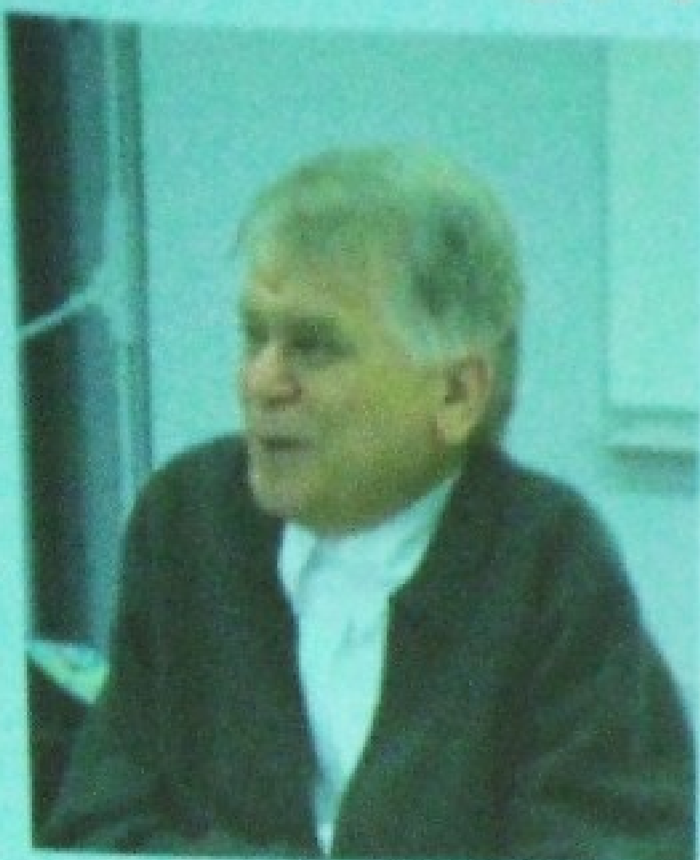
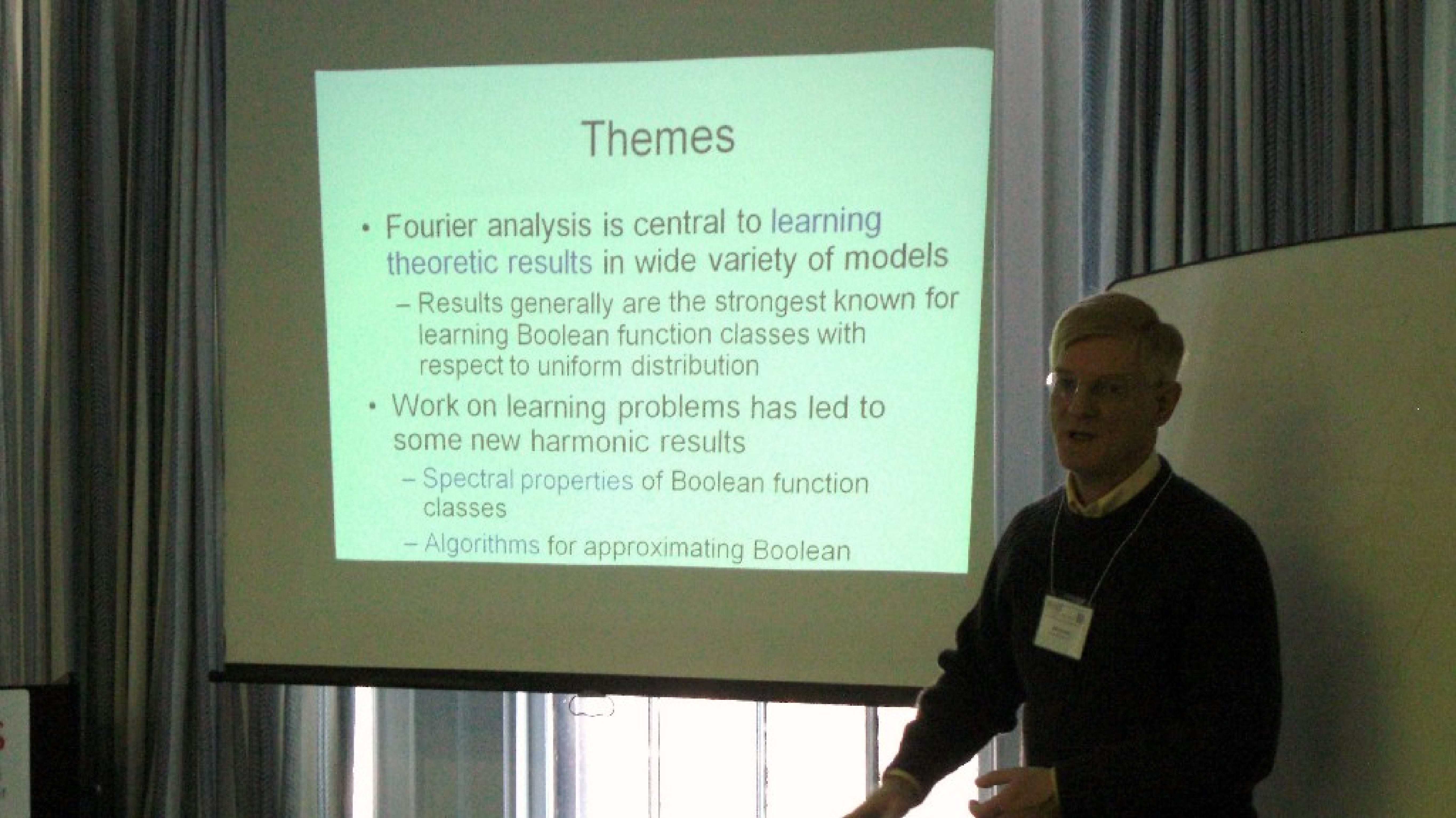
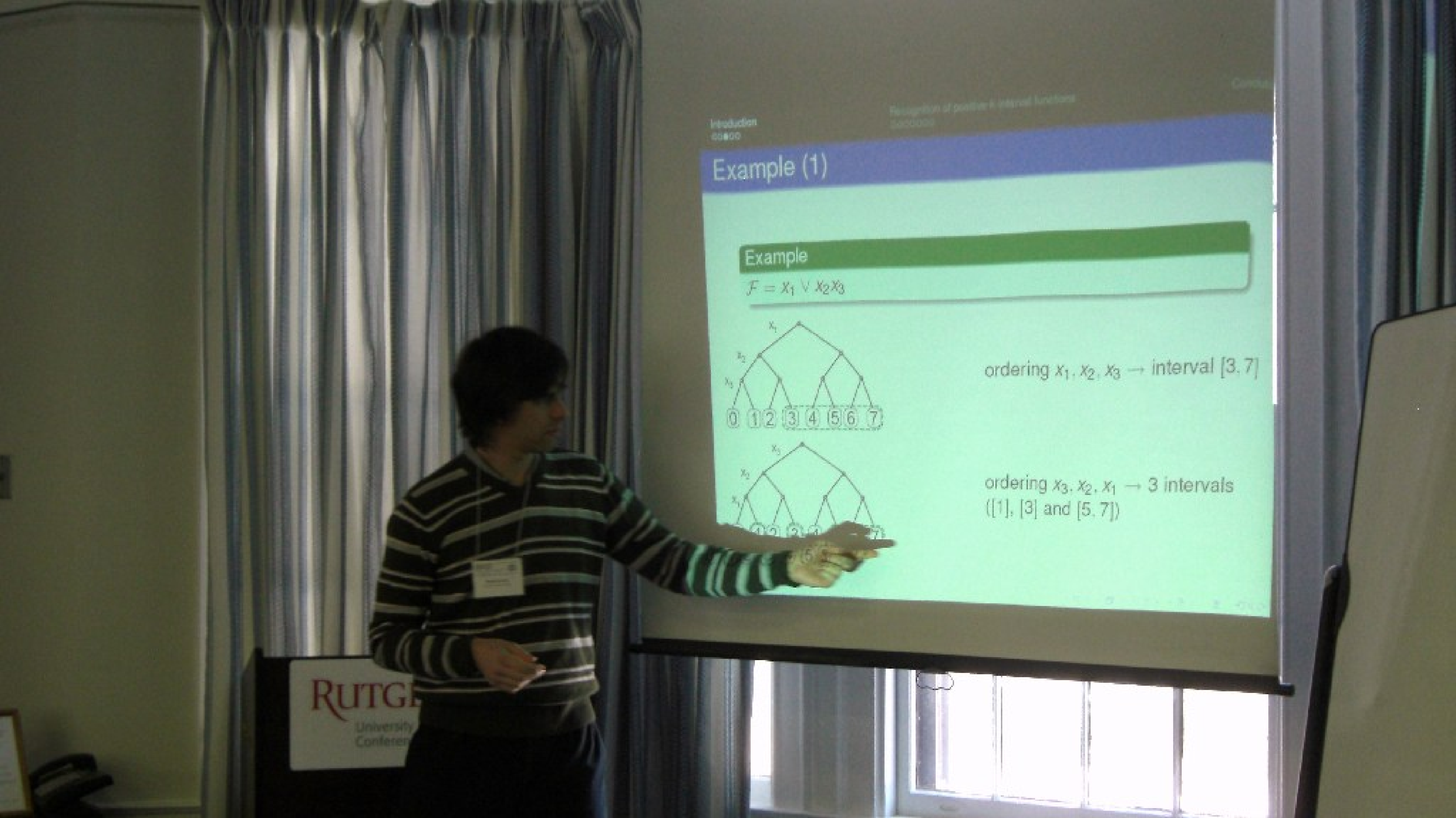
DIMACS-RUTCOR Workshop on Boolean and Pseudo-Boolean Functions in Memory of Peter L. Hammer

