

## DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE

Professor Ronald Young, BSc, MSc UWI, PhD St. Andrews  
– Head of Department

### **Overview & Staffing**

The two Sections of the Department worked as quite autonomous entities through the year. Both made valiant efforts to reorganize their curricula, energise their teaching and to deal with the staffing deficit that hampers the work primarily of the Computer Science Section. With the recruitment of Professor Jonathan Farley it was felt that the leadership gap in the Mathematics Section at least, would have been alleviated but this was not to be as Professor Farley resigned by the end of the year. The Section none-the-less was able to recruit promising young lecturers in Dr. Conall Kelly and Dr. Ponkala Nagarani. The Computer Science Section welcomed back Dr. Ezra Mugisa from an extended (no-pay) sabbatical and Dr. Ashley Hamilton-Taylor who completed his PhD studies at Georgia Tech. Dr. Timothy Stitt Lecturer in Computer Science resigned at the end of August 2006, to accept a higher paying job in Ireland. Mr. Paul Gaynor and Mr. Curtis Busby-Earle at the start of the year, joined the academic staff as Temporary Assistant Lecturers in Computer Science, while Miss Keisha Harriott resigned as Assistant Lecturer to pursue a PhD at Essex University, and Mr. Ricardo Paharsingh resigned as Assistant Lecturer and emigrated to Canada, both at the end of the academic year. Mrs. Gunjan Mansingh was promoted to Lecturer and Mr. Eyton Ferguson was reappointed at the Assistant Lecturer level on a three-year contract. The Computer Science Section has aggressively pursued hiring fully qualified staff members with a PhD in a Computing related discipline, and two candidates have committed to joining the academic staff in academic year 2007-2008. Both Sections maintained a commendable level of scholarly activity and research output during the 2006-2007 academic year.

## MATHEMATICS SECTION

Section Head: Dr. Raymond McEachin

### WORK OF THE SECTION

During the 2006-07 Academic Year, it was anticipated that the Mathematics Section would plan and seek approval for a newly organised first-year in mathematics. This effort has not been completed, but significant progress was made. The Section also focused on the Preliminary course delivery (M08B and M08C) by incorporating Assistant Tutors to help organize and lead tutorials in innovative ways. The pass rate in the first semester was substantially increased but, unfortunately, the rate in second semester reverted to normal. Efforts to improve the curriculum and teaching at the Preliminary and first-year levels will continue in the coming year.



During this year, it was also anticipated that the Section would launch a new summer programme to prepare new students to successfully face the rigors of university mathematics courses. This programme was piloted in February and March of 2007, and was, by all accounts, successful. The programme, due to logistical problems, was postponed to late August, 2007, and was held for a small but appreciative group of incoming students. The section expects to improve its recruiting strategies and expand the programme in the coming year.

The teaching in the Mathematics Section had an average rating of 4.0 (sd 0.9) for the instructors and 3.8 (sd 1.0) for the courses. The average response rate was 43%.

At the same time, the 11 academic staff members produced an average of 1.1 refereed publications per staff member.

### PAPERS PRESENTED

F. Arunaye

- “Lie Group Symmetries of Dynamical Systems.” International Conference on Applied Mathematics, University of the West Indies, St. Augustine, Trinidad and Tobago, September 2006.
- “On the Reduction of Process of the Nucci-REDUCE Algorithm for Computing Nonlocal Symmetries of Dynamical Systems: A Case Study of the Kepler and Kepler-Related Problems.” Seventh International Conference on Symmetry in Nonlinear Mathematical Physics, Kiev, Ukraine, June 2007

A. Rodkina

- (with Y. Hamaya), “On Almost Sure Asymptotic Stability of Nonlinear Delay Stochastic Difference Equation.” International Conference on Applied Mathematics, UWI, St. Augustine, September 2006, 12pp.
- “On Contemporary Problems of Mathematics of Finance.” Conference on Mathematics of Finance, Universidad Pontifica de Madre y Maestro, Santo Domingo, Dominican Republic, March 2007.
- “Decay Rate of Moments of the Solutions to Difference Equations with Unbounded Noises.” International Conference on Analytical Mechanics, Stability, and Control of Motion., Irkutsk, Russia, June 2007.
- “Non-Exponential Stability and Decay Rates in Nonlinear Stochastic Difference Equation with Unbounded Noises.” International Conference on Difference Equations and Applications, Lisbon, Portugal, July 2007.

