**SOUTH EAST ASIAN MATHEMATICAL SOCIETY**

# REVISED SEAMS SCHOOL PROPOSAL

# SEAMS School Diliman

Institute of Mathematics
University of the Philippines
Diliman, Quezon City
Philippines

29 June – 07 July 2016

**Organized by**

Algebra and Combinatorics Group
Institute of Mathematics
University of the Philippines Diliman

**2016**

# SEAMS SCHOOL PROPOSAL

1. The proposed title, place and dates of the SEAMS School

| | | |
|---|---|---|
| Title of the SEAMS School | : | SEAMS SCHOOL DILIMAN ON TOPICS IN MATRIX ANALYSIS AND APPLICATIONS |
| Place | : | Institute of Mathematics, University of the Philippines Diliman, Quezon City, Philippines |
| Dates | : | 29 June – 07 July 2016 |

2. Organizers (write the names, place of work, and email address, if you have more than two then add the necessary lines)

| | | |
|---|---|---|
| 1. Name | : | Jose Maria P. Balmaceda |
| Institution | : | Institute of Mathematics, University of the Philippines Diliman |
| Email and Phone | : | jose.balmaceda@gmail.com, joey@math.upd.edu.ph Tel/Fax: +632-920-1009, Mobile: +63915-893-7137 |
| 2. Name | : | Agnes T. Paras |
| Institution | : | Institute of Mathematics, University of the Philippines Diliman |
| Email and Phone | : | agnes@math.upd.edu.ph, Tel/Fax: +632-920-1009 |

3. Short Description of the **Scientific Content**, the **Aim** of the proposed school and the potential **Impact** to the local academic system and/or society. (max 100 words)

The School will consist of forty (40) hours of lectures and problem-solving sessions, focusing on selected topics in graduate level matrix analysis and applications.

It aims to: (i) provide participants with sufficient knowledge on fundamental topics in matrix analysis and applications that lead to areas of research, (ii) encourage participants to pursue further studies in mathematics and do research, and (iii) identify talented and motivated students who can be further supported for scholarships.

By giving priority to participants from developing countries in the region, the pool of students who will pursue higher studies in mathematics (up to the PhD) will hopefully be broadened.

4. The speakers of the school (name, address, email, male/female). Give the percentage of female speakers.

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1. Agnes T. Paras, Professor, Institute of Mathematics, UP Diliman
   Email: agnes@math.upd.edu.ph / female

2. Jose Maria P. Balmaceda, Professor, Institute of Mathematics, UP Diliman
   Email: joey@math.upd.ed.ph , jose.balmaceda@gmail.com / male

3. Jose Ernie C. Lope, Associate Professor, Institute of Mathematics, UP Diliman
   Email: ernie@math.upd.edu.ph / male

4. Ma. Nerissa M. Abara, Associate Professor, Institute of Mathematics, UP Diliman (
   Email: issa@math.upd.edu.ph / female

5. Minerva T. Catral, Assistant Professor, Xavier University, Cincinnati, Ohio, USA
   Email: / catralm@xavier.edu / female

6. Ralph John Dela Cruz, Assistant Professor, Institute of Mathematics, UP Diliman
   Email:  rbdelacruz@math.upd.edu.ph / male

7. Renier Mendoza, Assistant Professor, Institute of Mathematics, UP Diliman (male)
   Email:  rmendoza@math.upd.edu.ph / male

   Male lecturers: 4 (four)
   Female lecturers: 3 (three)

   We plan to invite DR. DENNIS MERINO, Professor, Southeast Louisiana University, USA as a lecturer for Matrix Analysis, but did not include his name because he has not confirmed yet. If Professor Merino is unavailable, we hope to invite Dr. MITSUGU HIRASAKA, Professor, Pusan National University, South Korea as lecturer for Combinatorial Matrix Theory.

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5. Describe in a few lines the local institution related to this school, including the main academic program and its strengths in teaching program and research. Give also the internet site of the local institutions. Do you plan to have a website of this SEAMS school?