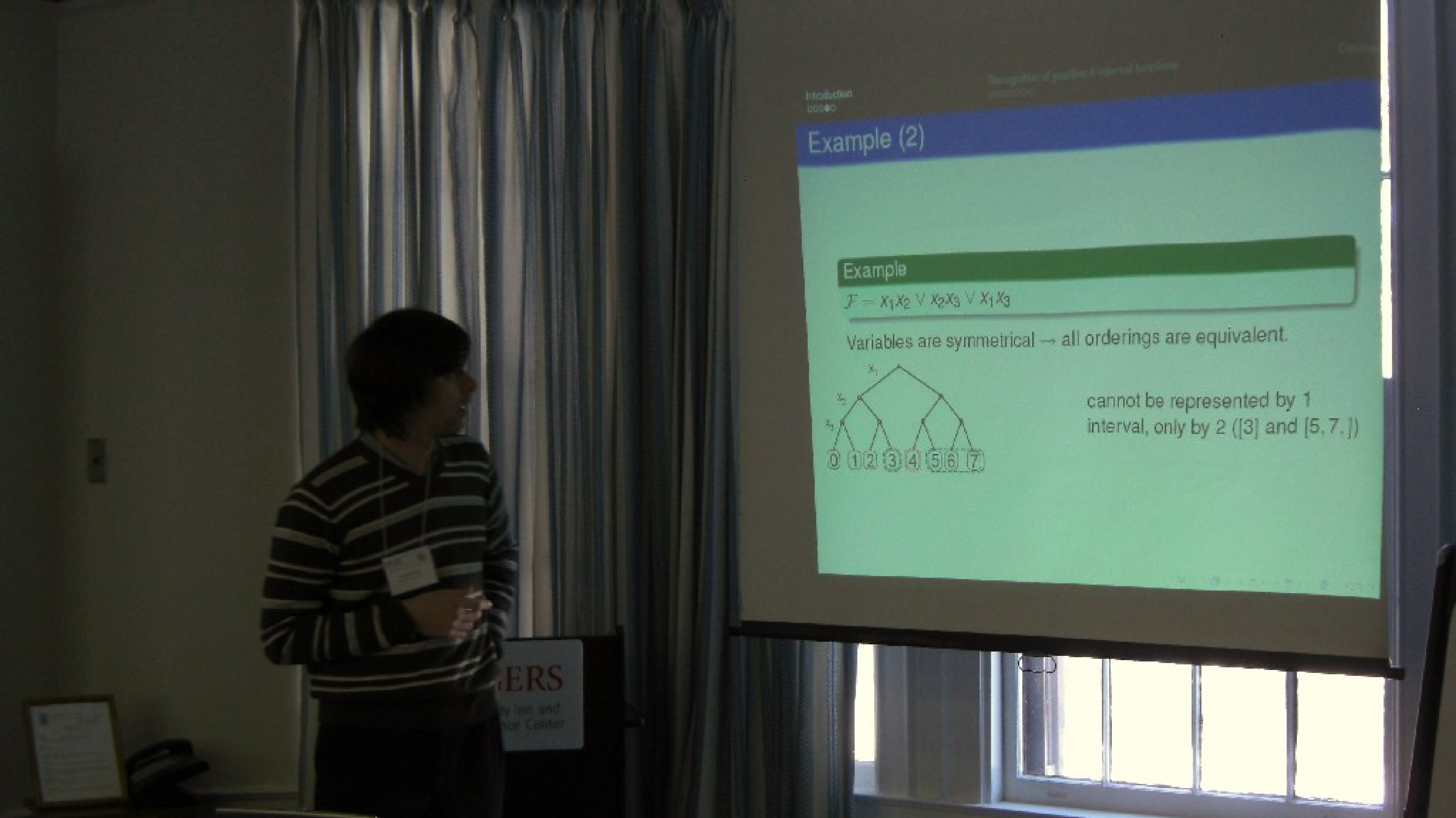


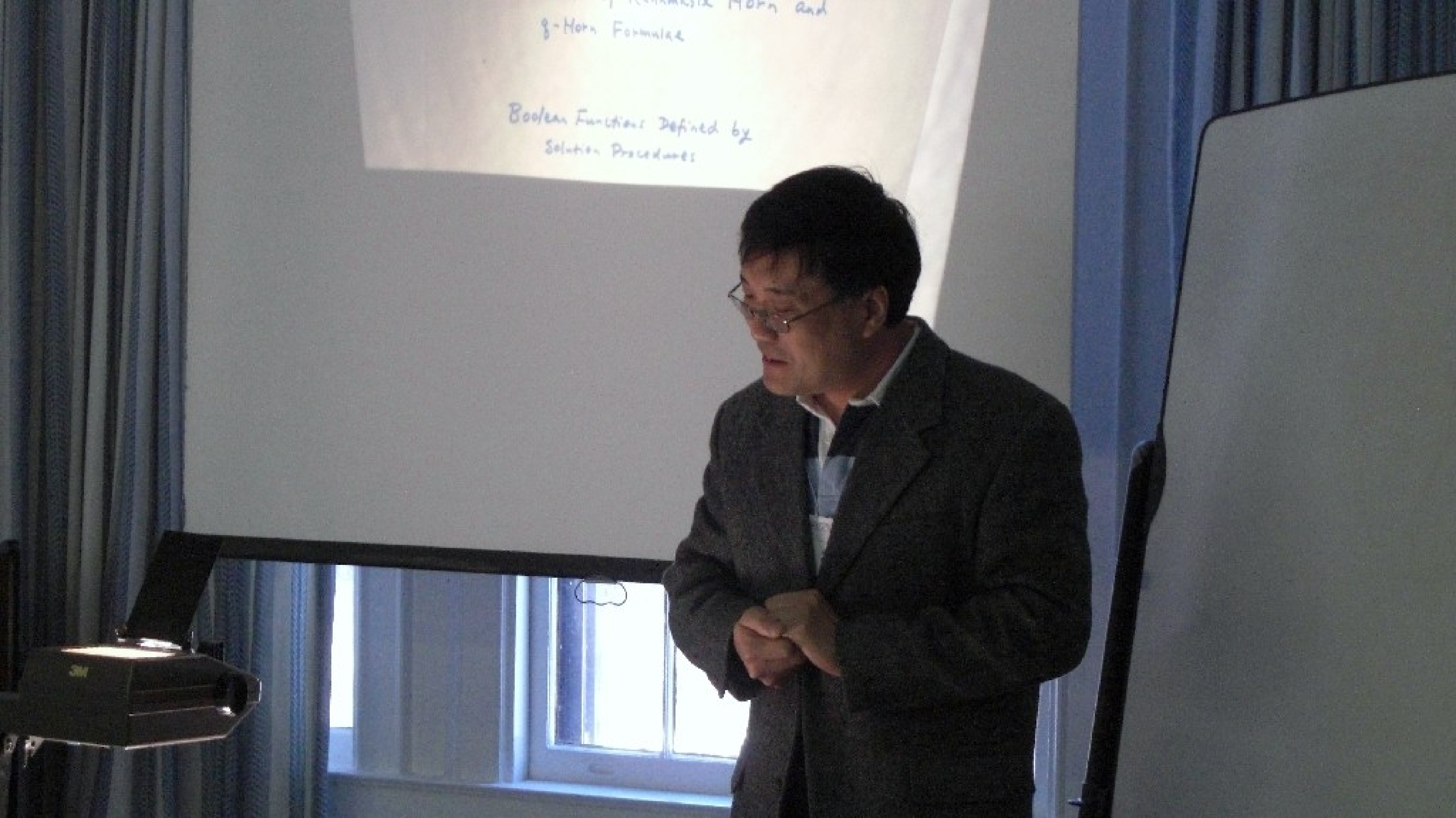

DIMACS-RUTCOR Workshop
on Boolean and Pseudo-
Boolean Functions in Memory
of Peter L. Hammer


Themes
• Fourier analysis is central to learning
theoretic results in wide variety of models
– Results generally are the strongest known for
learning Boolean function classes with
respect to uniform
• Work on learning
led to
some new
– Spectral properties
classes
– Algorithms for


Themes
• Fourier analysis is central to learning theoretic results in wide variety of models
– Results generally are the strongest known for learning Boolean function classes with respect to uniform distribution
• Work on learning problems has led to some new harmonic results
– Spectral properties of Boolean function classes
– Algorithms for approximating Boolean


Introduction
Example (1)
Example
F = x1 ∨ x2x3
x1
x2
x3
0 1 2 3 4 5 6 7
ordering x1, x2, x3 → interval [3, 7]
ordering x3, x2, x1 → 3 intervals
([1], [3] and [5, 7])


Introduction
Example (2)
Example
$\mathcal{F} = x_1x_2 \vee x_2x_3 \vee x_1x_3$
Variables are symmetrical → all orderings are equivalent.
x_1
x_2
x_3
0 1 2 3 4 5 6 7
cannot be represented by 1 interval, only by 2 ([3] and [5, 7.])


q-Horn Formulae
Boolean Functions Defined by
Solution Procedures


Structures of Renamable Horn and
q-Horn Formulas
Boolean Functions Defined by
Solution Procedures
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Miguel A. Lejeu
George Washington U
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on Boolean and Pseudo-Bool
in Memory of
Peter L. Hamme
January 2009
Workshop in Memory of Peter L. Hammer
M. Lejeune


Probabilistically Constrained Optimizati
Miguel A. Lejeune
George Washington University
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M. Lejeune


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On Approximate Horn Minimization
A. Bhattacharya, B. DasGupta, D. Mubayi, Gy. Tu
January 2009, RUTCOR
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Hammer


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Justifiable Learning
What Can and What Has To Be Learned From Data
Endre Boros
RUTCOR, Rutgers University


RS
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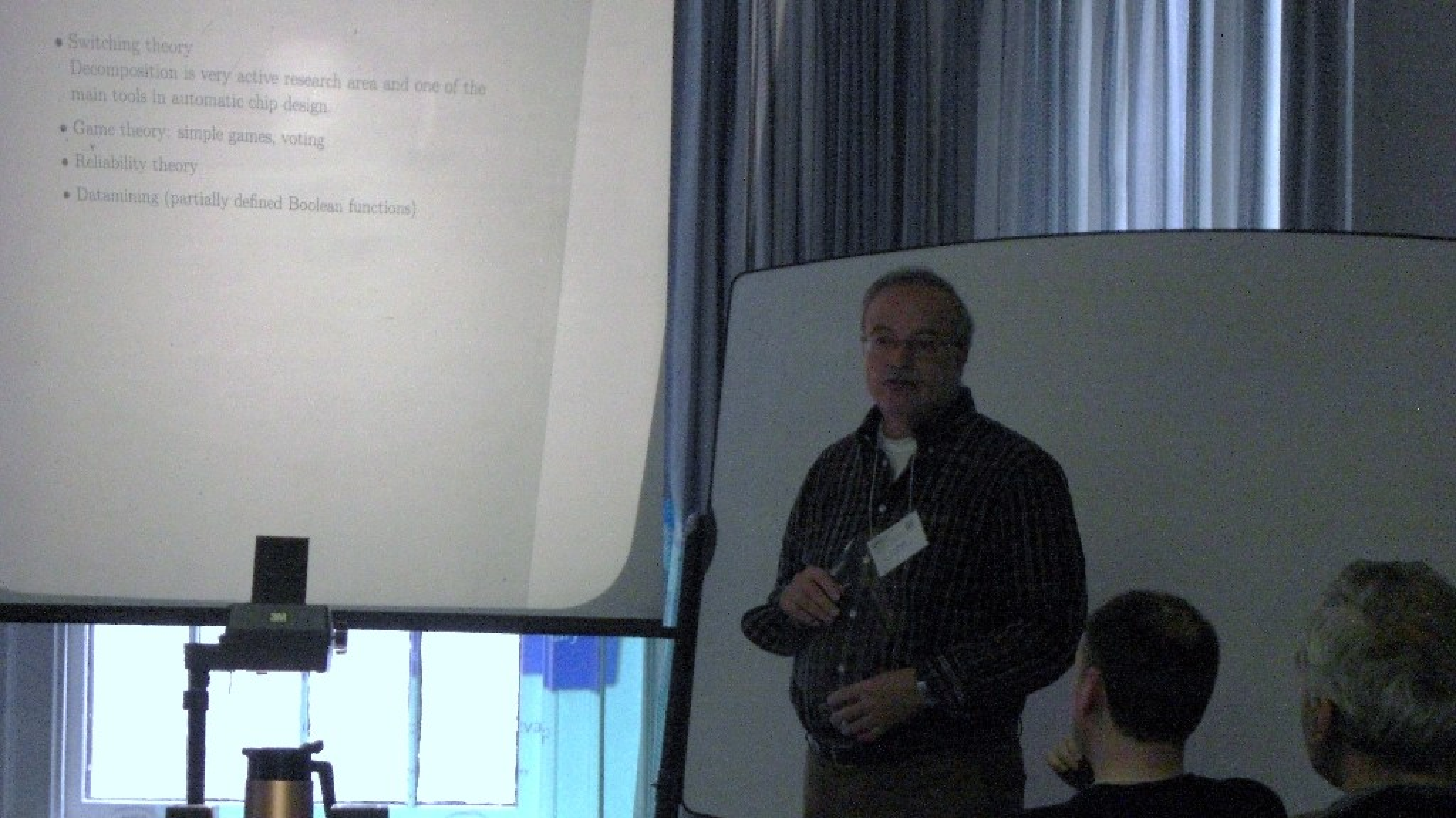
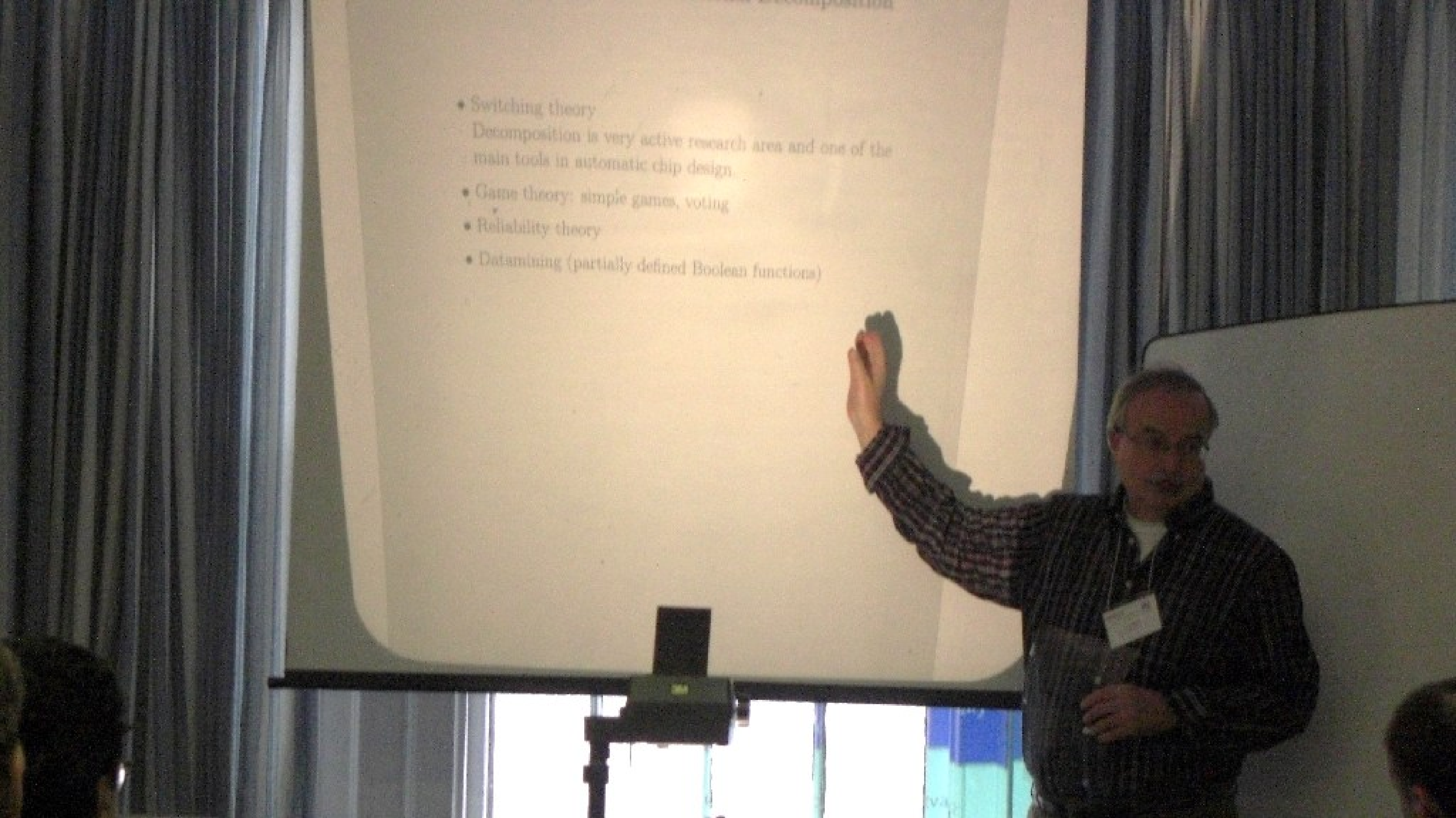
Justifiable Learning
Endre Boros


