DIMACS
Center for Discrete Mathematics & Theoretical Computer Science

DIMACS EDUCATIONAL MODULE SERIES

MODULE 03-3
Security Cameras and Floodlight Illumination
Date prepared: May 9, 2004

Marjorie Darrah
Senior Scientist
Institute for Scientific Research
P.O. Box 2720
Fairmont, WV 26554-2720
email: MDarrah@isr.us

Nancy Hagelgans
Department of Mathematics and Computer Science
Ursinus College
Collegville, PA 19426
email: NHagelgans@Ursinus.edu

Lidia Luquet
Department of Mathematics and Computer Science
Saint Mary's College of California
Moraga, CA 94575-3517
email: lluquet@stmarys-ca.edu

Allison Wolf
College of Computing
Georgia Institute of Technology
Atlanta, GA 30332-0280
email: awolf@cc.gatech.edu

DIMACS Center, CoRE Bldg., Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ 08854-8018
TEL: 732-445-5928 • FAX: 732-445-5932 • EMAIL: `center@dimacs.rutgers.edu`
Web: `http://dimacs.rutgers.edu/`

Founded as a National Science Foundation Science and Technology Center and a Joint Project of Rutgers University, Princeton University, AT&T Labs - Research, Bell Labs, NEC Laboratories America and Telcordia Technologies with affiliated members Avaya Labs, HP Labs, IBM Research, Microsoft Research.

Module Description Information

- **Title:**

  Security Cameras and Floodlight Illumination

- **Author(s):**

  Marjorie Darrah

  Nancy Hagelgans

  Lidia Luquet

  Allison Wolf

- **Abstract:**

  This module leads students to investigate several geometrical aspects of illumination: the effectiveness of various types of floodlights placed in polygonal rooms either with or without holes as well as problems related to lighting a stage. An optional Section 4 for more advanced students provides formal statements and proofs of some intuitive ideas used in the applications. Exploratory exercises occur throughout the text to encourage students to reflect on new concepts as they are introduced. In addition, more challenging problems are provided.

- **Target Audience:**

  The module is written for advanced high school students and lower level college students.

- **Prerequisites:**

  The prerequisites are high school geometry and proof by mathematical induction.

- **Topics:**

  The topics of this module include security cameras and floodlight illumination of polygons and of stages. The floodlight problems addressed involve determining the maximum of the smallest number of floodlights required to illuminate regions under certain specified restrictions. For example, the floodlights may be required to be placed only at the polygon's vertices and to have the same aperture; the polygons under consideration may be required to have the same number of vertices. Polygons both with and without holes are examined.

- **Goals:**

  One goal is to introduce students to some fundamental ideas of computational geometry through applications to illumination problems. Another goal is promote the idea that mathematics is a growing body of knowledge with easily stated unsolved problems.

- **Anticipated Number of Class Meetings:**

  The module requires three class meetings if Section 4 is omitted; two additional class meetings are needed for Section 4. Advanced students may study the module independently with no class meetings.

- **Contact Information:**

Marjorie Darrah
Senior Scientist
Institute for Scientific Research
P.O. Box 2720
Fairmont, WV 26554-2720
email: MDarrah@isr.us

Nancy Hagelgans
Department of Mathematics and Computer Science
Ursinus College
Collegville, PA 19426
email: NHagelgans@Ursinus.edu

Lidia Luquet
Department of Mathematics and Computer Science
Saint Mary's College of California
Moraga, CA 94575-3517
email: lluquet@stmarys-ca.edu

Allison Wolf
College of Computing
Georgia Institute of Technology
Atlanta, GA 30332-0280
email: awolf@cc.gatech.edu

- **Other DIMACS modules related to this module:**

  None at this time