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The Institute of Mathematics (I-MATH) is the leading institution for mathematics research and education in the Philippines. It has been designated since 1996 as a Center of Excellence in Mathematics by the Commission of Higher Education. The Institute offers the following degree programs: BSc Mathematics, MSc Mathematics, MSc Applied Mathematics, PhD Mathematics, Professional Master's in Applied Mathematics (Actuarial Science), and a graduate MA Math program (for teachers). The Institute organized the inaugural SEAMS School in 2011.

I-MATH is one of 9 degree-granting units of the College of Science, University of the Philippines Diliman. The University of the Philippines is officially designated as the (only) *national* university in the country. UP Diliman is the flagship campus of the UP System.

The proposed SEAMS School Diliman, once approved, will have its own website. The homepages of the institutions involved are:

UP System: www.up.edu.ph
UP Diliman: www.upd.edu.ph
College of Science, UP Diliman: www.science.upd.edu.ph
Institute of Mathematics, UP Diliman: www.math.upd.edu.ph

6. Provide information on the number and distribution of expected participants. Give the percentage of female participants who will attend the school.

SEAMS School Diliman expects around 40 participants, with 8 - 12 participants from Southeast Asia and nearby regions, especially from Laos, Cambodia, Indonesia, Nepal, and other developing countries. Majority of the Philippine participants will come from outside Metro Manila. The organizers aim to have 40-50% female participants. The target participants will be young students (master's students, advanced undergraduates).

7. Describe the objectives and the program of the proposed school, including the courses (max 5 courses), speakers (in each course), abstracts (8 lines for each course) and tentative schedule of the whole proposed school.

Objectives:

• Linear algebra and matrix theory are fundamental fields of study in mathematics with a variety of applications in many areas. The proposed school will focus on matrix analysis and related topics, beyond elementary linear algebra, including some applications. The objective of the school is to provide students with fundamental concepts and techniques in matrix analysis and introduce directions and problems for research.

Courses:

[1] Topics in Matrix Analysis

Speakers: A. Paras, R.J. Dela Cruz, M. Catral

A. Unitary Equivalence and Normal Matrices (unitary matrices, unitary equivalence, Schur's unitary triangularization theorem, normal matrices, spectral theorem for normal matrices)

B. Singular Value Decomposition, Jordan and other Canonical Forms (positive definite matrices, positive semidefinite matrices, polar decomposition of a matrix, singular value decomposition of a matrix, Jordan block, Jordan matrix, Jordan canonical form)

C. Nonnegative matrices and positive matrices (Perron-Frobenius theorem, stochastic and doubly stochastic matrices)

Several hours will be devoted to problem-solving sessions for the participants. Towards the end of the course, several research directions and problems, particularly on generalized inner products and matrix factorizations and decompositions will be presented.

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[2] Iterative Solutions of Linear Systems

Speakers: J.E. Lope, R. Mendoza

Solving linear systems is an important step in many applications, such as in numerically solving differential equations, either via finite differences or finite elements. The course will discuss various direct and iterative methods in solving linear systems, such as methods to solve linear systems Ax = B for certain types of matrices A (e.g. tridiagonal, sparse, etc.). The course will include hands-on computer sessions for the participants.

The course will also include a short introduction to multigrid methods, which are also useful approaches to solving linear systems. Certain computer techniques and algorithms discussed in the first course will also be implemented.

[3] Introduction to Combinatorial Matrix Theory

Speakers: J.M. Balmaceda, M.N. Abara, M. Catral

Combinatorial Matrix Theory is a rich branch of mathematics that combines linear algebra, combinatorics and graph theory. The lectures will present basic properties and research questions on certain matrices with prescribed combinatorial properties, including sign pattern matrices (here regarded as a form of qualitative matrix analysis) and adjacency matrices of graphs (algebraic and combinatorial properties).

