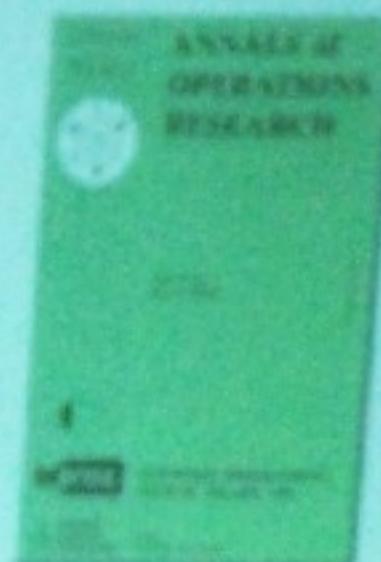
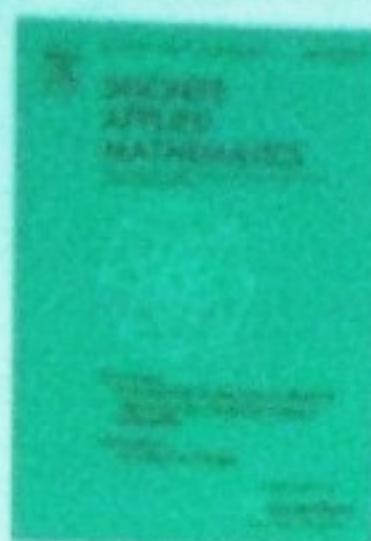
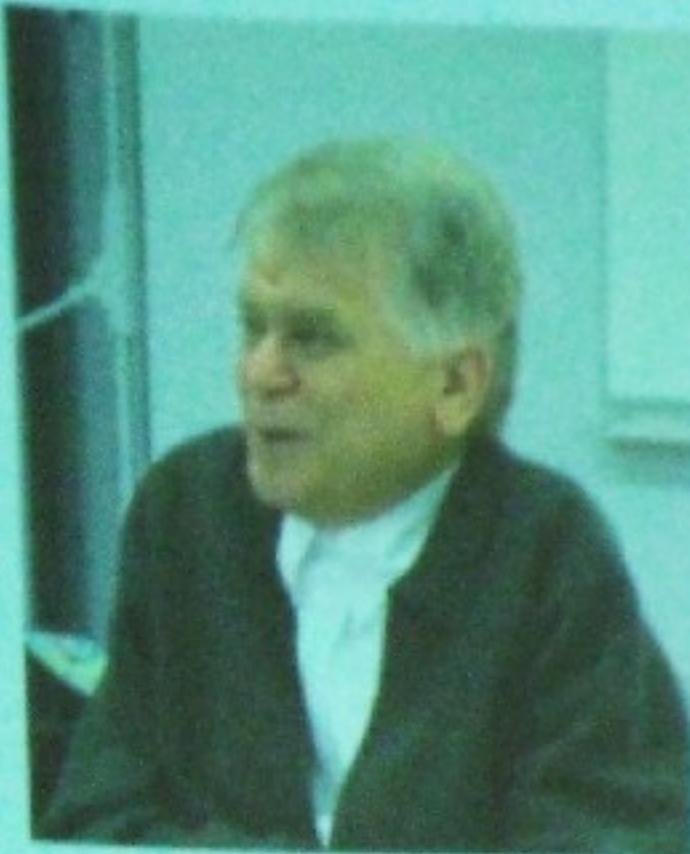
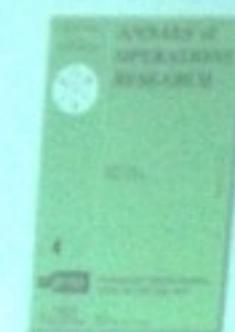
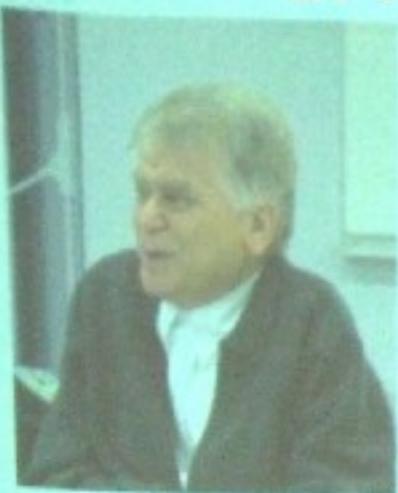