PowerPoint Presentation - Adobe Reader
Multi-Level Logic with Constant Depth:
Recent Research from Italy
Researchers:
Anna Bernasconi (U. Pisa), Valentina Ciriani (U. Milano-Crema) , Roberto Cordone (U. Milano-Crema), Fabrizio Luccio (U. Pisa), Linda Pagli (U. Pisa), Tiziano Villa (U. Verona, speaker)
DIMACS-RUTCOR Workshop on Boolean and Pseudo-Boolean Functions
in Memory of Peter L. Hammer
Rutgers, January 19-22, 2009
start


• Switching theory
Decomposition is very active research area and one of the main tools in automatic chip design.
• Game theory: simple games, voting
• Reliability theory
• Datamining (partially defined Boolean functions)


• Switching theory
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• Reliability theory
• Datamining (partially defined Boolean functions)


PLAN:
1. Introduction: shareholder networ
and measurement of control
2. Simple games, Boolean functions
and Banzhaf index
3. Application to the analysis of
financial networks
4. Further questions
January 2009
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1. Introduction: shareholde
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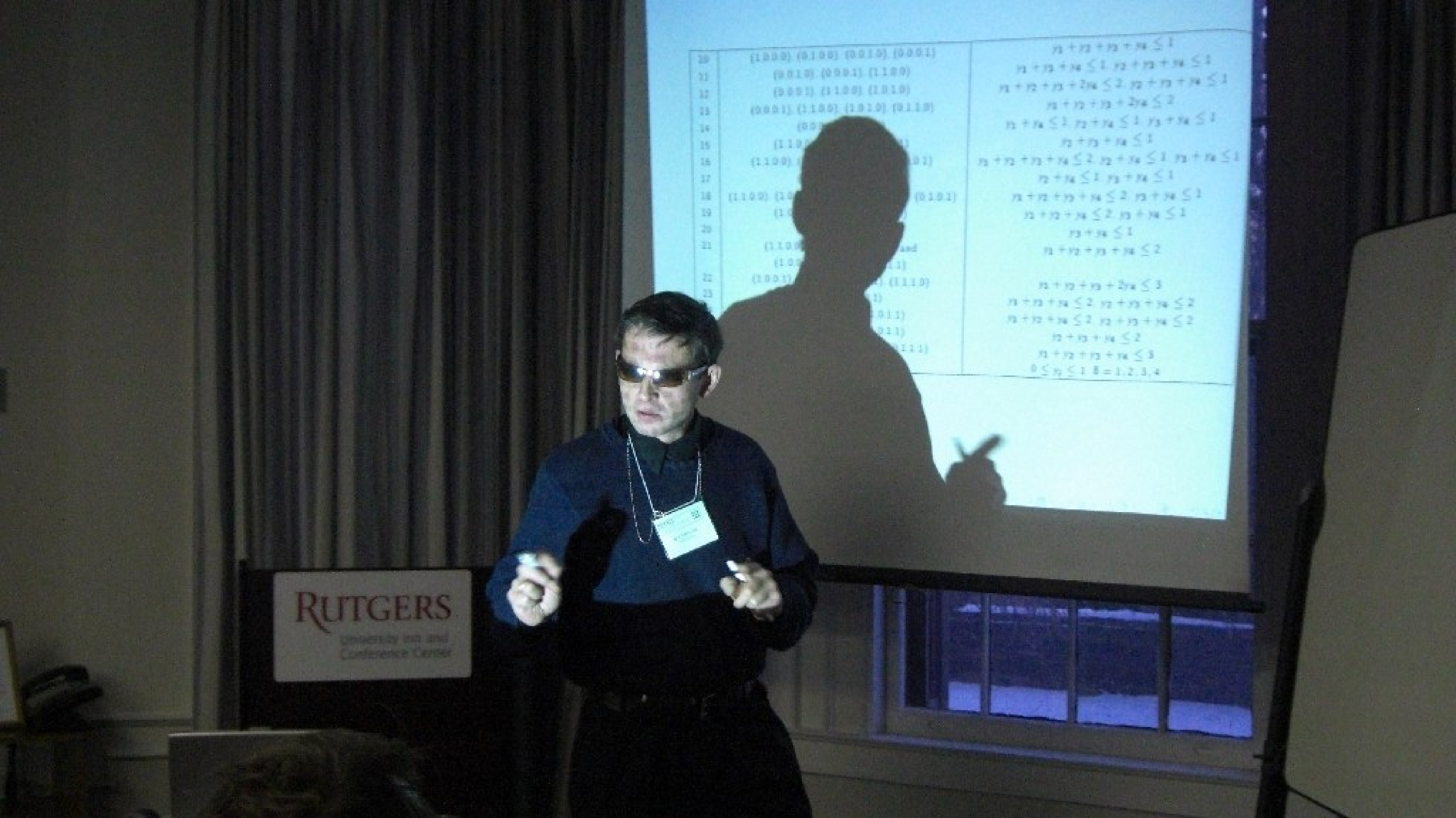
January 2009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$1 + y_2 + y_3 + y_4 \leq 2,\ y_2 + y_4 \leq 1,\ y_3 + y_4 \leq 1$
$y_2 + y_4 \leq 1,\ y_3 + y_4 \leq 1$
$y_1 + y_2 + y_3 + y_4 \leq 2,\ y_3 + y_4 \leq 1$
$y_1 + y_2 + y_4 \leq 2,\ y_3 + y_4 \leq 1$
$y_3 + y_4 \leq 1$
$y_1 + y_2 + y_3 + y_4 \leq 2$
$y_1 + y_2 + y_3 + 2y_4 \leq 3$
$y_1 + y_3 + y_4 \leq 2,\ y_2 + y_3 + y_4 \leq 2$
$y_1 + y_2 + y_4 \leq 2,\ y_2 + y_3 + y_4 \leq 2$
$y_2 + y_3 + y_4 \leq 2$
$y_1 + y_2 + y_3 + y_4 \leq 3$
$0 \leq y_i \leq 1\ \ i = 1, 2, 3, 4$
10^{100}
$10^{100} + 1$


On the Chvatál-Complexity of Binary Knapsack Problems
Gergely Kovács[1] Béla Vizvári[2]
[1]College for Modern Business Studies, Hungary
[2]Eastern Mediterranean University, Turkey
2009

Gergely Kovács[1]
[1]College for Modern Bus
[2]Eastern Mediterranea
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Experience with Timetabling
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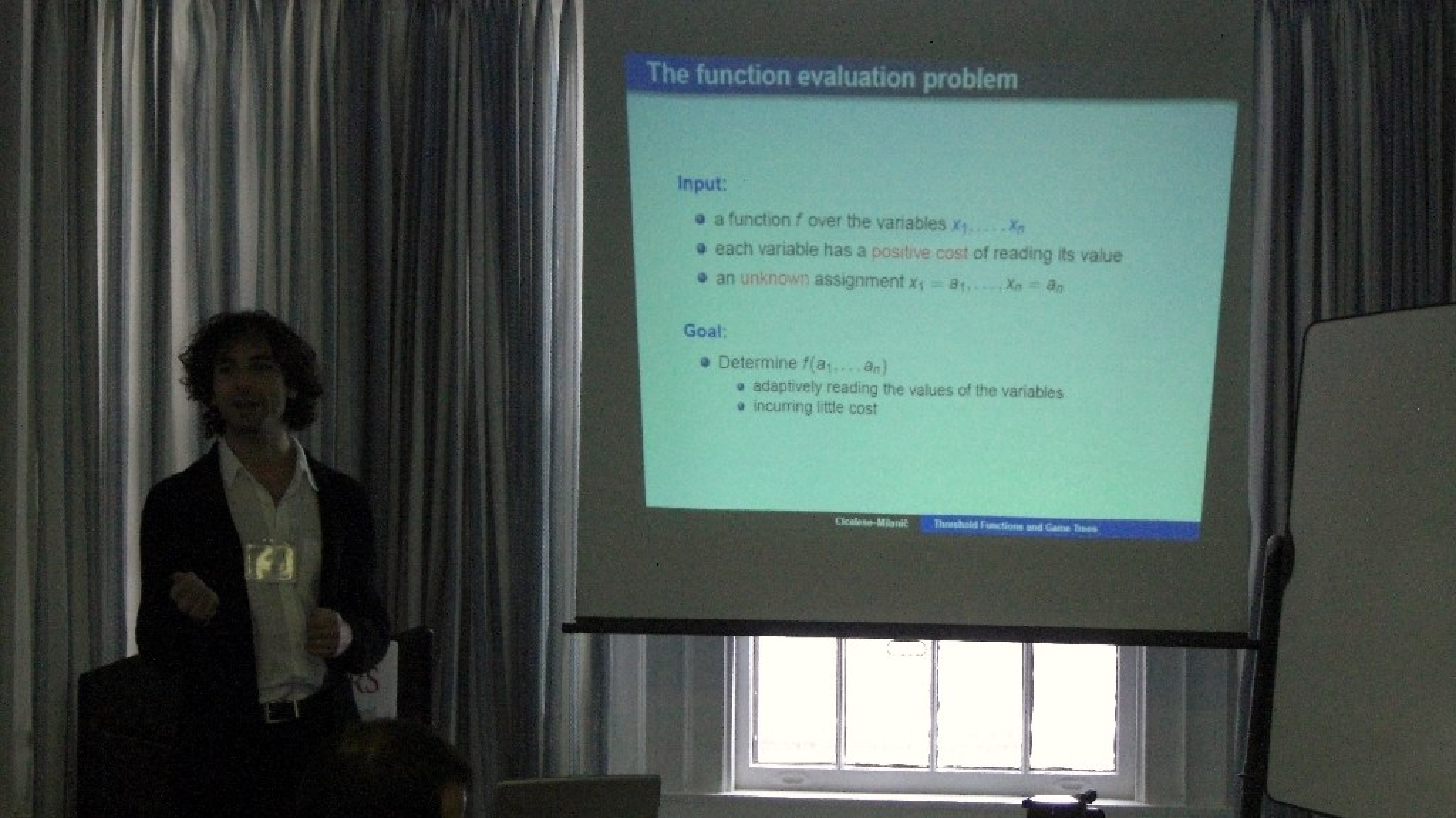
The function evaluation problem
Input:
a function f over the variables x1, . . . , xn
each variable has a positive cost of reading its value
an unknown assignment x1 = a1, . . . , xn = an
Goal:
Determine f(a1, . . . an)
adaptively reading the values of the variables
incurring little cost
Cicalese-Milanič
Threshold Functions and Game Trees