The course will also include an introduction to the theory of association schemes (which can be viewed as a unifying framework for the study of designs, codes, and finite geometries).

## TENTATIVE SCHEDULE OF ACTIVITIES

| | 26 JUNE SU | 27 JUNE M | 28 JUNE TU | 29 JUNE W | 30 JUNE TH | 01 JULY F | 02 JULY SA |
|---|---|---|---|---|---|---|---|
| 08:30 | | | | OPENING | | | |
| 09:00 | | | | MA | MA | MA | |
| 10:30 | | | | BREAK | BREAK | BREAK | |
| 11:00 | | | A R R I V A L | MA | MA | MA | E X C U R S I O N |
| 12:30 | | | | LUNCH | LUNCH | LUNCH | |
| 13:30 | | | | MA | MA | MA | |
| 15:00 | | | | BREAK | BREAK | BREAK | |
| 15:30 - 17:00 | | | | MA | MA + PROBLEM SOLVING | MA + PROBLEM SOLVING | |
| 18:00 | | | | | SCHOOL DINNER | | |

| | 03 JULY SU | 04 JULY M | 05 JULY TU | 06 JULY W | 07 JULY TH | 08 JULY F | 09 JULY SA |
|---|---|---|---|---|---|---|---|
| 09:00 | | MA | MA | CMT | CMT | | |
| 10:30 | | BREAK | BREAK | BREAK | BREAK | | |
| 11:00 | F R E E D A Y | MA + PROBLEM SOLVING | MA | CMT | CMT | D E P A R T U R E | |
| 12:30 | | LUNCH | LUNCH | LUNCH | LUNCH | | |
| 13:30 | | ISLS | ISLS | ISLS | CMT + PROBLEM SOLVING | | |
| 15:00 | | BREAK | BREAK | BREAK | CLOSING | | |
| 15:30 - 17:00 | | ISLS + COMPUTER SESSION | ISLS + COMPUTER SESSION | ISLS + COMPUTER SESSION | SOCIALS | | |

- MA – TOPICS IN MATRIX ANALYSIS (24 HRS)
- ISLS – ITERATIVE SOLUTIONS OF LINEAR SYSTEMS (9 HOURS), WITH PRACTICAL COMPUTER SESSIONS
- CMT – COMBINATORIAL MATRIX THEORY (7.5 HOURS)
- PROBLEM SOLVING SESSIONS ARE INCORPORATED IN ALL THREE COURSES.

**Provisional Budget (in Euro)**

| No | Item | Details | Sources CIMPA | Sources IMU-CDC | Sources Local | Total |
|----|------|---------|-------|---------|-------|-------|
| 1 | **Tickets** | | | | | |
| | Overseas Participants | 10 x € 350 | 3,000 | 500 | | 3,500 |
| | Speakers | 1 speaker from USA | | | 800 | 800 |
| | | | | | | |
| 2 | **Accommodation** | | | | | |
| | Participants | 12 rooms x €34 / night x 8 nights (twin sharing) | 500 | 500 | 2,264 | 3,264 |
| | Speakers | 2 rooms x €27 / night x 8 nights (single occupancy) | | | 432 | 432 |
| | | | | | | |
| 3 | **Food Expenses** | 48 participants x 7 days x €5/day (1 lunch + 2 snacks/ day) | 500 | 1,000 | 180 | 1,680 |
| | | School dinner | | | 300 | 300 |
| | | | | | | |
| 4 | **Local Transport** | Van rental for excursion and airport transfers | | | 200 | 200 |
| | | | | | | |
| | | | | | | |
| 5 | **Supplies and Printings** | | | | 500 | 500 |
| | | | | | | |
| 6 | **Living Expenses for overseas part** | | | | | |
| | | | | | | |
| 7 | **Social program (Excursion)** | Snacks, entrance fees | | | 300 | 300 |
| | | | | | | |
| | **TOTAL** | | **4,000** | **2,000** | **4,676** | **10,676** |

**Note**: At least 2/3 of **CIMPA support** can be used for travel, accommodation and/or living expenses of young researchers (less than 38 or recent PhD) from neighbouring countries of the activity; at most 1/3 at most can be used for lecturers (economy class travel and/or standard living expenses).
**CIMPA support cannot be used for:** reimbursements for participants living in developed countries (even if their nationality is from a developing country); registration fees; proceedings; organizational expenses.

