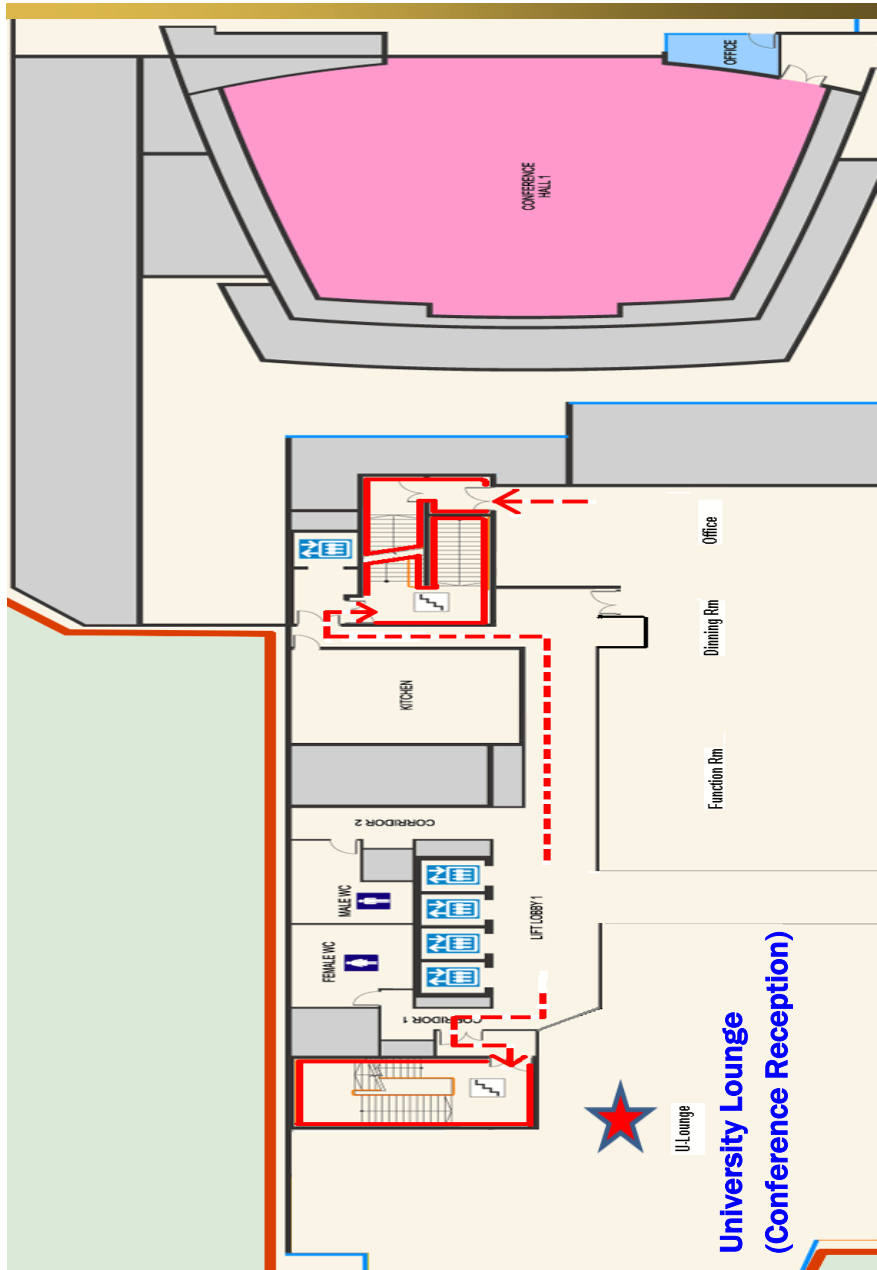
# MIC 2013 — The Legends Fort Canning Park, Lavender Ballroom
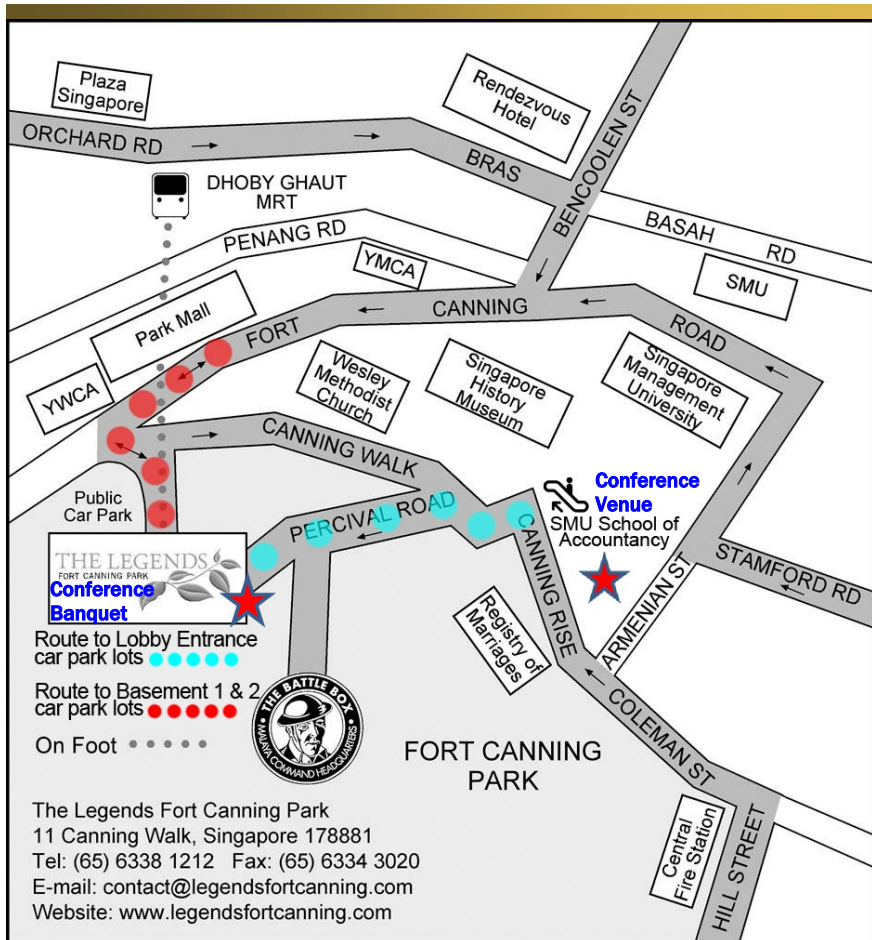
From Dhoby Ghaut MRT Station :

