

DMS-0739343 EMSW21-MCTP: Annual Report

January 20, 2009

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1 Introduction

This is an annual report on the grant DMS-0739343, which has the goal of increasing the number of high-quality mathematics majors pursuing their Bachelor of Science degree at the Georgia Institute of Technology.

This funded activity is in its first year. It supports

- Scholarships for high performing majors.
- A Mathematics Competition for High School Majors.
- A Teaching Seminar to train Undergraduate Teaching Assistants.
- A distance learning program to teach Calculus 2 and 3 in High Schools.

2 People supported by the grant

Benjamin Webb is the Grad TA that is helping with the Teaching Seminar. The Teaching Seminar is the principal training aspect of the Undergraduate TA program. This Seminar has won a system-wide 'Best Practices' award. A large number of the math majors are TAs, and top students from a variety of engineering disciplines also are in the program.

Carl Yerger and Mitch Keller are sharing the support in the Spring 2009 semester while helping with the High School Mathematics Competition, a recruiting tool.

Summer 08 REUs are below. A more complete list of REU activity is § 5.

William Drobney
Patrick Brandt
Daniel Yancey
Carola Conces
Abhisek Pandey
Nicole Larsen
Cindy Phillips
Jashua Anderson
Fei He
Daniel Connelly

3 Enrollment Figures

Tables for undergraduate enrollment, including second majors. (Second majors at Georgia Tech complete an additional 36 hours of credit, beyond minimum degree requirements.) In the tables below, enrollment is broken down by ethnicity and gender. MR is multiracial. NR is Not reported.

The School of Mathematics has two degree programs, Applied Mathematics and Discrete Mathematics, both being Bachelors of Science.

In considering the gender breakdown, note that 30% of the entire undergraduate population at Georgia Tech is female—a low number.

3.1 Applied Mathematics Majors

Semester	Asian		Black		Hispanic		Indian		White		MR		NR		Total		Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Spr 09	11	6	2	2	1	2	1	0	52	37	0	0	0	0	67	47	114
Fall 08	13	7	4	2	1	3	1	0	48	38	0	0	0	0	67	50	117
Spr 08	14	8	3	1	3	2	1	0	43	26	0	0	1	0	65	37	102
Fall 07	13	6	4	1	2	2	0	0	49	30	0	0	1	0	69	39	108
Spr 07	14	6	3	2	3	0	0	0	49	29	0	1	0	0	69	38	107
Fall 06	15	6	5	2	3	0	0	0	48	32	0	0	0	0	71	40	111

3.2 Discrete Mathematics Majors

Semester	Asian		Black		Hispanic		Indian		White		MR		NR		Total		Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Spr 09	1	1	0	0	5	1	0	0	26	6	0	0	0	0	32	8	40
Fall 08	1	1	0	0	6	0	0	0	23	6	0	0	0	0	30	7	37
Spr 08	1	0	0	0	5	0	0	0	23	4	0	0	0	0	29	4	33
Fall 07	1	1	0	0	5	0	0	0	22	4	0	0	0	0	28	5	33
Spr 07	4	1	0	0	2	0	0	0	23	6	0	0	0	0	29	7	36
Fall 06	5	0	0	0	2	1	1	0	22	5	0	0	0	0	30	6	36

3.3 Degrees Awarded

Semester	Asian		Black		Hispanic		Indian		White		MR		NR		Total		Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Fall 08				1	1								2	1	3	2	5
Sum 08													1		1		1
Spr 08			2				2						7	1	11	1	12
Fall 07													5		5		5
Sum 07							1							3	1	3	4
Spr 07			1	1		1							15	2	16	4	20
Fall 06			2	1	1								5		8	1	9

4 Placement into Graduate Programs

These students have been placed into graduate programs, starting in the Fall 2008 semester.