A. Mathew

- (with N. Hritonenko, & A. Rodkina). “Asymptotic Stability for Generalized Stochastic Ricker Population Model.” International Conference on Applied Mathematics, UWI, St. Augustine, September 2006.

R. McEachin

- “Perspectives on Mathematics Education in Jamaica.” International Conference on Applied Mathematics, UWI, St. Augustine, September 2006.

Wen-Bin Zhang

- “Beurling Primes with RH and Beurling Primes with Large Oscillation (Some Questions).” Number Theory Festival, University of Illinois at Urbana-Champaign, May 2007.

## PUBLICATIONS

### Refereed Journal Articles

C. Kelly

- \* (with J. A. D. Appleby). “Spurious Oscillation in a Uniform Euler Discretisation of Linear Stochastic Differential Equations with Vanishing Delay.” *J. Comput. Appl. Math.*, 205, 2 (2007): 923-935.
- \* (with J. A. D. Appleby). “Almost Sure Asymptotic Behaviour of One- and Two-Step Difference Equations with Random Coefficients on a Reducing Mesh.” *Proceedings of the IX International Chetayev Conference: Analytical Mechanics Stability, and Control of Motion (2007)*
- \* (with J. A. D. Appleby). “Oscillation of Solutions of a Nonuniform Discretisation of Linear Stochastic Differential Equations with Vanishing Delay.” *Dyn. Contin. Discrete Impuls. Syst. Ser. A Math Anal.* 13B (2006), suppl.: 535-550.

A. Rodkina

- \* (with J. A. D. Appleby & D. Mackey). “Almost Sure Polynomial Asymptotic Stability of Stochastic Difference Equations.” *Contemporary Mathematics, Fundamental Research*, 17 (2006): 110-128.
- \* (with J. A. D. Appleby & M. Riedle). “On Asymptotic Stability of Linear Stochastic Volterra Difference Equations with Respect to a Fading Perturbation”, *Difference Equations and Applications in Kyoto, Adv. Stud. Pure Math., Math. Soc. Japan, Tokyo, (2007) 8pp*
- \* (with Y. Hamaya). “On Global Asymptotic Stability of Nonlinear Stochastic Difference Equations with Delays.” *International Journal of Difference Equations*, 1, 1 (2006): 101-118.
- \* (with N. Hritonenko, & Y. Yatsenko). “Stability Analysis of Stochastic Ricker Population Model.” *Discrete Dynamics in*

Nature and Society, 2006: Article ID 64590, 13 pages.

- \* (with M. Basin). "On Delay-Dependent Stability for Vector Nonlinear Stochastic Delay-Difference Equations with Volterra Diffusion Term." *Systems Control Letters*, 56, 6 (2007): 423-430.
- \* (with G. Berkolaiko). "Decay Rate of Moments of the Solutions to Difference Equations with Unbounded Noises". *Proceedings of the IX International Chetayev Conference, Irkutsk, June 12-16, 2007*, pp373-381.

P. Nagarani

- \* (with G. Sarojamma). "Peristaltic Transport of Small Particles-Power Law Fluid Suspension in a Channel." *Australian Physical & Engineering Sciences in Medicine*, 30, 3 (2007): 185-193.
- \* (with G. Saorjamma & G. Jayaraman). "Exact Analysis of Unsteady Convective Diffusion in Casson Fluid Flow in an Annulus-Application to Catheterized Artery." *Acta Mechanica*, 187 (2006): pp189-202.

W.-B. Zhang

- \* "Beurling Primes with RH and Beurling Primes with Large Oscillation." *Mathematische Annalen*, 337 (2007): 671-704.

## **INCOME GENERATION**

The net income for the Mathematics Section for Summer School 2007 was just over J\$700,000. The Mathematics Section also offered a highly subscribed Preliminary Mathematics programme, with at least 110 students registering in each of Semesters I and II. Based on an estimated revenue of \$4,900 per credit per student (at 6 credits per course), an estimated 25% of revenue for administrative overheads, and direct teaching expenses of \$1,300,000, the Section estimates that its net income from this programme was \$3,550,000.