- Exit Dhoby Ghaut MRT Station at Exit B, cross Penang Road to Park Mall.
- At Park Mall lobby, take lift up to Level 4
- Exit glass door to car park, turn left & walk out from the car park bay
- Cross the road and you'll find yourself at the foot of Fort Canning Hill.
- Keep to your right and walk towards the entrance to the Hotel / Club's indoor car park
- On the path way, the staircase is the direct access into the Ballroom area/ foyer or all the way up to the Hotel Lobby & Palm Terrace (outdoor marquee)
- Alternatively, you may also take the Lift inside the carpark up to Level 2 (Hotel Lobby & Palm Terrace).

From Dhoby Ghaut MRT, it takes ± 8 minutes walk to the Hotel / Club.
From Park Mall, it takes ± 5 minutes walk to the Hotel / Club.

Orchard Road – 5 minutes walk
Dhoby Ghaut MRT Station – 5 minutes walk
Clarke Quay/Boat Quay Entertainment Hub – 10 minutes walk
Little India – 10 minutes
Museums & Civic District - 10 minutes walk

MI✦2◆13

| Social Event (River Safari, 80 Mandai Lake Road, Singapore 729826) | |
|---|---|
| Tuesday, 6th August 2013 | 2:00 - 6:00 pm |



River Safari is the newest addition to Wildlife Reserves Singapore's portfolio of award-winning parks. Nestled between Singapore's two award-winning wildlife parks – Singapore Zoo and Night Safari – River Safari offers an unforgettable adventure inspired by eight of the world's most iconic rivers. This $160-million attraction features state-of-the-art exhibit design, Southeast Asia's largest panda exhibit as well as the world's largest freshwater aquarium. Housing one of the world's largest collections of freshwater fauna, the park features over 5,000 specimens representing 300 species. And that includes Singapore's resident giant pandas, Kai Kai and Jia Jia.

