

THE UNIVERSITY OF CHICAGO
2011 Summer VIGRE Program for Undergraduates

This announcement describes an eight-week summer program of research and teaching for undergraduates at the University of Chicago. Its first year of operation was 2000, and details of its past operation may be found at <http://www.math.uchicago.edu/may/VIGRE/index.html>.

In this program, students have the opportunity for study and research in mathematics together with work in two of the outreach programs of the Department of Mathematics. Students participate in at least one of four courses taught by Department of Mathematics faculty members. Many also work as counselors in either the Young Scholars Program (YSP) or the SESAME teacher development program.

The purpose of the program is to provide an opportunity for students to be involved in a deeper experience in mathematics than is usually available during the academic quarters and to allow them to be effective partners in the educational outreach programs of the Mathematics Department. This program is especially beneficial for undergraduates who are considering graduate study and research in mathematics and for those who are interested in teaching mathematics at any level.

DATES: June 20–August 12, 2011; June 20–July 15 for the Apprentice Program. Participants in the full and intermediate programs are required to be in residence for all eight weeks. Apprentices are required to be in residence for the first five weeks and are welcome to participate in the program for the full eight weeks.

STIPENDS¹: Each student in the full program will receive a stipend of \$3000. Each student in the intermediate program will receive a stipend of \$2400. Each student in the apprentice program will receive a stipend of \$1500. All participants will be paid \$1500 at the end of July and the remainder at the end of August. Payment of the second installment is contingent on meeting the requirements of the program. The apprentice program stipend will be payable in July. Please note: taxes will be deducted from these paychecks. It is not permitted to hold a part-time job while participating in the REU without explicit permission from the program director.

ACCOMMODATIONS: Students are expected to find their own accommodations. Graduate students and past participants will offer advice and assistance.

APPLICATIONS: Students must be currently registered students at the University of Chicago and, to be eligible for financial support, must be United States citizens or permanent residents. Foreign University of Chicago students are welcome to participate in the program, but cannot receive financial support. Application forms for the summer of 2011 will be available in Eckhart 211 and 212 by Friday, February 4, and are due Monday, February 28, 2011. Late applications will not be considered. Completed applications should be returned to Eckhardt 314; if nobody is in the office, applications should be slipped under the door. Applicants will be notified of acceptance or possible wait list status by e-mail no later than March 21.

THE PROGRAM OF STUDY AND RESEARCH: Students attend courses taught by Department of Mathematics faculty. The courses consist of lectures and problem solving sessions; graduate student assistants run help and problem sessions. Some research problems and some problems aimed simply to aid understanding

¹Stipends have had to be lowered from last year in order to maximize the number of people we can afford to admit.

are introduced by the professors. No previous knowledge or study in the areas taught is required. In addition, opportunities for reading and research with graduate students and/or faculty are offered, and regular meetings with graduate student mentors are required.

The apprentice program is similar, but includes material aimed at those with less mathematical experience. It lasts five weeks. Its participants are typically freshmen and sophomores who have not been in advanced mathematics courses, and they often participate in the full program the following summer.

Participants in the full program serve as counselors in either the YSP program for high schools students, which takes place during the third through sixth weeks, or the SESAME program, which takes place the seventh and eighth weeks. These programs can usefully employ at most 44 students.

Participants in the intermediate program participate for the full eight weeks but are not employed by YSP or SESAME.

All participants in all programs are *required* to write a short mathematical paper on some problem or topic of their own choosing. It may be either expository or research, but it must be substantial. A first draft must be submitted to mentors by August 15 and the completed paper must be submitted by August 26, unless permission for a later date has been obtained from the director of the program.

The first few weeks have a larger proportion of lectures than the later weeks, setting up background in some areas, giving self-contained presentations in others, and offering many problems. Papers are encouraged to be on topics related to the lectures, but that is not required.

Graduate student counselors will be on hand ready and willing to offer help throughout the program. Moreover, each student will be paired with a graduate student mentor, who will meet with the student on a regular basis and will be available to offer tutorials. All participants are *required* to meet with their mentors at very least once a week. Topics for papers must be discussed with the mentors, first drafts must be submitted to them for feedback, and final drafts must take their comments into account. This is an essential feature of the program.

