

CHARTER RENEWAL APPLICATION – SIAG/DM (Discrete Mathematics)

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Discrete Mathematics. The SIAG/DM was originally formed under the aegis of SIAM on July 19, 1984 by the SIAM Council and July 20, 1984 by the SIAM Board of Trustees. Its initial operating period began January 1, 1985 and ended December 31, 1987. Its charter has been renewed by the council and board ten times thereafter. This SIAG had 764 members as of December 31, 2012; of these, 382 were students.

According to its Rules of Procedure, the objective(s) of the SIAG are to foster research in discrete mathematics and the development of its applications, and to bring together and stimulate interaction between the various and diverse communities of mathematical scientists such as those who specialize in combinatorics, computer science, communications, and operations research.

Within the framework of SIAM, the SIAG will conduct activities that implement its purposes.

Its purposed functions are to:

- 1) Organize minisymposia at the SIAM Annual Meeting on years where there is no SIAG conference.
- 2) Organize a track of at least six minisymposia at the SIAM Annual Meeting at least once every five years.

Other activities can include:

- 3) Organize a biennial SIAM Conference on discrete mathematics. The SIAG will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting or other SIAG conferences.

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The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

1. How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last [two/three] years?

Discrete mathematics is a vibrant field. In 2012, Endre Szemerédi won the well-known Abel Prize “for his fundamental contributions to discrete mathematics and theoretical computer science and in recognition of the profound and lasting impact of these contributions on additive number theory and ergodic theory.” His impact in extremal combinatorics is hard to overstate. Also, in 2012, Jean Bourgain and Terence Tao won the Crafoord Prize in mathematics “for their brilliant and groundbreaking work in harmonic analysis, partial differential equations, ergodic theory, number theory, combinatorics, functional analysis and theoretical computer science.” Their work emphasizes the connections between these fields of mathematics and is an example of the centrality of combinatorics and theoretical computer science. Maria Chudnovsky was named a 2012 MacArthur Fellow for her work on the classification and properties of graphs, and Daniel Spielman was also named a 2012 MacArthur Fellow for his work in theoretical computer science, including applications to graph theory, both important areas of discrete mathematics.

2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?

Our activity group is also doing well. In the SIAM DM10, our conference themes expanded to include three kinds of combinatorics: algebraic, additive and probabilistic, in recognition of the wide applicability of combinatorial techniques to all kinds of mathematical questions. In the SIAM DM12, discrete geometry, and separately, extremal combinatorics were recognized as separate conference themes, as was Ramsey theory, a topic in the intersection of graph theory and extremal combinatorics. As described in answer to question 1, the importance of extremal combinatorics, graph theory and their connections to theoretical computer science is widely recognized by the mathematical community.

Our SIAG has maintained its membership with a recent increase to 405 non-student members, and 322 student members in 2012. In comparison, SIAM DM12 had 366 attendees.

Discrete mathematics continues to be an important tool for all the different scientific and technological groups that form the SIAM community. For instance, graphs are used to model real world situations, such as in the work of Anthony Bonato, Dieter Mitsche and Pawel Pralat on modeling the flow of information in a terrorist network, recently featured on the SIAM website. Graphs are an important tool to design search and sort algorithms, using such work as that of Brodal, Fagerberg, Mailund, Pedersen and Sand on comparisons of triplet and quartet distances in rooted and unrooted trees, described at SODA13. Noga Alon, well-known for his combinatorial work and winner of the 2005 Godel prize, gave an invited address, *Graph Property Testing, Arithmetic Progressions and Communication* at SODA13, reflecting the connection between the theoretical concepts of extremal graph theory and theoretical computer science and information theory.

3. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past two years, and give a brief (one sentence or phrase) indication of the success or problems with each.

The activity group organizes the biennial SIAM DM conference. The last conference was held in Halifax, Nova Scotia with 366 attendees.

Also, the activity group co-organizes the annual ACM-SIAM Symposium on Discrete Algorithms (SODA). We officially appoint the SIAM representative to the SODA Steering Committee. The SODA conference remains one of the most prestigious and selective conferences.

4. Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM Annual Meetings. When did the SIAG last organize a track of minisymposia at an annual meeting?

At the annual 2012 SIAM meeting, Jeremy Kepner and John Gilbert, members of our SIAG, with David Bader, organized three minisymposia, MS26, MW38 and MS52, on *Massive Graphs: Big Compute meets Big Data*. William Hager, a member of our SIAG, with Timothy Davis, organized a minisymposia MS77, on *Graph Partitioning and Vertex Separators*. In addition, there were minisymposia organized by SIAG/AG by members of our SIAG on topics common to both our groups: William Martin and Iwan Duursma, who are members of our SIAG, organized two minisymposia, MS1 and MS11, on *Advances in Coding Theory and Cryptography*; Josephine Yu, a member of our SIAG, organized MS23 and MS46, *Combinatorial Algebraic Geometry*; Seth Sullivant, a member of our SIAG organized MS85 and MS109, on *Algebraic and Combinatorial Aspects of Mathematical Biology*.

Alex Pothén, who is a member of our SIAG, and Ali Pinar, organized four minisymposia, MS331, MS383, MS436 and MS486, on *Combinatorial Scientific Computing: Enabling Computational Science and Engineering through Combinatorial Algorithms* at the 2011 ICIAM.

Our SIAG organized a track of minisymposia at the annual 2009 SIAM meeting.

5. Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?

SIAG/DM awards biennially the distinctive: Dénes König Prize (SIAG/Discrete Mathematics). In 2012, the prize was awarded to Zeev Dvir for his elegant resolution of the Wolff conjecture in his paper, *On the size of Kakeya sets in finite fields*, J. of the AMS 22 (4) 1093-1097 (2009).

Hemanshu Kaul is our newsletter editor.

6. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.

Our activity group co-organizes the annual ACM-SIAM SODA conference. SODA14 will be held Jan. 5-7, 2014 in Portland OR. The conference chair is Chandra Chekuri. SODA15 will take place in Jan. 2015.

We will organize the SIAM DM14 conference, to be held June 16-19, 2014 in Minneapolis MN. The conference chair is Bojan Mohar.

We will award the fourth Dénes König Prize (SIAG/Discrete Mathematics) in June 2014. Ryan Martin, Vice-chair of our SIAG, will chair the prize committee.

We plan to organize a track of minisymposia at the 2015 annual SIAM meeting on themes related to those discussed in the answers to questions 1 and 2.

We will look into opportunities to coordinate or collaborate with SIAG/AG (begun in 2011) on our common interests in the intersection of Discrete Math and Applied Algebraic Geometry. The fact that our biennial meetings are in opposite years is a plus for this coordination.

7. How can SIAM help the activity group achieve its goals?

SIAM has done a fantastic job on putting in place a network of mathematicians and computer scientists from industry, government, and academia. Maintaining, improving and fostering the methods of communication between these groups is the best way to achieve our mutual goals of cooperation, and production of marvelous mathematical algorithms and theorems.

8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?

Our activity group will continue to maintain and improve, and also to seek out new ways to foster collaboration between theoretical and applied mathematicians and computer scientists at our biennial meetings, the annual SIAM meetings and SODA meetings, and with other SIAG's.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2014.

Signed

Karen Collins

SIAG DM Chair
May 31, 2013