DIMACS-RUTCOR Workshop on Boolean and Pseudo- Boolean Functions in Memory of Peter L. Hammer



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 distribution
- Work on learning problems has led to some new harmonic analysis
 - Spectral properties of function classes
 - Algorithms for approximation



Themes

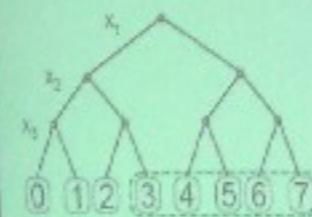
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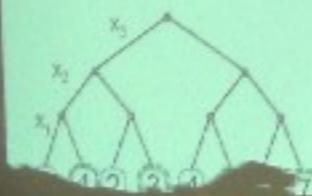
Example (1)

Example

$$\mathcal{F} = x_1 \vee x_2 \vee x_3$$



ordering $x_1, x_2, x_3 \rightarrow$ interval [3, 7]



ordering $x_3, x_2, x_1 \rightarrow$ 3 intervals
([1], [3] and [5, 7])

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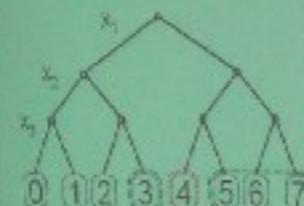
A woman with dark hair tied back, wearing a black and white horizontally striped long-sleeved shirt, stands at a podium. She is facing towards the right side of the frame, where a large projection screen is visible. A name tag is pinned to her shirt. The podium has a small sign on it that reads "ERS".

Example (2)

Example

$$\mathcal{F} = X_1X_2 \vee X_2X_3 \vee X_1X_3$$

Variables are symmetrical → all orderings are equivalent.



cannot be represented by 1 interval, only by 2 ([3] and [5, 7.])

γ -Horn and
 β -Horn Formulas

Boolean Functions Defined by
Solution Procedures



Structures of Recurrent Horn and
 β -Horn Formulae

Borel Functions Defined by
Solvability Procedures

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Miguel A. Lejeune
George Washington U

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in Memory of
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January 2009

Workshop in Memory of Peter L. Hammer

M. Lejeune



Miguel A. Lejeune
George Washington University

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on Boolean and Pseudo-Boolean Functions
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January 2009

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M. Lejeune





ELIA BALEKOWSKA
E-mail: elia@imail.org
Phone: +48 61 677 2



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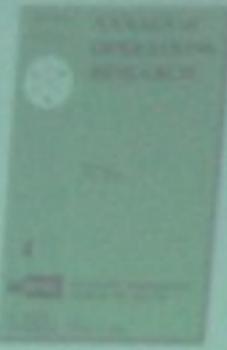
On Approximate Horn Minimization

A. Bhattacharya, B. DasGupta, D. Mubayi, Gy. Tu

January 2009, RUTCOR



DR Workshop and Pseudo- functions in Memory Hammer





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Justifiable Learning

What Can and What Has To Be Learned From Data

Endre Boros

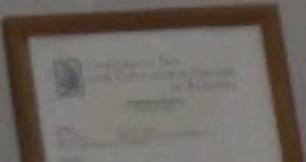
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Justifiable Learning

Zoltan Kovacs, Law Faculty, University of Szeged

Endre Boros

HUCCS, Budapest University

What is responsible law? What can be done? P. Kovacs, T. Kovacs & E. Boros

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EHE

PowerPoint Presentation - Adobe Reader

File Edit View document Tools Window Help



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

hammer09

PowerPoint Pre...