There will be student presentations on days (and/or evenings) near the end of the program, with the dates to be determined later. It is hoped that many will make presentations. These can be made by individuals or by groups working together.

The program offers a wide variety of material at various mathematical levels. Some is problem oriented, some introduces areas that are not ordinarily encountered in the undergraduate curriculum. There will be lots of problems, including research problems, that students can work on in groups or alone throughout the program — and later!! Students are encouraged to work together and to organize evening and weekend sessions. Students are expected to spend substantial amounts of time working on projects or problems outside of classes.

The program for 2011 has not yet been firmly established. As always, we plan to offer a variety of courses at various levels, arranged into several “sequences”. The program will be frontloaded in intensity in order to minimize scheduling problems with respect to YSP and SESAME and to maximize opportunities to get started on research problems and papers. In addition, there will be a special course for apprentices in the second, third, and fourth weeks. Abstracts of all course offerings will be made available no later than March 7. At this writing (January 31), faculty participants have not yet been determined. They will be announced as soon as

possible. (Updates of this announcement will appear on line). To give some idea, the following gives the full list of 2010 faculty speakers and the topics they presented.

0. The apprentice program

Weeks 2-5: Laci Babai, linear algebra and combinatorics

1. Topics in geometry

1a. Weeks 1-3: Howard Masur, hyperbolic geometry

1b. Weeks 4-7: Benson Farb, mapping class groups

2. Topics in logic

2a. Week 1: Dennis Hirschfeldt

2b. Weeks 2 and 3: Antonio Montalban

An Introduction to Reverse Mathematics

2c. Week 4: Maryanthe Malliaris

3. Topics in applied math, analysis, and probability

1a. Weeks 1-2: Eva Strawbridge, nonlinear dynamics

1b. Week 3: Takis Souganidis, a topic in analysis

3c. Weeks 4 and 5: Gregory Lawler, probability

4. Finite topological spaces and related topics

Weeks 1-8: Peter May

5. Algebra, Russian style

Weeks 1-8: Rina Anno and Peter May

6. Weeks 3-6: Laslo Babai, discrete mathematics

6a. Weeks 3-5: Semigroups, graphs, matrices, avalanches, and more — the abelian sandpile model

6b. Week 6: Groups and graphs — Symmetry in finite structures

Abstracts of courses from the 2002 – 2010 REU's can be found at <http://www.math.uchicago.edu/may/VIGRE>.

THE COUNSELOR PROGRAM: Each VIGRE student in the full program serves as a counselor in either YSP or SESAME.

YSP is a four-week program for mathematically talented seventh through twelfth graders. There are three components: one for students in grades 7-8, one for students in grades 9-10, and one for students in grades 11-12. The YSP consists of lectures in number theory, problem solving sessions led by VIGRE counselors, and computer sessions. Counselors are assigned to a particular component and to a small group of students for problem solving and computer sessions.

SESAME is a two-week program for elementary school teachers from the Chicago Public Schools. VIGRE Counselors work in one of several courses in the SESAME program (number theory, geometry, history of mathematics, physics for teachers, etc, and serve in much the same capacity as they do in YSP.

Applicants to the full program will be asked to state which outreach program, YSP or SESAME, they would prefer to be assigned to, but there is no guarantee

that students will get their first choice. Typically, experienced counselors from previous VIGRE REU's and experienced Junior Tutors are assigned to YSP. Computer experience is a plus.

WEEKLY YSP and SESAME WORK SCHEDULE:

Week 1 (June 21 – 25) Free

Week 2 (June 28 – July 2) Preparation and training: 9 – 12 M-F

Week 3 (July 5 – 9) YSP duties: 9:30 a.m. - 2:30 p.m.

Week 4 (July 12 – 16) YSP duties: 9:30 a.m. - 2:30 p.m.

Week 5 (July 19 – 23) YSP duties: 9:30 a.m. - 2:30 p.m.

Week 6 (July 26 – 30) YSP duties: 9:30 a.m. - 2:30 p.m.

Week 7 (August 2 – 6) SESAME duties: 9:00 - 4:00.

Week 8 (August 9 – 13) SESAME duties: 9:00 - 4:00.