# MIC 2013    Social Event, River Safari

The meeting point to River Safari will be at **SMU Administration Building, Level 1 Lobby, 2pm** as indicated on the map below.



The "Coach Bay" area indicated on the **River Safari map** below will be the pick-up point from River Safari back to SMU at **6pm.**
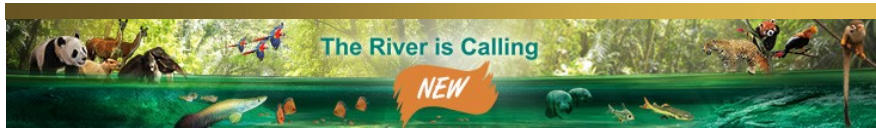
**Flowing Rivers: From Mississippi to Mekong**

Begin your journey at Mississippi River where you meet, amongst others, the beavers, our water-loving architects, and the quirky looking paddlefish with their signature snouts. Meander along the world's longest river, the Nile River, and find out how we keep the voracious and predatory tigerfish with other 'fishy' inhabitants like the strikingly patterned giraffe catfish and African arowana! Along the way, find out more about the 'mbu' and its life in Congo River, the world's deepest river. Stroll pass the sacred Ganges River and learn more about the `pot-nosed' Indian gharials. Swim by the Murray River - the food bowl of Australia, and end at Mekong River where awesome giant catfish and giant freshwater stingrays swim leisurely!

**Yangtze Treasures**

Renowned as the longest river in Asia, Yangtze River supports a diverse variety of animals, some of which include the critically endangered Yangtze alligator, Chinese giant salamander and sturgeon. Find out the challenges in conserving these species and continue on your journey to the bamboo forest to wave hello to Kai Kai and Jia Jia, our well-loved giant pandas. Meet the adorable red pandas and flamboyant golden pheasants and appreciate their inter-relationship with giant pandas in the bamboo forest ecosystem.

**Amazing Amazonia**

Before you charge through the world's most voluminous river, step into the Squirrel Monkey Forest to enjoy an immersive experience of the Amazon rainforest, in the company of free-ranging monkeys. Journey on to Amazon Flooded Forest, which showcases the annual flooding that drowns the Amazonian forests and creates a water wonderland for animals to feed, play and breed. Get to see our giant river otters and manatees in action about their unique adaptations to the varying conditions at different times of the year!

*      Park Map : http://www.riversafari.com.sg/visitor-info/park-map.html
*      Highlight of River Safari :
1)     Mekong River
2)     Yangtze Treasures
3)     Amazon Amazonia

# Suggested Restaurants

MIC 2013



**Legend:**
- MRT
- Taxi Stand
- Bus Stop
- P SMU Carpark
- P Carpark
- Drop Off
- Concourse

Bugis MRT

5

6
Carlton Hotel

7
CHIJMES

Victoria Street

Bras Basah Road

SMU Administration Building

NTUC Income Centre

Queen Street

Singapore Art Museum

Cathedral of the Good Shepherd

City Hall MRT

Victoria Street

Waterloo Street

4
Bras Basah Road

Bras Basah MRT

University Square

Stamford Road

Lee Kong Chian School of Business

Plaza by the Park

3

2

Bencoolen Street

School of Information Systems

Concourse

Campus Green

8
Concourse

Li Ka Shing Library

Visitor Centre

Stamford Road

Stamford Road

Stamford Road

Fort Canning Link

1
Rendezvous Hotel

Bras Basah Road

School of Economics
School of Social Sciences

Bencoolen Street

SMU Gallery

School of Accountancy
School of Law

Fort Canning Tunnel

Prinsep St

SMU Residences @ Prinsep.