9:48 AM

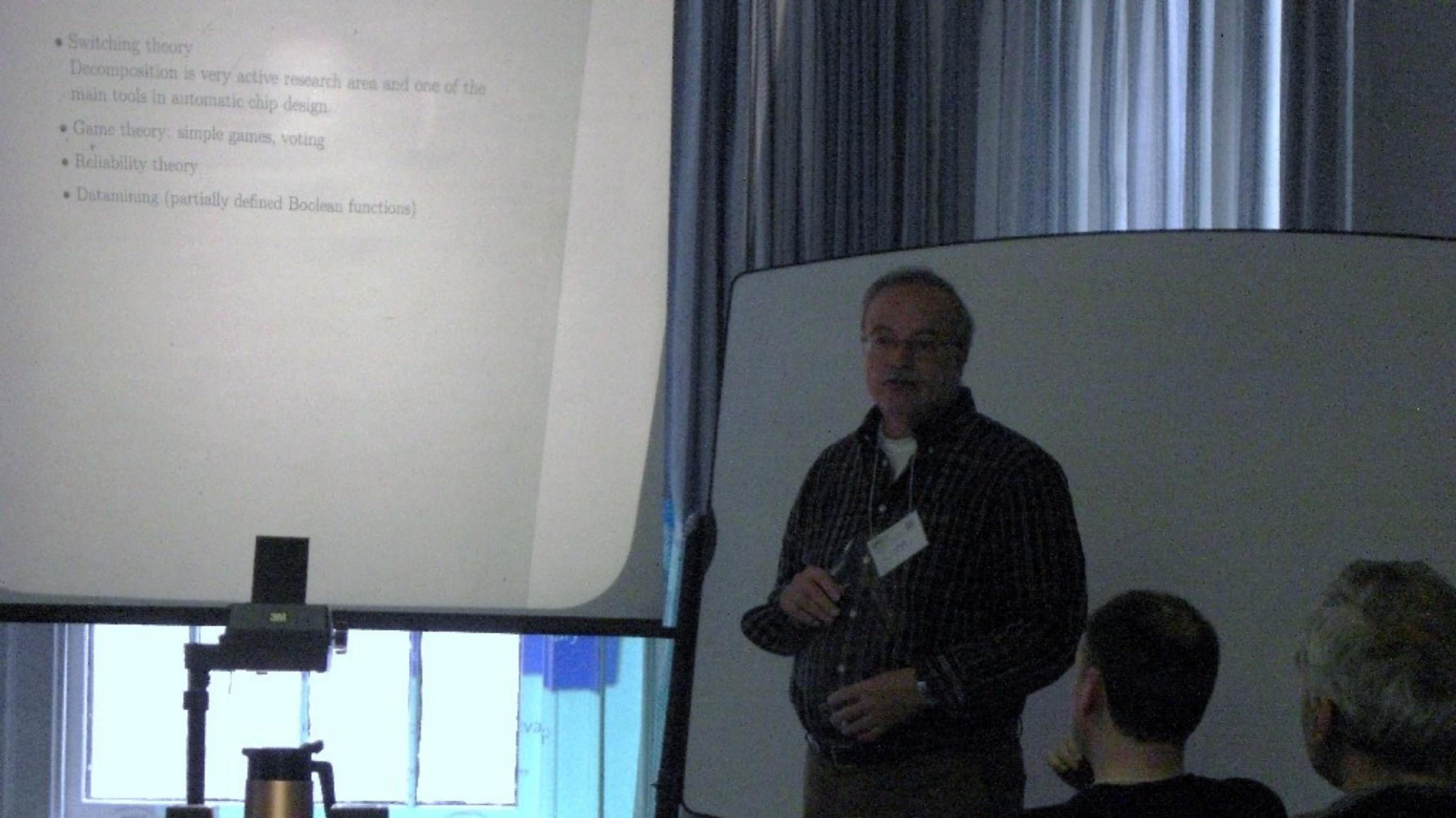
- Switching theory

Decomposition is very active research area and one of the main tools in automatic chip design