Algorithmic issues: the state of the art
Are there efficient algorithms with optimal competitiveness?
game trees: there is a polynomial-time algorithm
monotone Boolean functions ??? OPEN QUESTION
subclasses of monotone Boolean functions:
AND/OR trees = game trees with 0-1 values [Charikar et al. 2002]
threshold tree functions [Cicalese-Laber 2005]
This talk:
threshold functions (a quadratic algorithm)
extended threshold tree functions (a pseudo-polynomial algorithm)
Threshold Functions and Game Trees
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Overview
Halfspaces over $\{-1,1\}^n$
learning
testing
approximation
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Joint work with:
Ilias Diakonikolas
Columbia
Kevin Matulef
MIT
Ryan O'Donnell
CMU
Ronitt Rubinfeld
MIT / Tel Aviv
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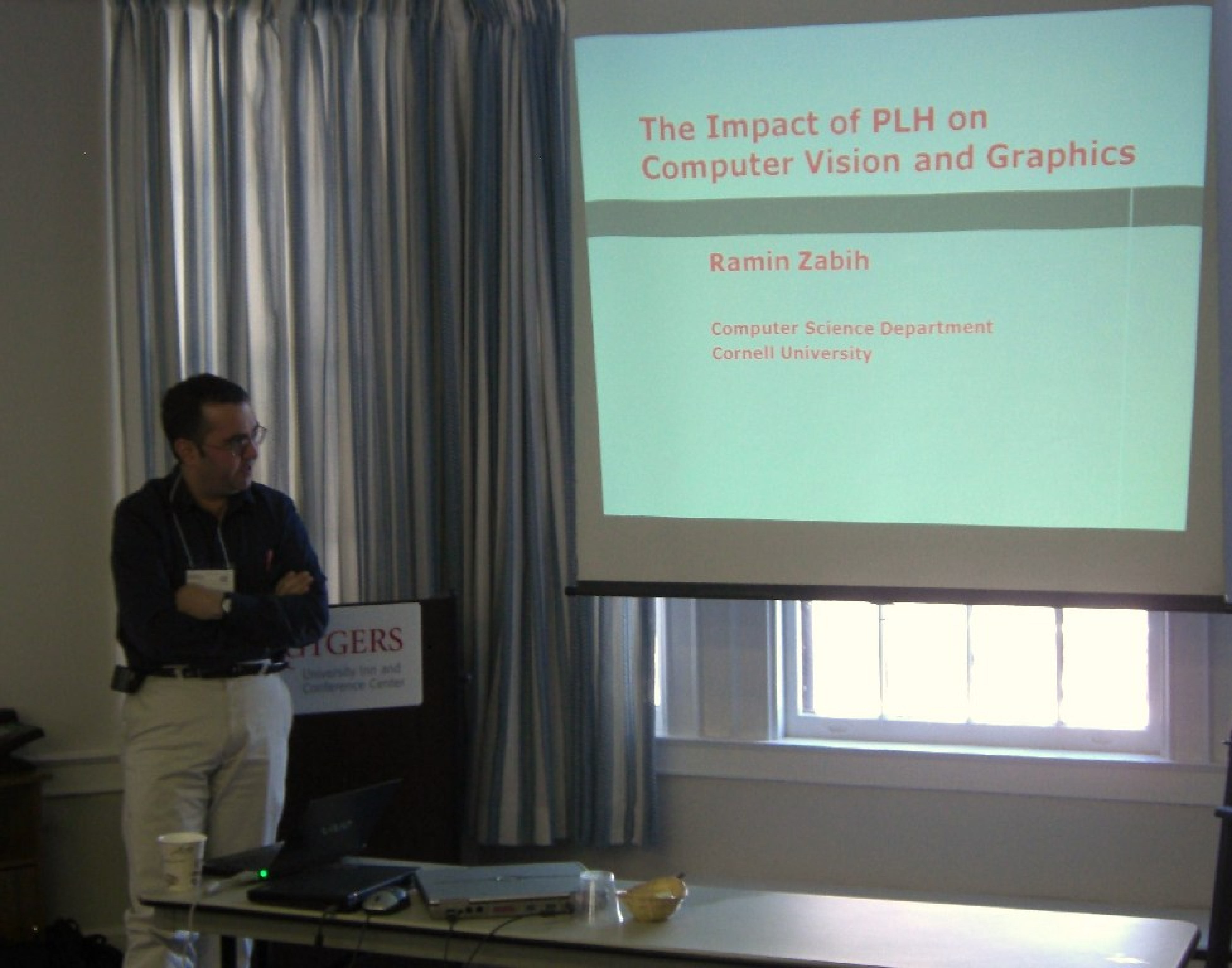
The Impact of PLH on
Computer Vision and Graphics
Ramin Zabih
Computer Science Department
Cornell University
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The Impact of PLH on
Computer Vision and Graphics
Ramin Zabih
Computer Science Department
Cornell University
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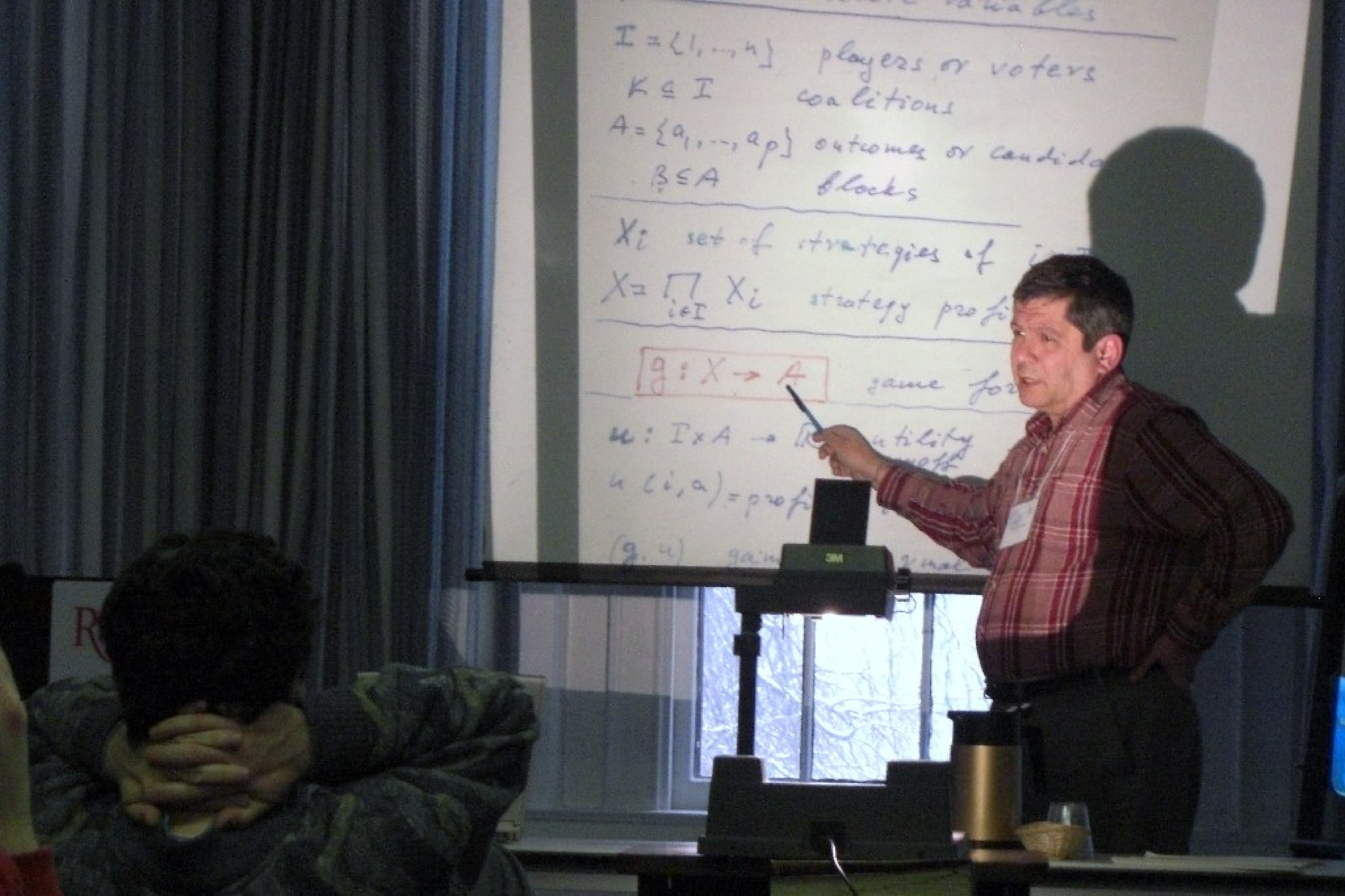

I = {1, ..., n}   players or voters
K ⊆ I   coalitions
A = {a1, ..., ap}   outcomes or
B ⊆ A   blocks
Xi   set of strategies of
X = ∏ Xi   strategy
g : X → A   game
u : I x A →   utility
u (i, a) =
(g, u)
3M


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OXFORD UNIVERSITY
COMPUTING LABORATORY
Motivation
Expressible by quadratic submodular polynomials
= minimisation via (s, t)-Min-Cut.
The Expressive Power of Binary Submodular Functions
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Problem
Which submodular polynomials can be expressed by quadratic submodular polynomials?
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Adding Unsafe Constraints
to Improve Satisfiability
Performance
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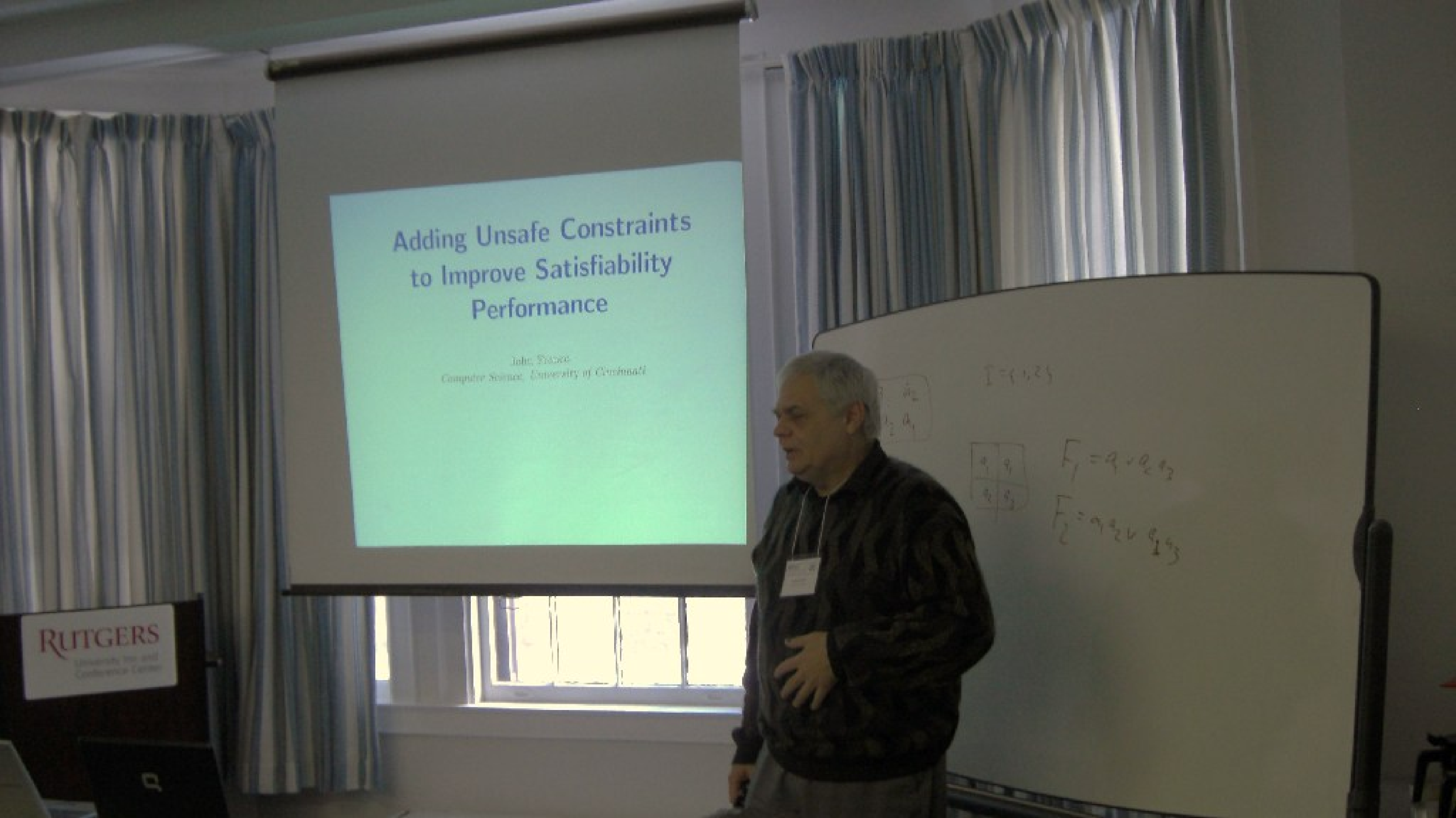
Adding Unsafe Constraints
to Improve Satisfiability
Performance
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REVERSE-ENGINEERING COUNTRY RISK RATINGS: A COMBINATORIAL NON-RECURSIVE MODEL
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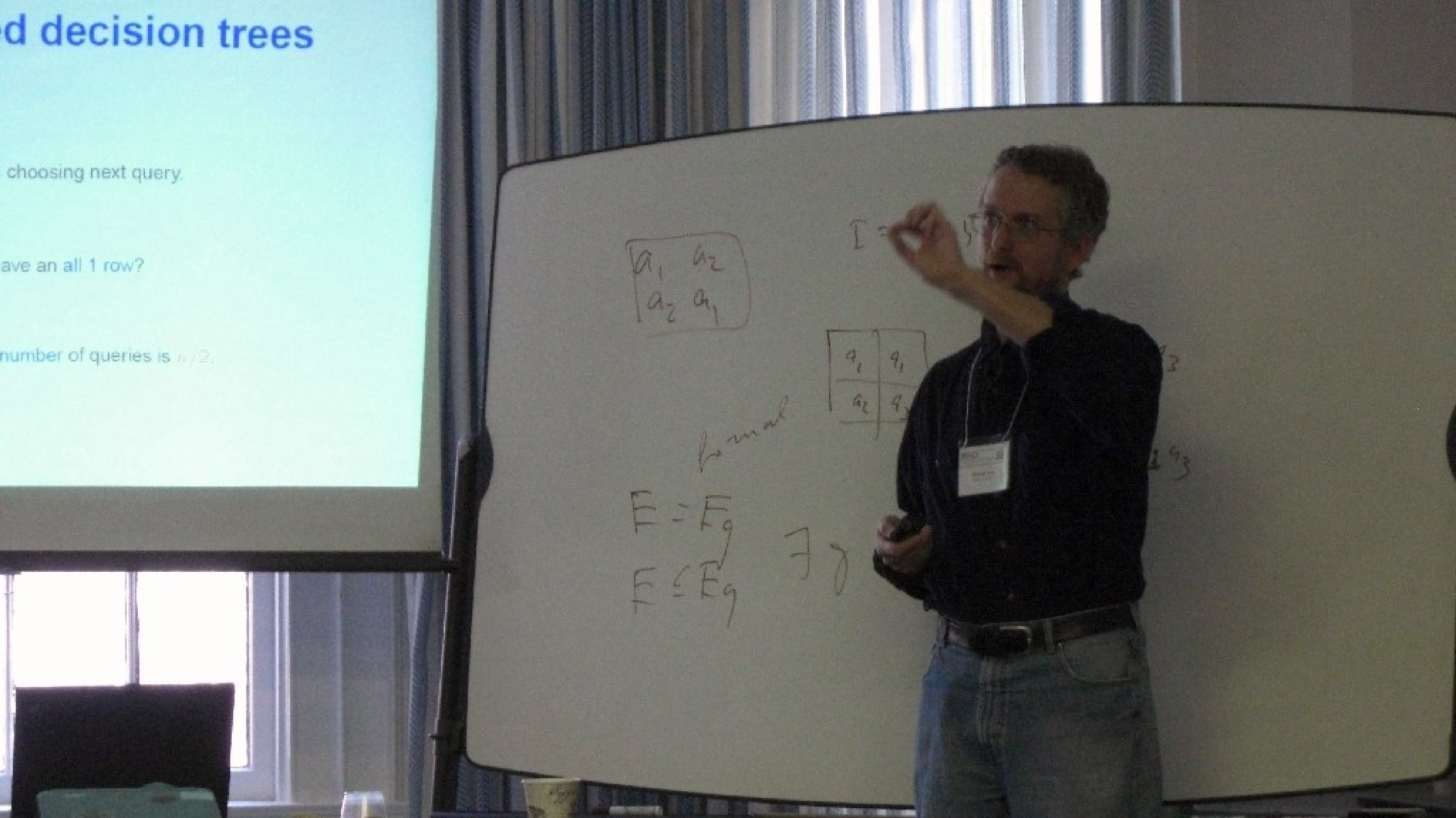
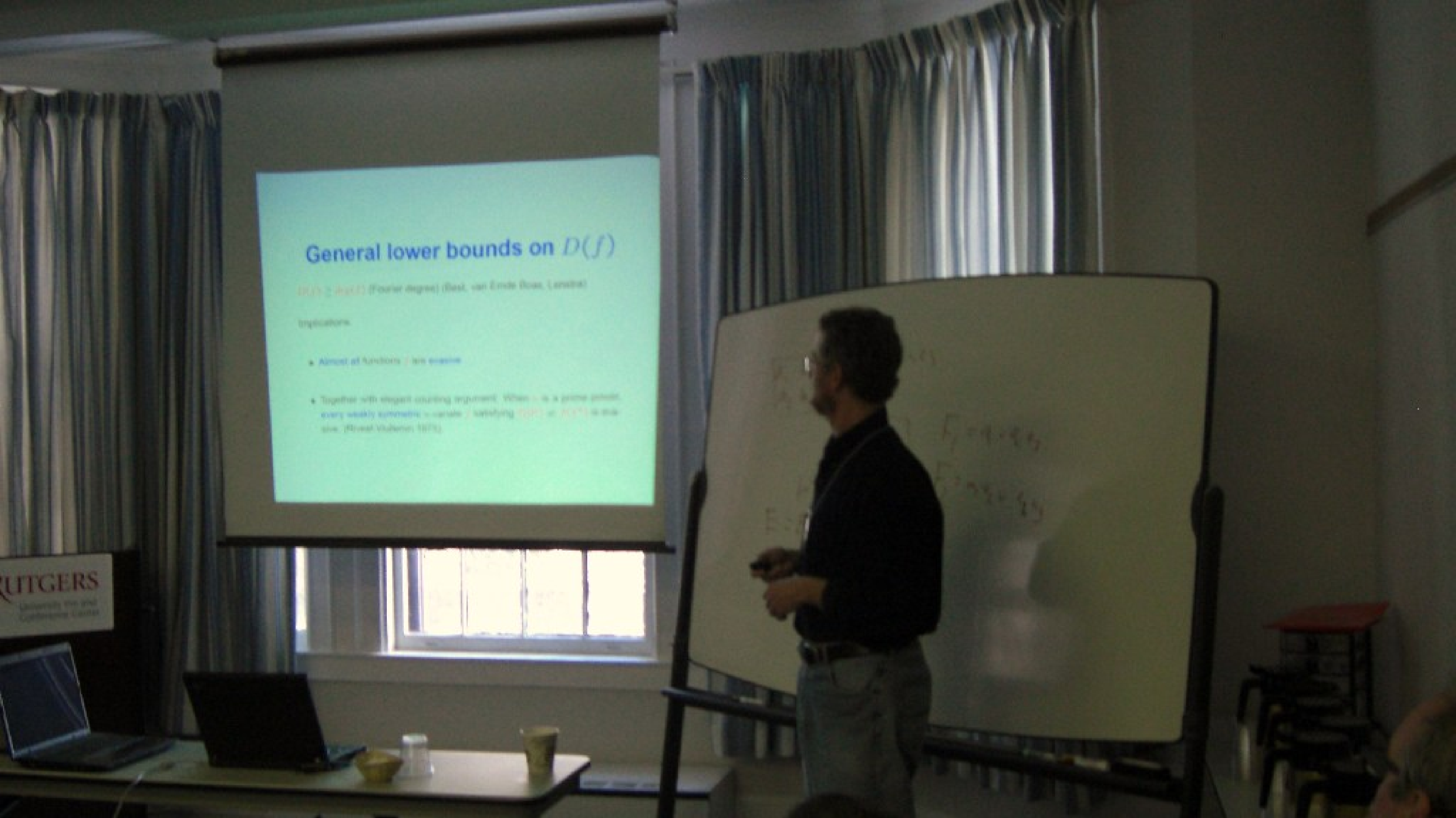