**Expected Funding**

| No | Item | Confirmed (Yes/Not Yet) | Total |
|----|------|-------------------------|-------|
| 1 | CIMPA | Not Yet | €4,000 |
| 2 | IMU-CDC | Not Yet | €2,000 |
| 3 | Department of Science and Technology | Most Likely | €1,000 |
| 4 | University of the Philippines | Most Likely | €2,500 |
| | Other sponsors | Most likely | €1,200 |
| | **TOTAL** | | **€10,700** |

Short CVs of the Organizers:

**Jose Maria P. Balmaceda**
Professor, Institute of Mathematics and Dean, College of Science, Univ. of the Philippines
Tel/Fax: +632 920-1009; Mobile +63915 893 7137
Email: joey@math.upd.edu.ph,  jose.balmaceda@gmail.com

## Education

Ph.D. Mathematics, Univ. of Illinois at Urbana-Champaign, Illinois, U.S.A., May 1991
M.S. Mathematics, Univ. of the Philippines, Diliman, April 1983
B.S. Mathematics, *magna cum laude,* Univ. of the Philippines, Diliman, April 1981

## Current Positions

*Professor 12,* Institute of Mathematics, (Full Professor since June 2000)
*Dean*, College of Science, June 1, 2011 to present (Acting Dean, May 1-31, 2011)
*Academician*, National Academy of Science and Technology Philippines (elected 2008)
*Chair,* Technical Committee for Mathematics, Commission on Higher Education (Philippines),
       2012 to present (*Chair*, Jan 2008 to 2010; *member*, Jan 2006 – Dec 2007)
*President,* Mathematical Society of the Philippines, 2014-2016 (former President, 1997-1999)

## Previous Academic Positions

*Director,* Institute of Mathematics, Dec. 1, 2007 to May 31, 2011
*Chair*, Math'l Sciences Division, National Research Council of the Phil, 2006 –2011
*Visiting Professor,* Mathematics Dept, Sophia University, Tokyo, 01 Oct – 31 Dec, 2008.
*Visiting Researcher,* Institute of Math, University of Innsbruck, Austria, May 28 – July 7, 2007*.*
*Visiting Scientist*, Kyushu Graduate School of Math, Fukuoka, Oct-Nov 1999; Sept to Oct 1995.
*Visiting Scholar and Lecturer*, Math Dept, Pusan National Univ, April 1996 to March 1997.
*Visiting Researcher and Postdoctoral Fellow*, Kyushu Univ, Fukuoka, Apr 1992 to Dec 1993

## Research Interests

*Finite Groups and Representations, Algebraic Combinatorics*

## Selected Scientific Publications

1. *Higher mathematics in the Philippines today*, in Mathematics in Southeast Asia: Country Reports, published by the Commission on Developing Countries, International Mathematical Union, August 2014, pp. 41-70.
2. *Cryptography over noncommutative algebraic structures,* in Proc. of the 10th Taiwan-Philippines Symposium on Analysis, Kaohsiung, Taiwan, 2014, H.J. Kuo, ed., Airiti Press, Taiwan (2015) pp 29-36. DOI: 10.6140/AP.9789860438437.004.
3. *Leonard triples from Leonard pairs constructed from the standard basis of the Lie algebra sl2* (with J. Maralit), Linear Algebra Appl. Vol. 437 No. 7 (2012) pp. 1961-1977.
4. *Multiplicity-free groups and finite Gelfand pairs* (with R. Relator), in Proc. of the 8th Taiwan-Philippines Symposium on Analysis, Taichung, Taiwan, 2009, Fang-Bo Yeh and Huang-Nang Huang (eds.), pp. 13-20.