Orchard Road

9
National Museum of Singapore

Dhoby Ghaut MRT

P

10
YMCA

Fort Canning Road

Fort Canning Rise

Fort Canning Walk

Fort Canning Park

1. Straits Café at Rendezvous
Offers international buffet breakfast, lunch & dinner (7am to 11pm daily)
Buffet from $32++ per person

2. Kopitiam Food Court
Indulge in a variety of local delights (opens 24 hours daily)
Chicken rice from $4.8++, Noodles from $3.5++, Coffee & Toast from $2++

3. The Coffee Bean & Tea Leaf
Chill with coffee & cakes (7.30am to 11pm Mon - Sat, 9am to 11pm Sun & PH)
Coffee from $4++, Cake from $6++

4. Dome Cafe
Fresh coffee, cakes & full meals (8.30am to 10.30pm daily)
Salad from $7.5++, Pasta from  $12.8++, Pizza from $12.50++

5. Coffee Express 2000 at  Bras Basah Complex
Indulge in a variety of local delights (opens 24 hours daily)
Chicken Rice set from $4.5++, Noodles from $3.5++, Coffee & Toast from $2++

6. Wahlok Restaurant in Carlton Hotel
Offers fine Cantonese cuisine (11.30am to 10.30pm daily)
8 course set menu start from $88 per person

7. CHIJMES
A range of Westerns/Chinese/Japanese cuisine are available
Japanese BBQ about $30++ per person, Grill & ribs about $20++ per person

8. Koufu Food Court
Indulge in a variety of local delights (7.30am to 8pm Mon - Fri)
Western delight from $4.5++, Fish soup from $4++, Economic rice from $3++

9. National Museum of Singapore
Offers a selection of fine dinning restaurant and cozy cafes
Chef Chan set menu from $38++ per person, Novus Bar & Café set lunch from $32++

10. Metro-Y Restaurant
The best of local porridge buffet (7:15am to 10pm Mon - Fri)
Buffet from $13.80++ per person

# WIFI Connection Guide

**MIC 2013**

1. Logon to your computer. At the System Tray (left bottom of screen), double click on the wireless network connection icon.



2. The screen below will be shown. Click the **View Wireless Networks** button.

# WIFI Connection Guide

MIC 2013
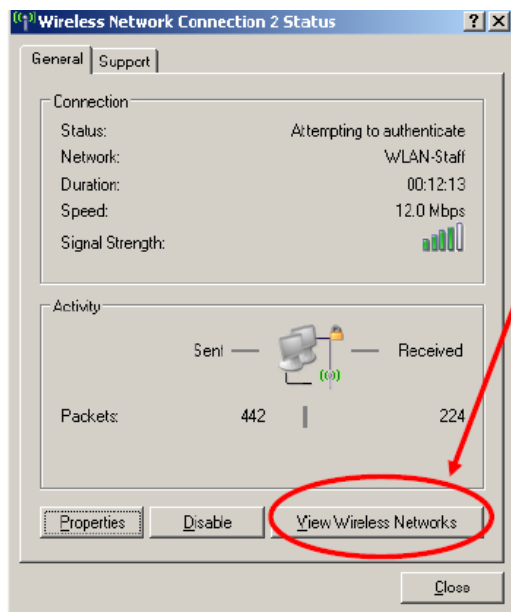
3.  A list of available wireless connections will be shown. Navigate to **SMU_Visitor** and click on the **Connect** button.



Step 1: Locate the SSID "SMU_Visitor"
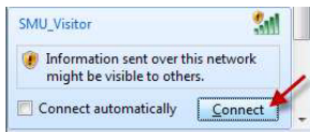


Step 2: Connect to the SSID "SMU_Visitor"

4.  Upon successful connection, **SMU_Visitor** will shown as **Connected**.



Step 3: You should observe that it can be connected to successfully.