## **PUBLIC SERVICE**

Professor Rodkina

- Member, Editorial Board, International Journal on Difference Equations and Dynamical Systems
- Member, Reviewer, Mathematical Reviews of the American Mathematical Society

Professor Wen-Bin-Zhang

- Member, Reviewer, Mathematical Reviews of the American Mathematical Society

### INFORMATION ON STUDENTS

The following table indicates the number of Mathematics students by year and programme:

|         | Maths (BSc) | Actuarial Science | Maths with Education |
|---------|-------------|-------------------|----------------------|
| Prelim. | 110         |                   |                      |
| Level 1 | 180         | 25                | 3                    |
| Level 2 | 95          | 21                | 2                    |
| Level 3 | 60          | 19                | 1                    |

During the 2006/07 academic year, 25 students graduated with a BSc (Mathematics) degree, 17 with a BSc (Actuarial Science), and 1 with a BSc (Mathematics with Education).

In the Mathematics Section, there were 2 students in the MSc (Mathematics) degree programme and 3 in the MPhil (Mathematics) Programme, with none completing during the year.

## COMPUTER SCIENCE SECTION

Section Head: Dr. Daniel Coore

### WORK OF THE SECTION

The Computer Science Sections of the three campuses met on the Cave Hill Campus in September, 2006. The discussions centered around the curricula offered, and on the research activities at each campus, with a view to identifying areas of commonality and how the Sections could work more closely to enhance each other in those areas. It was widely accepted that the meeting was useful and that it should occur with some degree of regularity, perhaps every two years.

The Section continues to offer undergraduate majors in Computer Science and in Computer Studies, and a Computer Science option in the BEd programme. It also offers PhD, MPhil, and MSc degrees in Computer Science as well as an MSc in Computer Based Management Information Systems (the last in conjunction with the Department of Management Studies).

The Section continued its curricular reviews, both at the undergraduate and graduate levels. Although there were no changes to the undergraduate programme, the delivery of content for a few courses, especially those offered in the BEd option, was modified to try to improve their effectiveness. Major changes to the MSc programme have begun, but are still in progress.

One of the aims of our curriculum strengthening exercises has been to provide the means for increased exposure of our students to industry professionals and practices. To that end, we have begun the design of an internship programme for undergraduates, and we have also engaged in discussions with some local companies to find other ways to achieve this aim. One outcome of these has been an agreement between the Section and Fujitsu to have Fujitsu offer training in courses that can lead to certification in specific skills that the Section would not normally offer

within the degree programme. Fujitsu have enthusiastically endorsed this project with the donation of equipment and the provision of training personnel in the first instance. The courses will begin in academic year 2007-2008. The Section has also revived, under the direction of Dr. Ezra Mugisa, the Software Engineering lab as a unit that will provide software engineering consultation services to the public. It is expected that it will provide yet another vehicle of exposure to industry for students.

Daniel Coore was invited to participate in a Dagstuhl workshop on Spatial Computing in September, 2006. Workshops hosted at Dagstuhl are participated in by invitation only and are usually setup to initiate new areas in Computer Science, or to encourage deeper study of areas that are not already being widely researched. Dr. Coore was invited because of his research in Amorphous Computing.

Dr. Ashley Taylor has been working collaboratively with CARIMAC on writing proposals for funding and in offering short courses on applications of 3D animation to education. A very successful course for youths and adults was delivered by Dr. Taylor in Summer 2007. This kind of collaboration is reflective of the commitment of the Section to work with other units of the Campus to facilitate the delivery of computing related services. Other examples include: the joint work of Dr. Taylor with the Department of Educational Studies to put together a proposal to respond to the GOJ e-Learning project, which is valued at US\$50 million; consultation provided by Dr. Daniel Coore to Mona Geoinformatics Institute in the delivery of EIMS, the information system that was used by the EOJ to manage all of the data being reported from the 2007 general elections.

## **PAPERS PRESENTED**

### **Refereed Conference Papers**

Ezra K. Mugisa

- (with Benjamin Kanagwa). "Towards Understanding Service Oriented Architecture and Systems Using Viewpoints." In proceedings of the 2007 International Conference on Software Engineering Theory and Practice (SETP-07), July 2007 Orlando, Florida, USA, ISRST.



- (with Benjamin Kanagwa). “Architecture Analysis of Service Oriented Architectures.” In proceedings of the 2007 International Conference on Software Engineering Research and Practice (SERP'07), June 2007, Las Vegas, Nevada, USA, CSREA Press.