5. *Multiplicity-free transitive subgroups of the alternating groups* (with R. Relator), in 5th Asian Mathematical Conference Proceedings (Volume I), June 2009, Lee See Keong and Hailiza Kamarul Haili (eds), (2009) pp 565 - 582. ISBN: 978-967-5417-53-5.
6. *Mass formula for self-dual codes over Zp2,* (with R.A.Betty and F. Nemenzo), Discrete Mathematics, Vol 308 No 14 (2008) pp 2984-3002.
7. *Hilbert Series and free distance bounds for quaternary convolutional codes, in* Algebraic Combinatorics: An International Conference in Honor of Eiichi Bannai's 60th Birthday, Sendai, Japan, July 2006, A. Munemasa, ed., (published 2007), pp. 185-189.
8. *Association schemes and type II matrices,* in Proc. of the 6th Taiwan-Philippines Symposium in Analysis, J. Tsay, ed., National Sun-Yat Sen University, Kaohsiung, Taiwan, Oct 2005 (published 2006), pp. 1-11
9. *Multiplicity-free groups and Terwilliger algebras*, in Proc. 2nd Asian Mathematics Conference, Suranaree, Thailand, World Scientific Publ. Co., 1998 , pp. 111- 116.
10. *Multiplicity-free actions of the alternating groups*, Journal of the Korean Mathematical Society, Vol 34 No. 2 (1997) pp. 453 - 467.
11. *A note on multiplicity-free permutation characters*, Discrete Mathematics (North-Holland) , vol. 151, 1996,  pp. 55-58.
12. *The Terwilliger algebras of the group association schemes of S5 and A5,* (with M. Oura), Kyushu Journal of Math., vol. 48 no. 2, 1994, pp. 221-231.
13. *On a theorem of Jaeger*, Memoirs of the Faculty of Science, Ser. A (Math), Kyushu Univ. (now Kyushu Journal of Mathematics), vol. 47 no. 2, 1993, pp. 391-396.

**Selected Presentations in international conferences**

1. *Association Schemes, Terwilliger Algebras and Leonard Triples of Krawtchouk Type,* Bandung Workshop on Combinatorics and Optimization (BWCOP 2014), Bandung, Indonesia, 1-2 Nov 2014.
2. *Trace Formulas and a Bilinear Form from Leonard Systems,* 2014 ICM, Seoul, 13-21 August 2014.
3. *Type II Matrices, Spin Models, and Association Schemes,* SEAMS-Yunnan Workshop on Mathematics and Information Science, Yunnan University, China, 18-21 June 2014. (invited)
4. *Cryptography over Non-commutative Algebraic Structures,* 10th Taiwan-Philippines Symposium on Analysis, National Kaohsiung University, Taiwan, 31 Mar − 3 Apr 2014. (invited)
5. *Extending Leonard Pairs to Leonard Triples*, International Conference on Group Theory and Related Topics, Shanghai University, China, May 18-22, 2012 (plenary)
6. *Gelfand Pairs in Alternating Groups,* 2010 ICM, Hyderabad, India, August 19-27, 2010.
7. *Hilbert Series and Free Distance Bounds for Quaternary Convolutional Codes* (Algebraic Combinatorics: A Conference in Honor of Eiichi Bannai's 60th Birthday, Sendai, 20 − 25 June 2006.
8. *Association Schemes and Type II Matrices,* 6th Taiwan-Philippines Symposium in Analysis, National Sun Yat Sen University, Kaohsiung, Taiwan, October 2005
9. *Mass Formula for Self Dual Codes over Zp2,*  (with R.A. Betty and F. Nemenzo), 2nd East Asian Conference in Algebra and Combinatorics, Kyushu University, August 2003.
10. *Spin Models and Related Structures,* 3rd Asian Mathematical Conference, Manila 23-27 Oct 2000 (invited speaker)