Gerardo Viza (BS 2008) University of Rochester (physics)
 Abhishek Pandey (BS 2008) is in the QCF program at GT
 Brandon Pitman (BS 2008) GT--CS
 Brian Benson (BS 2008), UIUC Grad School
 Gokhan Civan (BS 2008), Maryland Grad School
 Julian Dawson (BS 2006) University of Central Florida
 Andrew Brown (BS 2006) University of Georgia-Stats
 Steven Britt (BS 2006) University of North Carolina

Historical information about placement of Majors in graduate school is:

Year	'02	'03	'04	'05	'06	'07	'08
Majors Placed	8	6	8	7	9	12	8
Women	2	3	0	4	3	1	0
Minority	1	0	1	1	0	1	1

5 Research Experience for Undergraduates

Majors participating in REUs outside Georgia Tech: Females and minority are indicated.

Aisha Arroyo (F, M), Program for Women, IAS
 Aisha Arroyo (F, M), Leadership Alliance Summer Research Program, Princeton
 Nicole Larse (F), Program for Women, IAS
 Cindy Phillips (F) Park City REU
 Jon Eisen, NSA Summer Program
 Blacki Li Milhose (M) REU in Computing
 Michelle Delcourt (F) REU at Clemson
 AJ Friend, REU in GT-Biology
 Dustin Burns, REU at UGA

Undergraduates participating in GT-REUs (14 students, 9 of these supported by the MCTP, remainder by individual NSF grants.) Here, we indicate the faculty sponsor and minority/female status.

William Drobny (Belinfante)
 Stefan Froehlich (Baker)
 Daniel Connelly (Baker)
 Fei He (Chow, Zhou)
 Kevin Spears (Alben)
 Joshua Anderson (Alben)
 Cindy Phillips (F, Belegradek)
 Jeremy McKibben-Sanders (Lubinsky)
 Nicole Larsen (F, Heitsch)
 Robert Glenn (Tetali)
 Abhishek Pandey (Dieci, Zhou)
 Spencer Nettleton (Bakhtin)
 Carola Conces (F, Geronimo)
 Daniel Yancey (Alben)

Statistics for REU participants over the last few years is as follows. (All '07 REUs were funded by individual NSF grants.)

Year	GT-REU	Other REU	Women	Minorities	GT Faculty Mentors
'01	6		3	0	6
'02	12		1	2	10
'03	7		0	0	5
'04	9		4	0	8
'05	14	6	3	1	14
'06	14	8	5	0	12
'07	5		1	1	5
'08	14	9	6	2	12

Finally, GT introduced a Undergraduate Research Seminar. Dr. Enid Steinbart, the Director of Undergraduate Advising, ran a one-credit Research Seminar course in the Fall 2008 semester. The 14 meetings were evenly divided between faculty and undergraduate presentations.

6 High School Mathematics Competition

The National Mathematics Honor Society Pi Mu Epsilon, the Tech School of Mathematics and the Tech College of Sciences hosted its annual High School Mathematics Competition (HSMC) on Feb. 23.

The HSMC is a one-day event, largely run by undergraduates and graduate students, giving them ownership of the event, and experience at managing such an outreach event. Competitors 323 students from more than 70 different schools, some in state and some out of state. Top prizes include scholarships for undergraduate study at Georgia Tech.

41 out of 111 high school seniors who participated at the 2008 HSMC are enrolled at Georgia Tech in the College of Architecture, the College of Computing, the College of Engineering and the College of Sciences. This group includes 3 scholarship winners (1 CS, 1 UEC and 1 AE).

Over the recent history of the competition, Two of the 11 scholarship winners who came to Tech enrolled in Mathematics. Adam Tart (1st place Varsity, 2004), received a Discrete Math BS, and is a Mitchell Scholar. Will Drobny (3rd place JV, 2004; 2nd place Varsity, 2007) is a current GT undergraduate.

Adam Tart was our undergraduate TA. Will Drobny and Leo Chen (3rd place V, 2004), a BMED student, are our UTAs this year.