- Game theory: simple games, voting

- Reliability theory

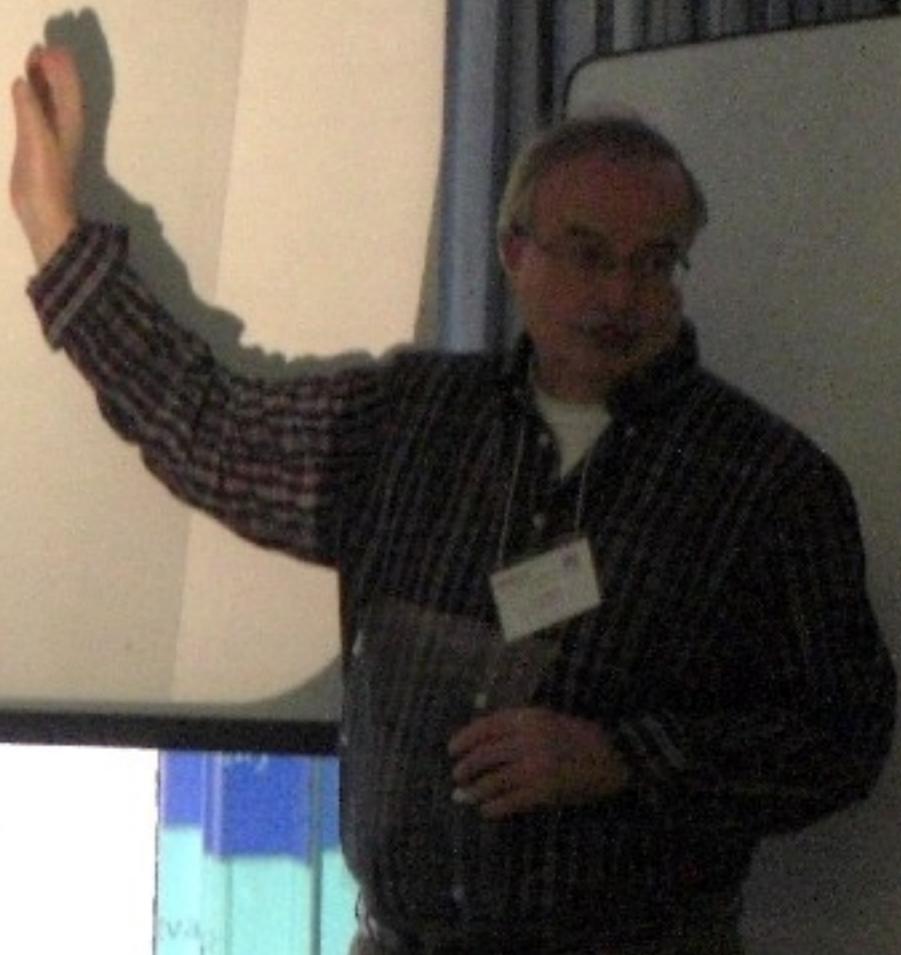
- Datamining (partially defined Boolean functions)



- Switching theory

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)







PLAN:

1. *Introduction: shareholder network 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

- 
1. *Introduction: shareholders 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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29	(1000) (0100) (0010) (0001)	$y_1 + y_2 + y_3 + y_4 \leq 1$
30	(0010) (0001) (1100)	$y_2 + y_3 + y_4 \leq 1, y_2 + y_3 + y_4 \leq 1$
31	(0001) (1100) (1010)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_3 + y_4 \leq 1$
32	(0001) (1100) (1010) (0110)	$y_2 + y_3 + y_4 \leq 2$
33	(0001) (1100) (1010) (0110) (0011)	$y_2 + y_3 \leq 1, y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$
34	(0001) (1100) (1010) (0110) (0011) (1100)	$y_2 + y_3 + y_4 \leq 1$
35	(1100) (1010) (0110) (0011) (1100) (1010)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$
36	(1100) (1010) (0110) (0011) (1100) (1010) (0101)	$y_2 + y_3 \leq 1, y_3 + y_4 \leq 1$
37	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$
38	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$
39	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100)	$y_2 + y_3 + y_4 \leq 2$
40	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111)	$y_2 + y_3 + y_4 \leq 2$
41	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100)	$y_2 + y_3 + y_4 \leq 3$
42	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100) (0111)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_3 + y_4 \leq 2$
43	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100) (0111) (1100)	$y_2 + y_3 + y_4 \leq 2, y_2 + y_3 + y_4 \leq 2$
44	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100) (0111) (1100) (1100)	$y_2 + y_3 + y_4 \leq 2$
45	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100) (0111) (1100) (1100) (1100)	$y_2 + y_3 + y_4 \leq 3$
46	(1100) (1010) (0110) (0011) (1100) (1010) (0101) (1100) (0101) (1100) (0111) (1100) (0111) (1100) (1100) (1100) (1100)	$0 \leq y_i \leq 1, i = 1, 2, 3, 4$

$$y_1 + y_2 + y_3 + y_4 \leq 2, y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$$