d decision trees
choosing next query.
ave an all 1 row?
number of queries is n/2.


General lower bounds on $D(f)$
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Exclusive and essential sets of implicates of a Boolean function
Ondrej Cepek
Charles University in Prague, Czech Republic
jointly with Endre Boros, Alex Kogan, Petr Kucera, Petr Savicky
DIMACS-RUTCOR Seminar on Boolean and Pseudo-Boolean Functions, January 20, 2009


Cube Partitions and Nonrepeating Decision Trees
Bob Sloan[1] Balázs Szörényi[2,3] György Turán[1,2]
[1]University of Illinois at
[2]Hungarian Academy of Sciences
[3]Ruhr-Universität Bochu
January 2009 / Workshop on Boolea
Functions in memory of Pet
Boolean
Bob Sloan, Balázs Szörényi, György Turán
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Outline
Introduction
DNF with many prime implicants
Cube partitions
Neighboring partitions for NUD–k-term DNF
General Splitting Problem for Cube Partitions
Open Problems
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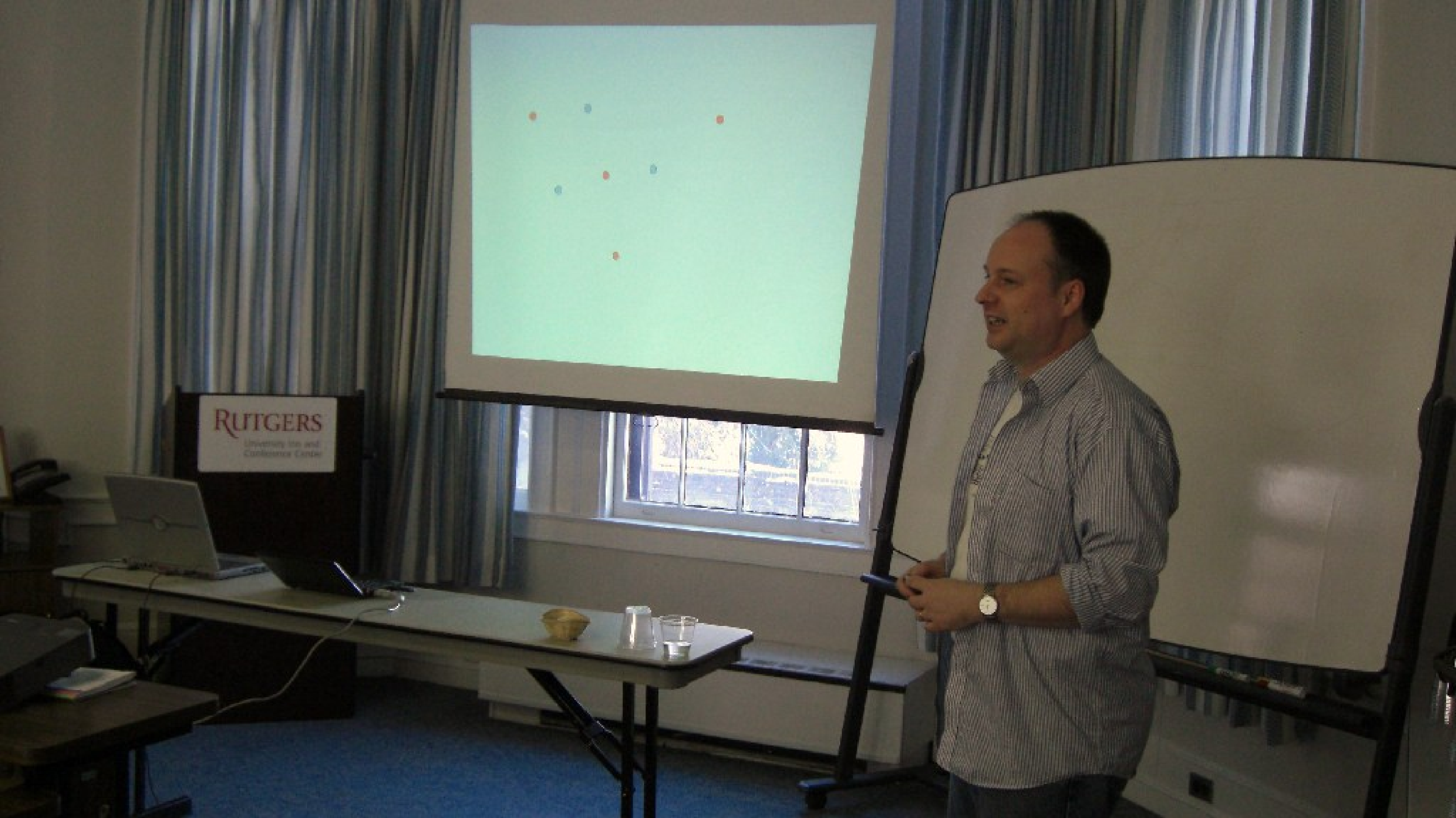
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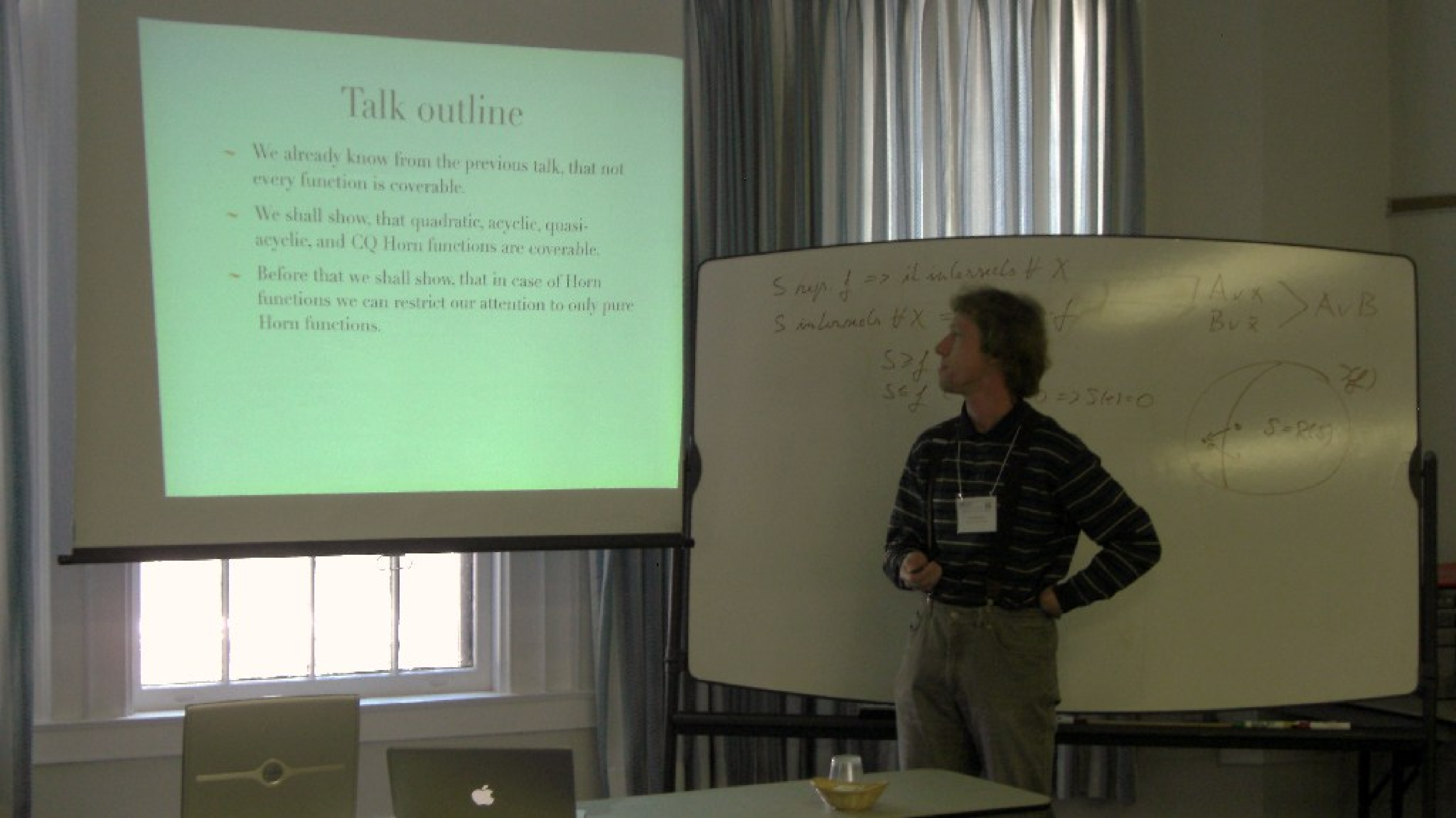
Talk outline
We already know from the previous talk, that not every function is coverable.
We shall show, that quadratic, acyclic, quasi-acyclic, and CQ Horn functions are coverable.
Before that we shall show, that in case of Horn functions we can restrict our attention to only pure Horn functions.


Negative implicates
Let f be a Horn function.
Let X be an exclusive set of implicates of f, such that no two clauses in E = I(f) \ R(X) are resolvable.
Then there exists an integer k, and pairwise disjoint essential sets Q1, …, Qk ⊆ E, such that for every CNF C representing f.
|C ∩ Qj| = 1, j = 1, …, k
C does not contain other elements of E.