The high school math teacher honored this year was Steve Sigur from The Paideia School in Atlanta. He has taught for over three decades and has been An American Regions Mathematics League (ARML) coach for the last 23 years, Steve Sigur was named the ARML Outstanding Coach of the Year at Penn State in June 2007. He is working on a book, soon to be published, with John Conway at Princeton named *The Triangle Book*.

Congratulations to the 2008 School of Math organizers : Students David Jimenez, Mitch Keller, Nicole Larsen, Cindy Phillips; Staff Christy Dalton, Sharon McDowell, Annette Rohrs; and Faculty Rena Brakebill, Michael Loss, Tom Morley.

7 Putnam Exam

GT offers a Problem Solving class geared for the Putnam exams, typically taught by Professor Matt Baker. In the most recent competition, GT had four participants in the top 300 nationwide:

Stefan Froehlich (score 38, rank 135),
Dragos Ilas (score 30, rank 221),
Jonathan Loesch (score 28, rank 260),
Will Drobny (score 24, rank 292)

The first three were in the Putnam class and each improved significantly over the previous year; Froehlich is a sophomore and Drobny is a freshman. Drobny is recruited into the program by the HSMC. In addition, Rob Ward scored 20, Aisha Arroyo 13, and Srdjan Lesaja 11.

8 High School Distance Learning Calculus

This program is an innovative method to teach the Calculus to high-performing High School Students. These students are enrolled in their High Schools, and a standard Calculus class at the Georgia Tech campus.

The students follow, and participate in the class from their own High School, using real-time video conferencing technology. The Professor teaches these students, and 150 GT undergraduates, from a distance learning classroom on campus.

As the data below shows, the enrollment in this class has increased dramatically. These students form an important pool from which we can recruit additional mathematics majors.

Semester	Sections	Students
Fa 05	2	34
Spr 06	1	32
Fa 06	2	79
Spr 07	1	72
Fa 07	2	99
Spr 08	1	81
Fa 08	2	205
Spr 09	1	187

9 Scholarships

The scholarship program, an important element of recruiting high quality mathematics majors will begin in the upcoming Fall 09 semester. A delay in official funding of this grant prevented us from starting this program in the Fall 08 semester.

10 Other Items of Note

- This is a paper produced from an REU.

Steele, G. Ander. 2008. *Carmichael numbers in number rings*, J. Number Theory **128**, no. 4, 910–917. MR **2400049** (2009a:11219)

- From the 2007 REU, comes this paper. Civan was in the the REU, and is now in graduate study at U Maryland.

arXiv:0901.0490

Title: Product Structures for Legendrian Contact Homology

Authors: Gokhan Civan, John B. Etnyre, Paul Koprowski,
Joshua M. Sabloff, Alden Walker

Comments: 21 pages, 6 figures

Subjects: Symplectic Geometry (math.SG); Geometric Topology (math.GT)

- Michelle Delcourt presented this paper at the 23rd Clemson mini-Conference on Discrete Mathematics and Algorithms, October 2008, and the 2009 Joint AMS-MAA meeting, MAA-CUPM Undergraduate Poster Session, January 2009.

Taking the "convoluted" out of Bernoulli convolution:

A combinatorial approach

Michelle Delcourt (GT), Julia Davis (Grove City),
Zebediah Engberg (Hampshire).

- Adam Tart (BS 2007) won a Mitchell Scholarship. NSF-GRF Honorable mention.
- Blair Dowling Simpson (BS 2003) PhD Princeton 2008, Oak Ridge postdoc.
- Yakov Kerzhner (BS 2003) PhD NYU 2008. Columbia U postdoc.

- Nicole Larsen (BS 2008) Astronaut Scholarship
- G Anders Steele (BS 2007) NSF-GRF Honorable Mention,
- Neil Arner (BS, 2001) served as TA to former British Prime Minister Tony Blair's 'Faith and Globalization' seminar at Yale Divinity School.
- Nathan Bell (BS 2003) UIUC PhD is Computer Graphics
- Carola Conces is in an eight month internship at the Georgia Senate Budget and Evaluation Office.