$$y_2 + y_4 \leq 1, y_3 + y_4 \leq 1$$

$$y_1 + y_2 + y_3 + y_4 \leq 2, y_3 + y_4 \leq 1$$

$$y_1 + y_2 + y_4 \leq 2, y_3 + y_4 \leq 1$$

$$y_3 + y_4 \leq 1$$

$$y_1 + y_2 + y_3 + y_4 \leq 2$$

$$y_1 + y_2 + y_3 + 2y_4 \leq 3$$

$$y_1 + y_3 + y_4 \leq 2, y_2 + y_3 + y_4 \leq 2$$

$$y_1 + y_2 + y_4 \leq 2, y_2 + y_3 + y_4 \leq 2$$

$$y_2 + y_3 + y_4 \leq 2$$

$$y_1 + y_2 + y_3 + y_4 \leq 3$$

$$0 \leq y_i \leq 1 \quad i = 1, 2, 3, 4$$

10^{100}

$10^{100} + 1$



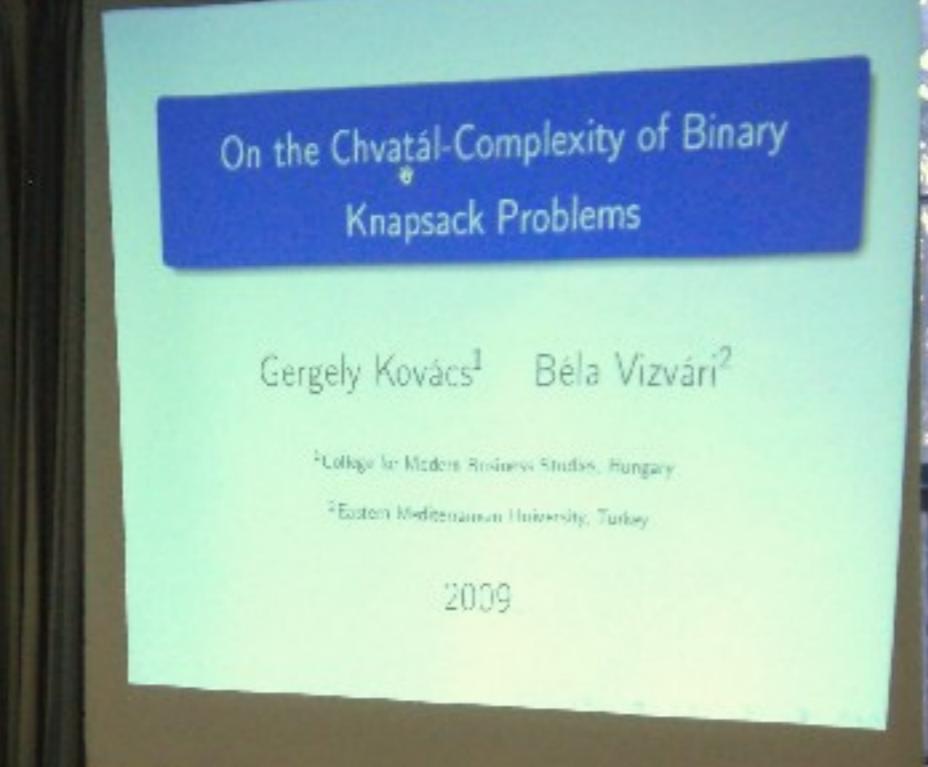
On the Chvátal-Complexity of Binary Knapsack Problems

Gergely Kovács¹ Béla Vizvári²

¹College for Modern Business Studies, Hungary

²Eastern Mediterranean University, Turkey

2009



Gergely Kovács¹

¹College for Modern Busi

²Eastern Mediterranean

200



Experience with Timetabling



Experience with Timetabling

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The function evaluation problem

Input:

- a function f over the variables x_1, \dots, x_n
- each variable has a **positive cost** of reading its value
- an **unknown** assignment $x_1 = a_1, \dots, x_n = a_n$

Goal:

- Determine $f(a_1, \dots, a_n)$
 - adaptively reading the values of the variables
 - incurring little cost

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)

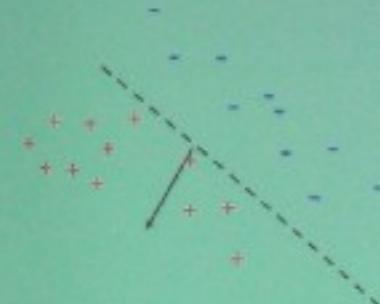
Cicalese-Milani: Threshold Functions and Game Trees

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Overview

Halfspaces over $\{-1, 1\}^n$



A woman with short dark hair, wearing a black long-sleeved shirt and a name tag, stands to the left of the projector screen, gesturing with her hands as if speaking.