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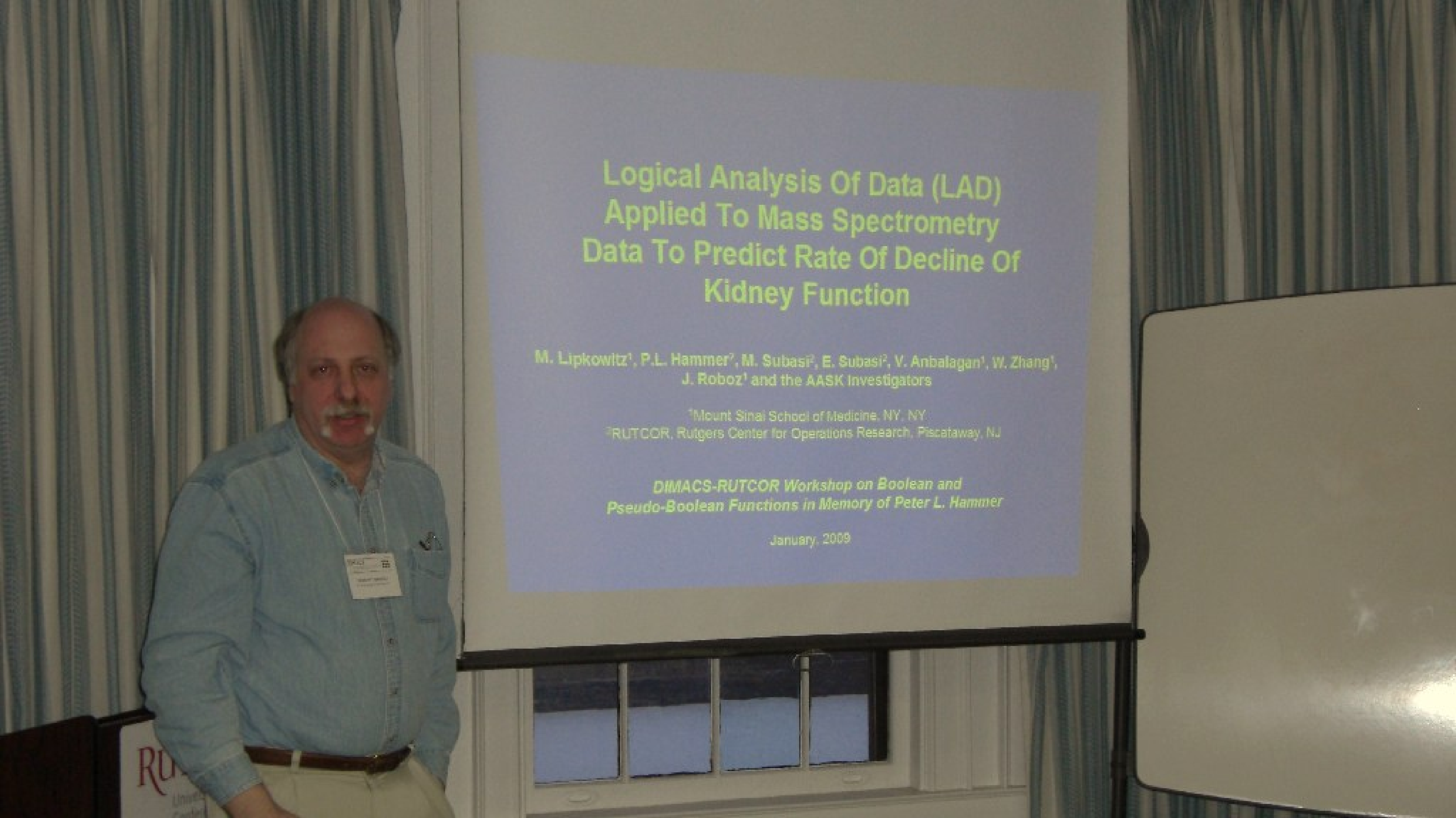
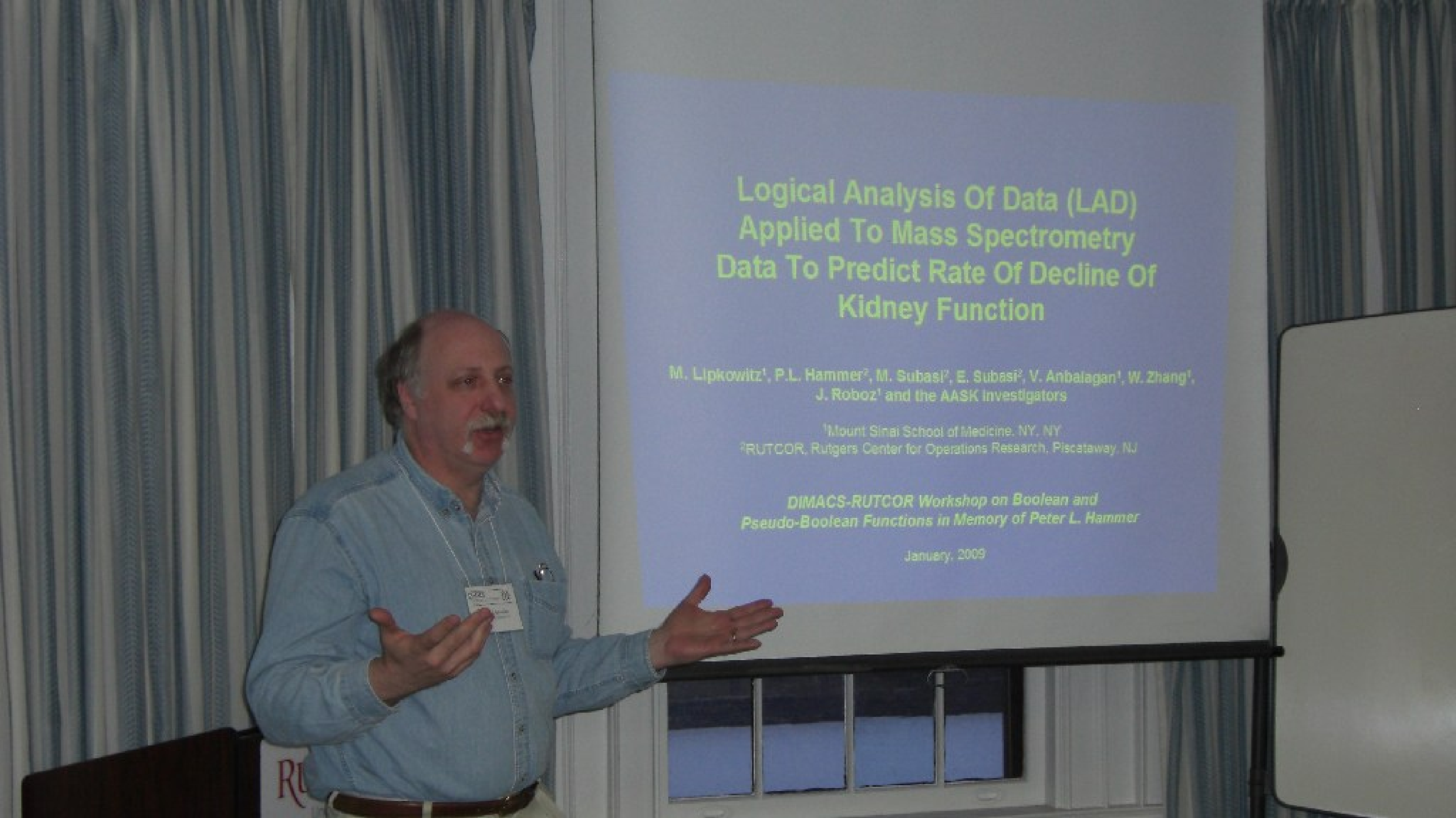
An Improved
Maximum
Noam
Joint work
Jonathan Eckstein,
January 20,
Center


Logical Analysis Of Data (LAD) Applied To Mass Spectrometry Data To Predict Rate Of Decline Of Kidney Function
M. Lipkowitz1, P.L. Hammer2, M. Subasi2, E. Subasi2, V. Anbalagan1, W. Zhang1, J. Roboz1 and the AASK Investigators
1Mount Sinai School of Medicine, NY, NY
2RUTCOR, Rutgers Center for Operations Research, Piscataway, NJ
DIMACS-RUTCOR Workshop on Boolean and Pseudo-Boolean Functions in Memory of Peter L. Hammer
January, 2009


Logical Analysis Of Data (LAD) Applied To Mass Spectrometry Data To Predict Rate Of Decline Of Kidney Function
M. Lipkowitz[1], P.L. Hammer[2], M. Subasi[2], E. Subasi[2], V. Anbalagan[1], W. Zhang[1], J. Roboz[1] and the AASK investigators
[1]Mount Sinai School of Medicine, NY, NY
[2]RUTCOR, Rutgers Center for Operations Research, Piscataway, NJ
DIMACS-RUTCOR Workshop on Boolean and Pseudo-Boolean Functions in Memory of Peter L. Hammer
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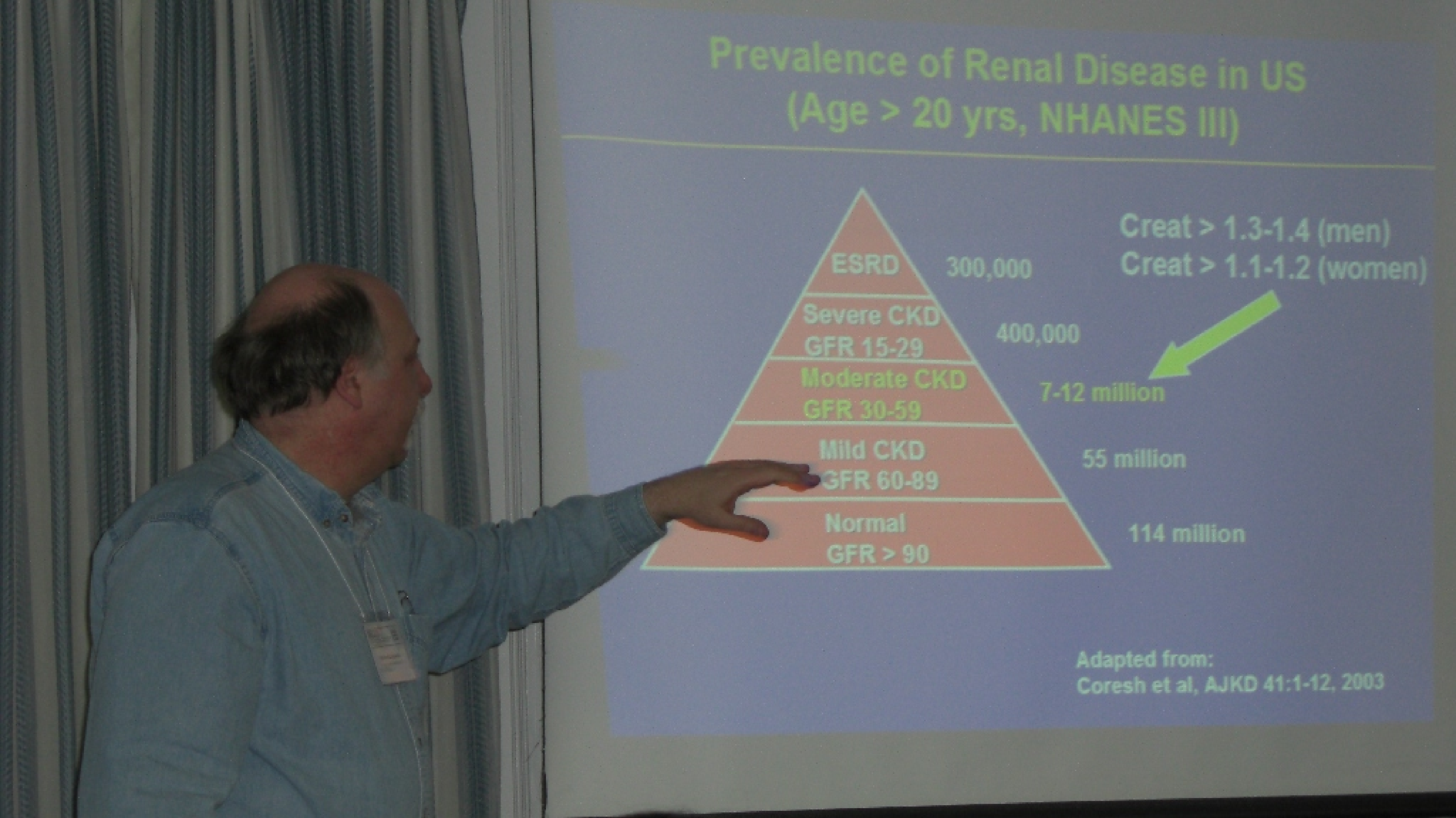
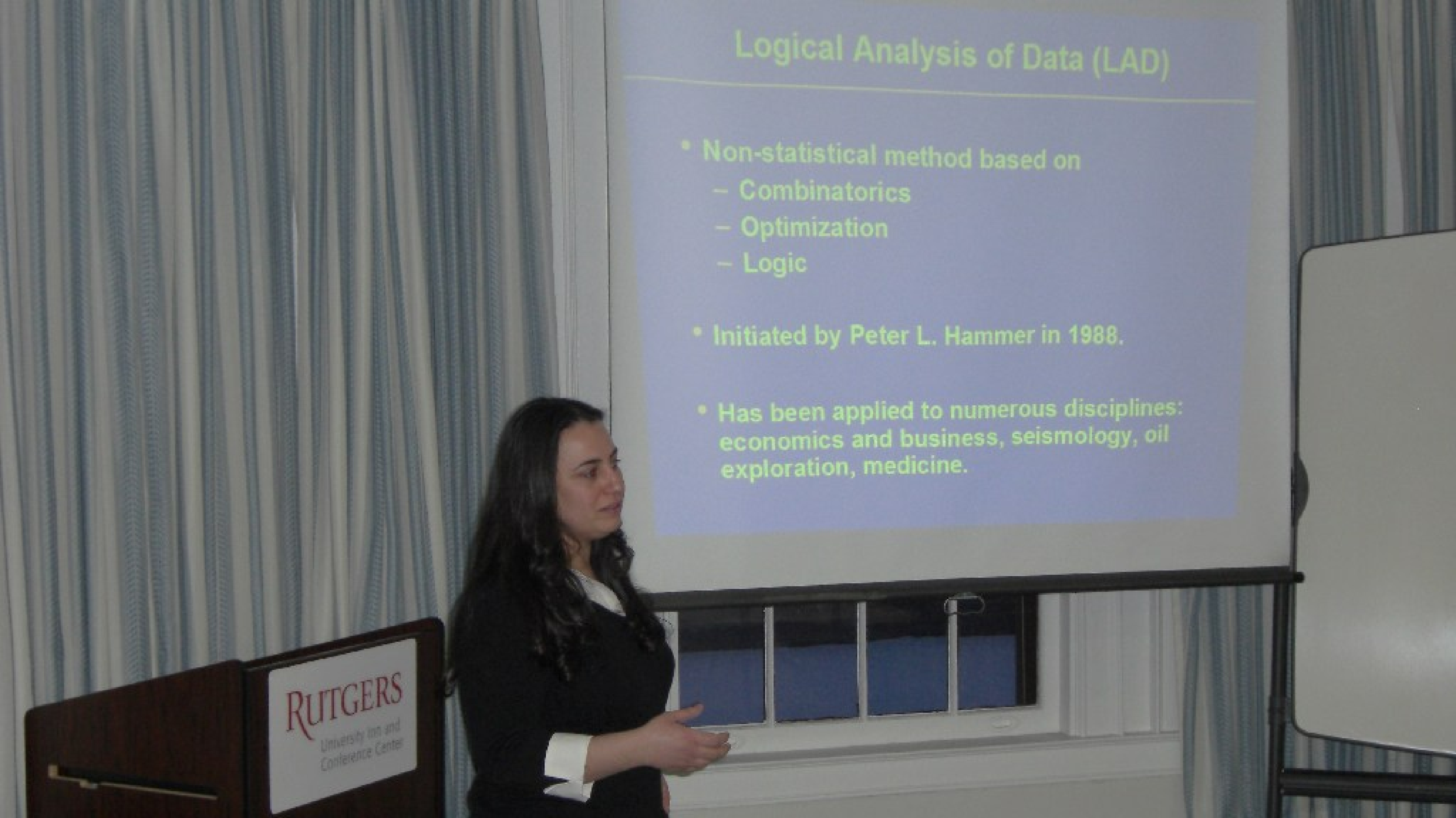

