

UNIVERSITY OF PUERTO RICO  
FACULTY OF NATURAL SCIENCES  
DEPARTMENT OF MATHEMATICS  
RÍO PIEDRAS CAMPUS

## Discrete Mathematics Seminar

**A conjecture of Metropolis-Rota  
and a geometric bridge  
from convex polytopes to threshold logic**

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About 30 years ago, Metropolis-Rota published a paper where they have proved a characterization theorem for cubical lattices. The article that also appeared in Bulletin of AMS included the following conjecture:

*"We are led to surmise that the second such face structure, or cubical algebra as we shall call it, ought to play a complementary role to the Boolean algebra."*

The authors also explained how they expected their characterization result should play a complementary role: *"The resulting algebraic structure is suited for application to synthesis problems for Boolean functions"*. Since then, many authors have worked on the cubical lattices following the conjecture's guideline, however the main conjecture remained untouched. Back in nineties, we applied cubical lattice techniques to establish a geometric connection to threshold logic via geometric flavors from convex polytopes. More recently, once again applying cubical lattice methods, we have presented a characterization result on cut-complexes that is exactly recognizing a class of threshold Boolean functions, and thus confirming the conjecture of Metropolis-Rota.

The talk will be for general audience and accessible to the graduate students.

Friday, March 30, 2012  
10:00-11:00 am  
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