Hamilton-Taylor, A.

- (with Davis, E. T., Hailston, K., Kraemer, E., Rhodes, P., Papadimitiou, C., and Garcia, B.). “Examining Perceptual Processing of Program Visualization Displays to Enhance Effectiveness.” 2006 Human Factors and Ergonomics Society (HFES) 50th Annual Meeting, October 2006.
- (with Rhodes,P., Kraemer,E., Thomas,S., Ross,M., Davis,E., Hailston,K., Main,K.). “VizEval - An Experimental System for the Study of Program Visualization Quality,” IEEE Symposium on Visual Languages and Human-Centric Computing VL/HCC 06, pp 55 - 58. Brighton, UK, September 2006.
- (with Bina Reed, Philippa Rhodes, Eileen Kraemer, Elizabeth Thorpe Davis, and Kenneth Hailston). “The Effect of Comparison Cueing and Exchange Motion on Comprehension of Program Visualizations.” ACM Software Visualization SoftViz06, pp 181 - 182. Brighton, England, September 2006.

Rao L.

- (with Mansingh G. and Duggan E.) “An Ontology in the Domain of Information Systems Delivery and Evolution.” 12th Americas Conference on Information Systems, August 2006, Acapulco, Mexico.

Mansingh G.

- (with Rao L. and Osei-Bryson K. M.) “Towards an ontology based metadata warehouse.” Knowledge Sharing and Collaborative Engineering, IASTED, November – December 2006 St. Thomas, U.S. Virgin Islands.

Daniel Coore

- “Order from Disorder: How to program an amorphous computer”. Journée de séminaires autour de l'Amorphous

Computing. Centre de Recherche INRIA FUTURS d'Orsay, France. July 2007.

- “An Introduction to Amorphous Computing”. Journée de séminaires autour de l'Amorphous Computing. Centre de Recherche INRIA FUTURS d'Orsay, France. July 2007.
- “Overcoming the Barriers to FOSS Adoption.” JCS BizTech Forum 2006. Ocho Rios, Jamaica. October 2006.
- “Introduction to Amorphous Computing”. Dagstuhl seminar #6261 on Spatial Computing. Dagstuhl, Germany. September 2006.

## **PUBLICATIONS**

### **Book Chapter**

- \* B. Kanagwa, E. K. Mugisa. “Architectural Building Blocks for Reusable Service Oriented Architecture with Integrated Transaction Processing.” In Joseph Kizza, Janet Aisbett, Andrew Vince, Tom Wanyama (Eds) Advances in Systems Modelling and ICT Applications. Fountain Publishers. Kampala, 2006.

### **Refereed Journal Article**

- \* Lila Rao, Kweku-Muata Osei-Bryson. “Towards defining dimensions of knowledge systems quality.” *Expert Systems with Applications* 33(2): 368-378 (2007).

## **INCOME GENERATION**

The Computer Science Section generated just over \$700,000 from the Computer Based MIS MSc programme that is offered jointly with the Department of Management Studies.

## **STUDENT MATTERS**

The HACKERS student club continues to thrive. They continue to host short seminars on practical topics of interest to students, especially those that are not covered in depth by the Computer Science

curriculum. They have also engaged in small technical projects, such as putting together a parallel distributed computer from old lab computers; and constructing a Web site for themselves. The Section continues to support the club, and encourages them to seek to participate in activities that involve other computing related student groups, e.g. international competitions for programming or robotics.

### **Throughput**

A total of 50 students from the Faculty of Pure and Applied Sciences and 18 students from the Faculty of Humanities and Education completed the Computer Science major. Only 2 from the Faculty of Pure and Applied Sciences earned first class honours, a markedly lower number than usual. This is possibly attributable to the new GPA system, but that investigation has not yet been carried out. Equal numbers of male and female students (12 in all) from the Faculty of Pure and Applied Sciences achieved first or upper second class honours in Computer Science.

### **Awards**

The Section was pleased to grant the Dr. Karl Robinson Award for the best performance in Computer Science courses up to Semester I of year 3 to Mr. Amar Singh.

Mr. Samuel Morgan was selected, on the basis of an essay competition, as one of two representatives of Jamaica at the Youth Forum, hosted by the International Telecommunications Union (ITU). The forum was staged within the context of the 10th ITU TELECOMWORLD Exhibition and Forum in Hong Kong in December, 2006.