Prevalence of Renal Disease in US
(Age > 20 yrs, NHANES III)
ESRD
300,000
Severe CKD
GFR 15-29
400,000
Moderate CKD
GFR 30-59
7-12 million
Mild CKD
GFR 60-89
55 million
Normal
GFR > 90
114 million
Creat > 1.3-1.4 (men)
Creat > 1.1-1.2 (women)
Adapted from:
Coresh et al, AJKD 41:1-12, 2003


Logical Analysis of Data (LAD)
• Non-statistical method based on
– Combinatorics
– Optimization
– Logic
• Initiated by Peter L. Hammer in 1988.
• Has been applied to numerous disciplines: economics and business, seismology, oil exploration, medicine.
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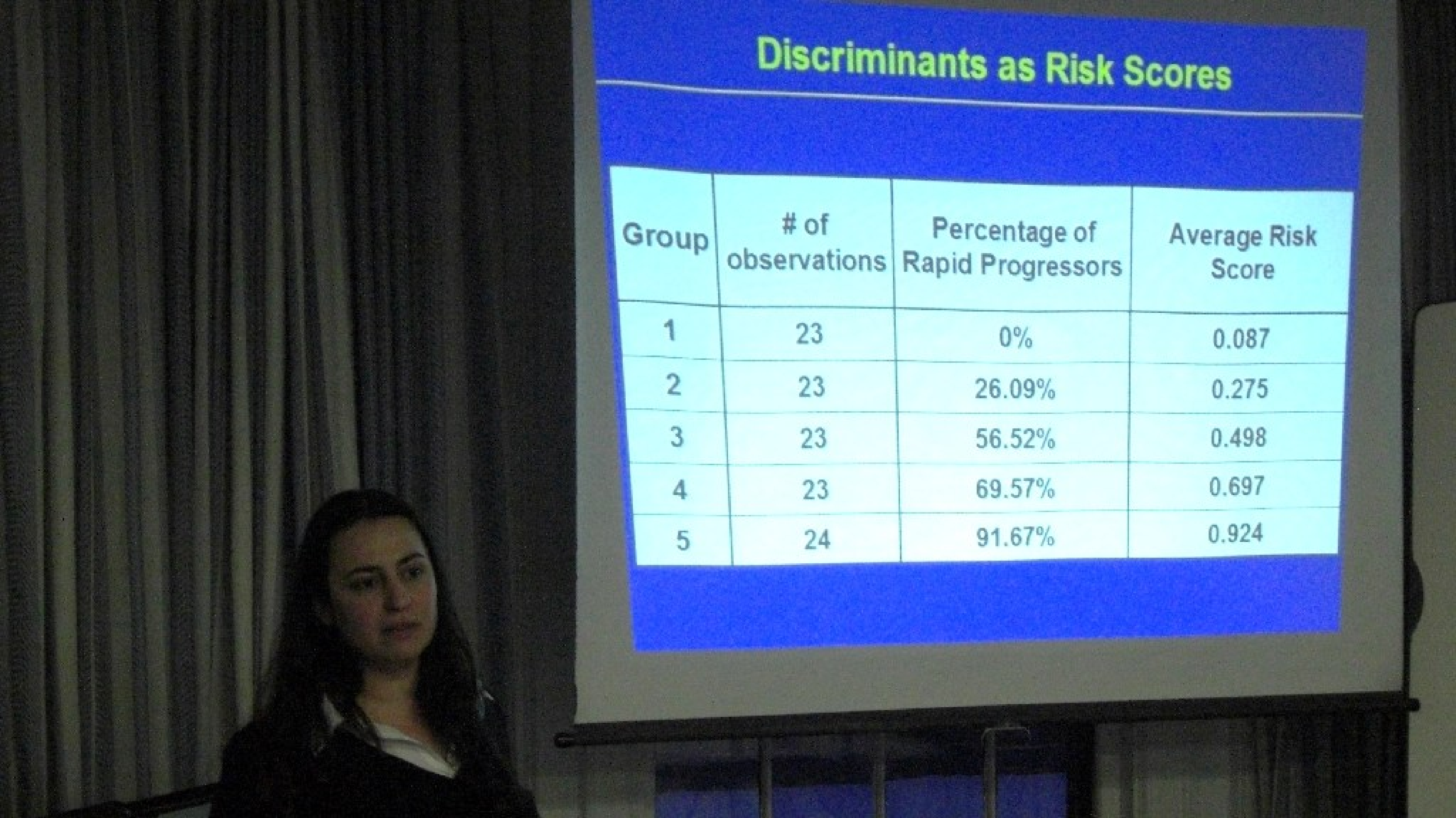
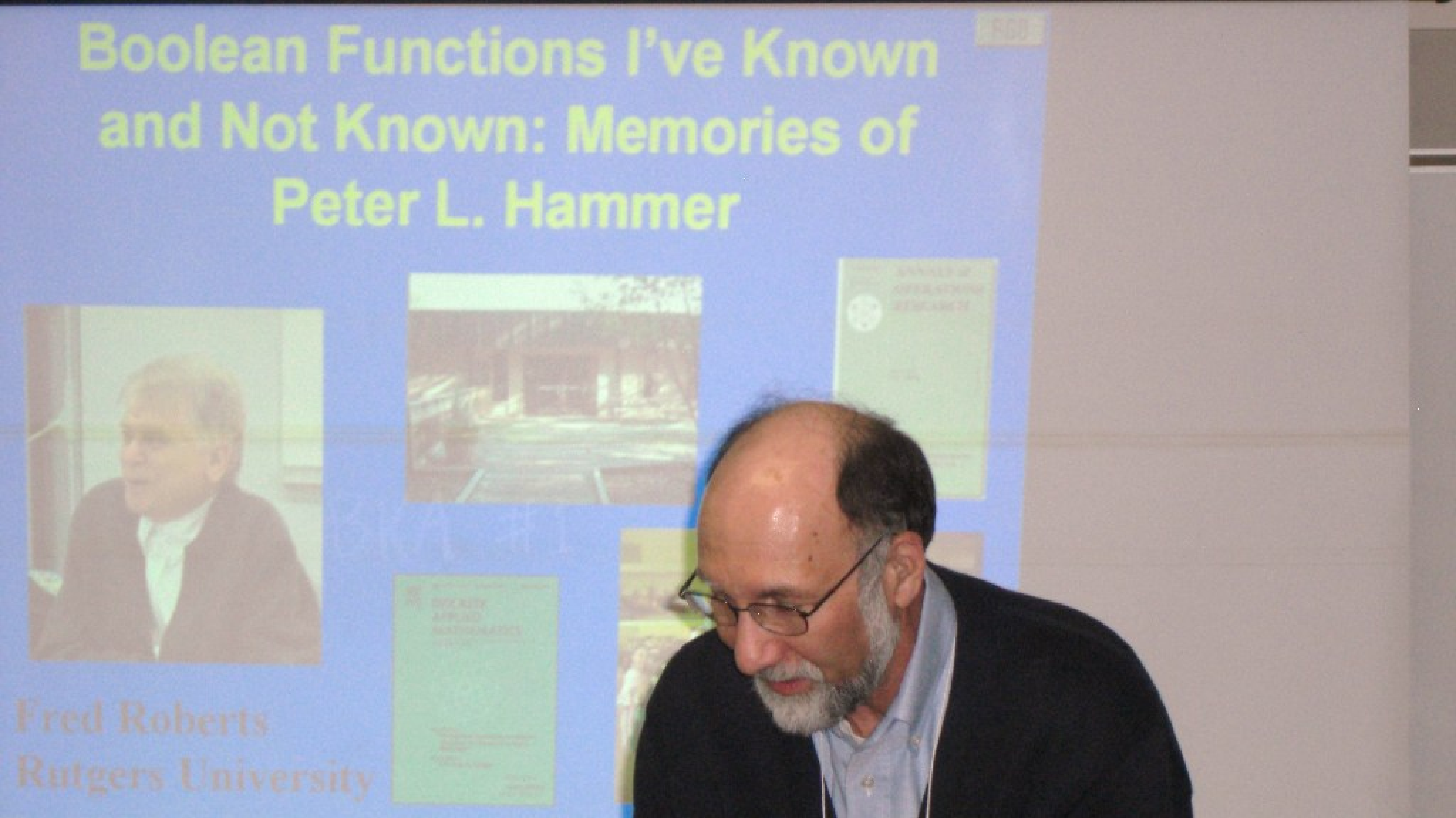
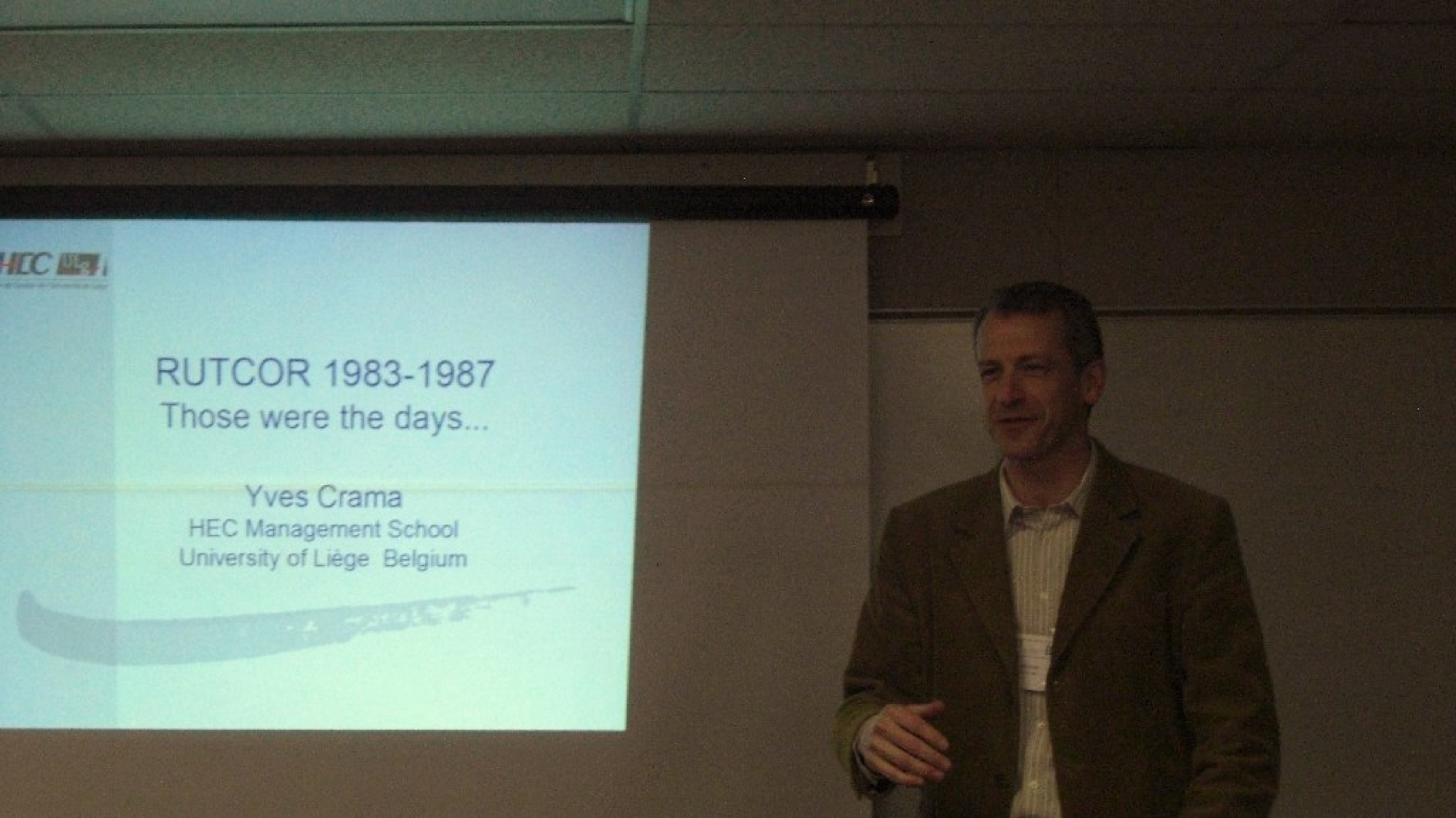