**AGNES T. PARAS**
Professor
Institute of Mathematics
University of the Philippines at Diliman
agnes@math.upd.edu.ph

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**Education**

Ph.D. Mathematics, Wesleyan University, Connecticut, USA, May 1993
M.S. Mathematics, University of the Philippines at Diliman, June 1988
B.S. Mathematics, University of the Philippines at Diliman, Oct 1985

**Academic Positions**

Head, Algebra and Combinatorics Academic Group, Institute of Mathematics, UP Diliman,
    2010 to present
Assistant Professor to Professor, Institute of Mathematics, UP Diliman, Oct 1993  to present
Visiting Researcher and Postdoctoral Fellow, Mathematics Department, Essen University,
    Germany, Nov 1999 to Oct 2000 and Oct 1995 to Sep 1997
Teaching Assistant, Mathematics Department, Wesleyan University, Connecticut, USA,
    Sep 1988 to May 1993
Instructor, Mathematics Department, UP Diliman, June 1986 to May 1988.

**Research Interests**

- Matrix Analysis, Ring and Module Theory, Infinite Abelian Groups, Automorphisms of
  Groups

**Recent Publications**

1. *S orthogonal matrices and S symmetries* (with R.J. de la Cruz and D.I. Merino), Linear
   Algebra Appl., 474 (2015) 213-229.

2. *The phi_S polar decomposition when the cosquare of S is normal* (with D.Q. Granario
   and D.I. Merino), Linear Algebra Appl., 467, (2015) 75-85.

3. *The inertia of the Hermitian H corresponding to H unitary matrices* (with E.N. Gueco
   and D.I. Merino), Science Diliman, Vol. 27, No. 1, (2015) 91-101.

4. *The Cartan-Dieudonne-Scherk theorems for complex S-orthogonal matrices* (with R.J.
   De la Cruz, K.L. De la Rosa and D.I. Merino), Linear Algebra Appl., 458, (2014) 251-260.

5. *The phi_S polar decomposition* (with D.Q. Granario and D.I. Merino), Linear Algebra
   Appl., 438, (2013) 609-620.

6. *The lambda_S Householder matrices*  (with D.I. Merino and T. E. Teh), Linear Algebra
   Appl., 436 (2012) 2653-2664.

7. *The J-Householder matrices* (with P.R.K de la Rosa, and D.I. Merino), Linear Algebra

Appl., 436 (2012) 1189-1194.

8. *The sum of orthogonal matrices in M_n(Z_k)* (with D.I. Merino, E. Reyes and G. Walls), Linear Algebra Appl., 434 (2011) 210-2175.

9. *The phi_S polar decomposition of matrices* (with R.J. de la Cruz and D.I. Merino), Linear Algebra Appl., 434 (2011) 4-13.

10. *Phi_s orthogonal matrices* (with M.N. Abara and D.I. Merino), Linear Algebra Appl., 432 (2010) 2834-2846.

11. *On the phi_J polar decomposition of matrices* (with D.C. Pelejo and D.I. Merino), Linear Algebra Appl., 432 (2010) 1165-1175.

**Recent Scientific Presentations**

1. Plenary Speaker, 2010, Annual Convention of the Mathematical Society of the Philippines, May 2010

2. Invited Speaker, 2009 Asian Mathematical Conference, Putra World Trade Center, July 2009

**Awards and Honors**

1. UP Diliman Chancellor's Award for Outstanding Faculty Member, 2013

2. Achievement Award (Mathematical Sciences Division), National Research Council of the Philippines, 2008

3. National Academy of Science and Technology -Third World Academy of Science Prize (Mathematics), 2004

4. Outstanding Young Scientist (Mathematical Sciences Division), National Academy of Science and Technology, 2003.

Submitted by:

JOSE MARIA P. BALMACEDA
Organizer
01 November 2015 (Revised Proposal)