# WIFI Connection Guide

**MIC✦ 2✦13**

5.      Launch your web browser (ex, Internet Explorer) and enter the website you want to access (ex, www.google.com)
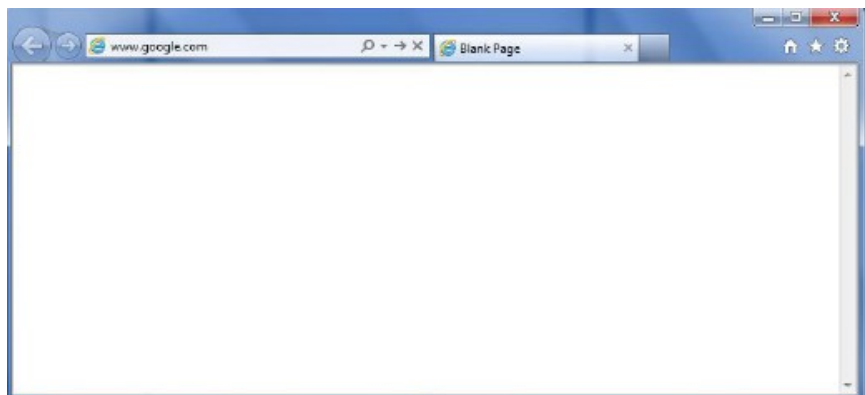


6.      You will be prompted for username and password to login. Enter the username and password which you received from the registration desk and click the **Log In** button.

Note: Logging in indicates the acknowledgement of the Acceptable Use Policy.

# MIC 2013   WIFI Connection Guide
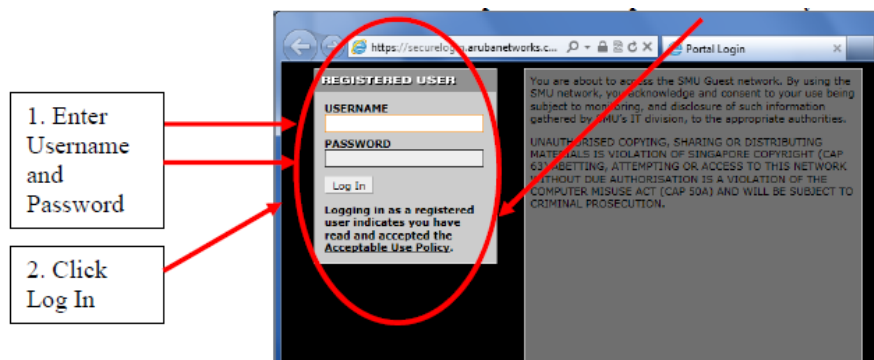
7.  You will see the below page after successful login. Click on the **here** link to go to the website which you were trying to access previously.
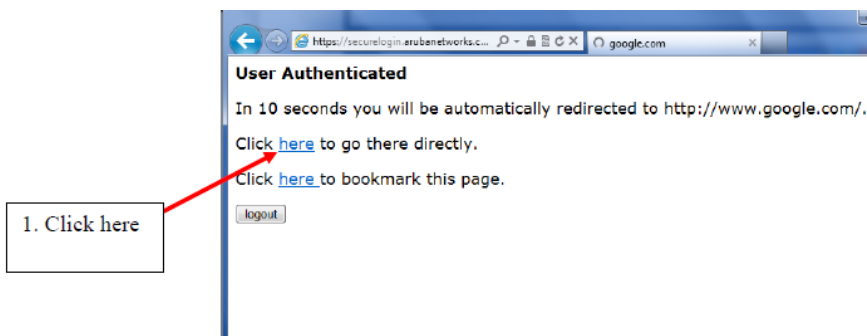


8.  The webpage will be shown. Congratulations, you have successfully logon to our WLAN-Guest network. You may now proceed with your web browsing.

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# Notes

# MIC 2013

## 5 – 8 August
## Singapore Management University

### http://research.larc.smu.edu.sg/mic2013