Discriminants as Risk Scores
Group
# of observations
Percentage of Rapid Progressors
Average Risk Score
1 23 0% 0.087
2 23 26.09% 0.275
3 23 56.52% 0.498
4 23 69.57% 0.697
5 24 91.67% 0.924


POINCARÉ
S(t)
S(T)
BKA #1


POINCARE
S(t)
S(T)


Boolean Functions I've Known
and Not Known: Memories of
Peter L. Hammer
Fred Roberts
Rutgers University


RUTCOR 1983-1987
Those were the days...
Yves Crama
HEC Management School
University of Liège Belgium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Those were the days...
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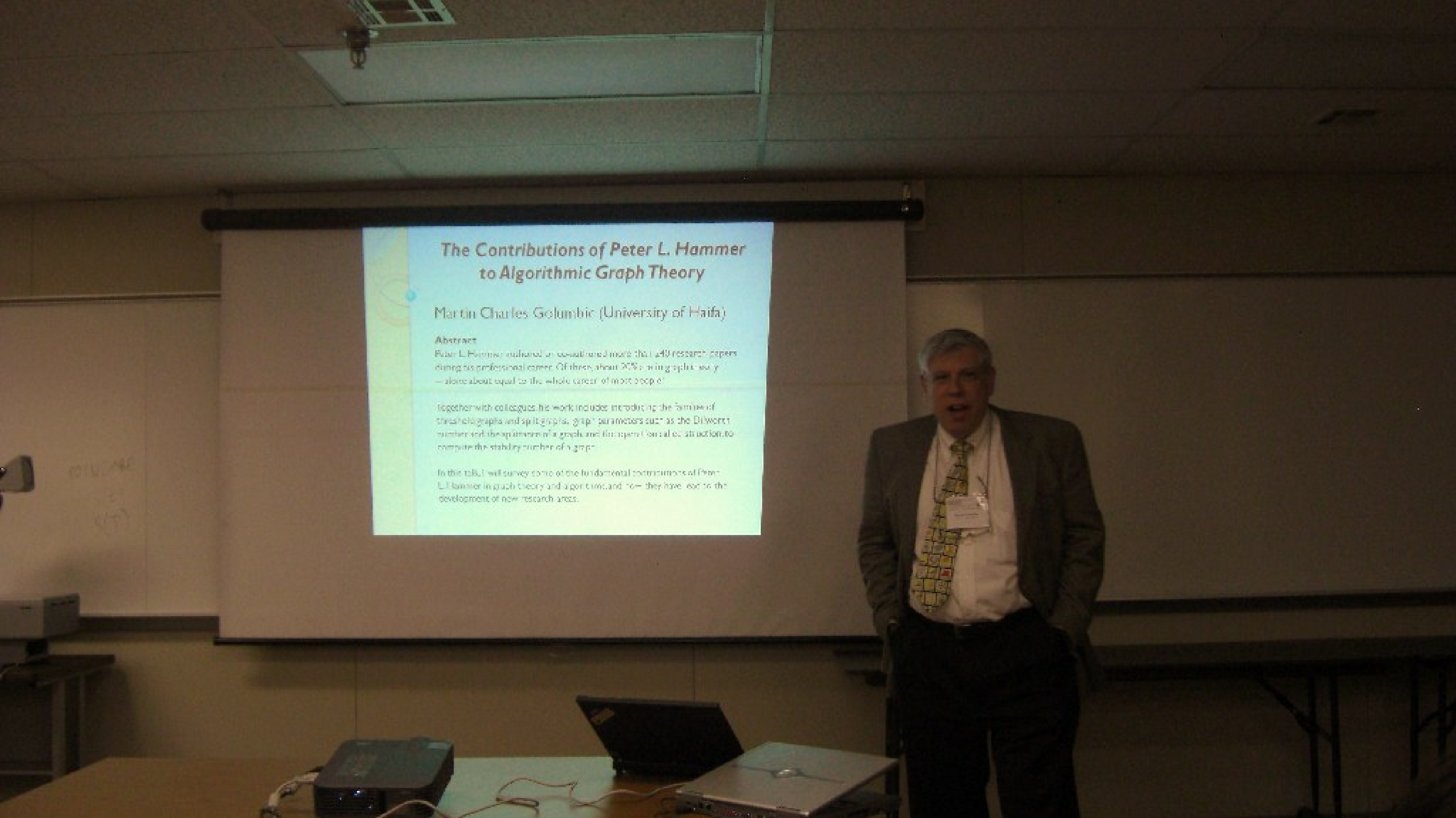
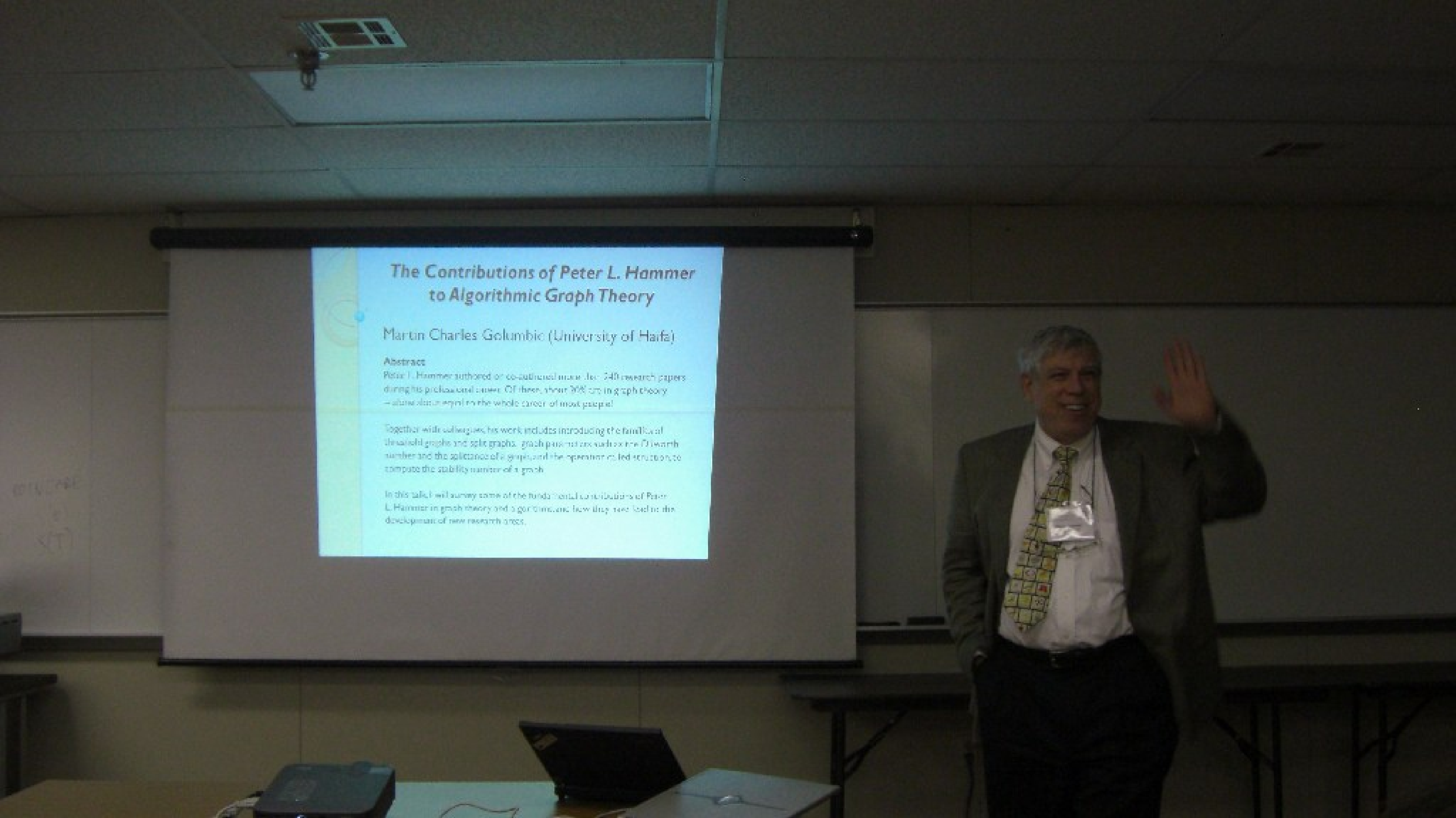
University of Liège Belgium


The Contributions of Peter L. Hammer to Algorithmic Graph Theory
Martin Charles Golumbic (University of Haifa)
Abstract


The Contributions of Peter L. Hammer
to Algorithmic Graph Theory
Martin Charles Golumbic (University of Haifa)
Abstract

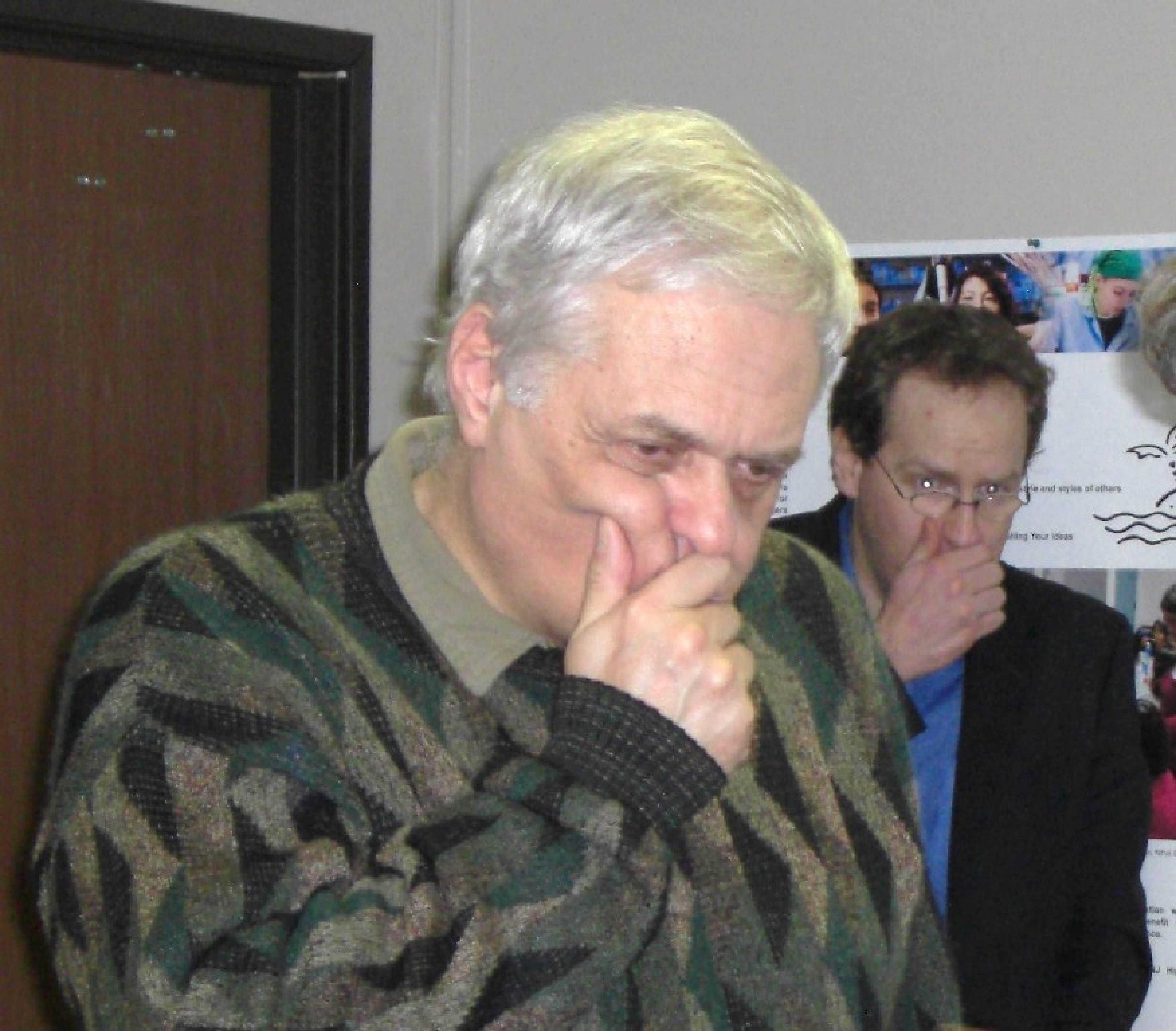

Some Observations on Boolean Logic
and Optimization
John Hooker
Carnegie Mellon University


Some Observations on Boolean Logic
and Optimization


EXIT


EXIT


EXIT

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