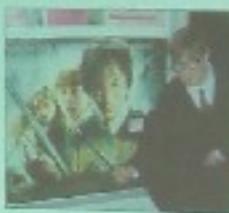
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Joint work with:



Ilias Diakonikolas
Columbia



Kevin Matulef
MIT



Ryan O'Donnell
CMU



Ronitt Rubinfeld
MIT / Tel Aviv

A man with short dark hair, wearing a black long-sleeved shirt and a lanyard with an ID badge, stands in front of a white banner. He is gesturing with his right hand while speaking. The banner has the word "RUTGERS" in large red letters, followed by "University Inn and Conference Center" in smaller blue text.

The Impact of PLH on Computer Vision and Graphics

Ramin Zabih

Computer Science Department
Cornell University



The Impact of PLH on Computer Vision and Graphics

Ramin Zabih

Computer Science Department
Cornell University

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$I = \{1, \dots, n\}$ players or voters
 $K \subseteq I$ coalitions
 $A = \{a_1, \dots, a_p\}$ outcomes or candidates
 $B \subseteq A$ blocks

X_i set of strategies of $i \in I$
 $X = \prod_{i \in I} X_i$ strategy profile

$\varrho : X \rightarrow A$

same for

$u : I \times A \rightarrow \mathbb{R}$ utility
 $u(i, a) = \text{profit}$

(ϱ, u) game

model

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Motivation

Expressible by quadratic submodular polynomials
= minimisation via (s, t) -Min-Cut.

Zivny et al.

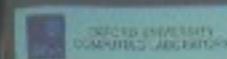
The Expressive Power of Binary Submodular Functions

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Problem

Which submodular polynomials can be expressed
by quadratic submodular polynomials?

Ziv Shmueli

The Extensive Power of Binary Submodular Functions

Adding Unsafe Constraints to Improve Satisfiability Performance

John P. Gallagher
University of Edinburgh



$$\begin{array}{|c|c|} \hline 0 & 0 \\ \hline 0 & 1 \\ \hline \end{array}$$

$\neg F_1$

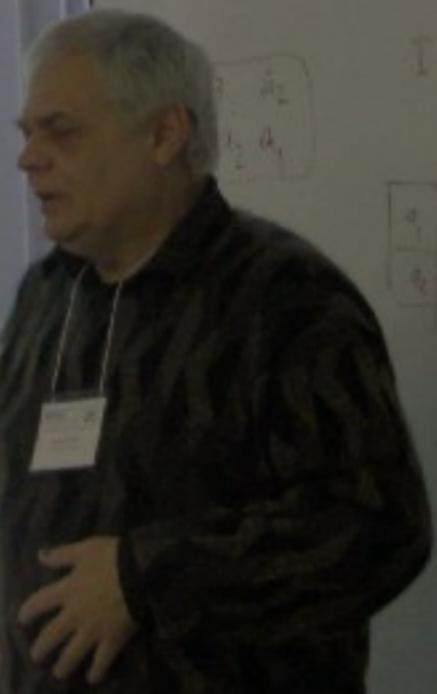
$$\begin{array}{|c|c|} \hline 0 & 0 \\ \hline 1 & 0 \\ \hline \end{array}$$

$$\begin{array}{l} F_1 = 0, 1, 0, 1 \\ F_2 = 0, 0, 1, 1 \end{array}$$

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Information Sciences

Adding Unsafe Constraints to Improve Satisfiability Performance

John Franco
Computer Science, University of Cincinnati



$$\mathbb{I} = \{1, 2\}$$

$$\begin{matrix} q_1 & q_2 \\ q_3 & q_4 \end{matrix}$$

$$F_1 = q_1 \vee q_2 \vee q_3$$

$$F_2 = q_1 \vee q_2 \vee q_4$$



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REVERSE-ENGINEERING COUNTRY
RISK RATINGS:
A COMBINATORIAL NON-RECURSIVE
MODEL

Peter L. Hammer
Alexander Kogan
Miguel A. Lejeune



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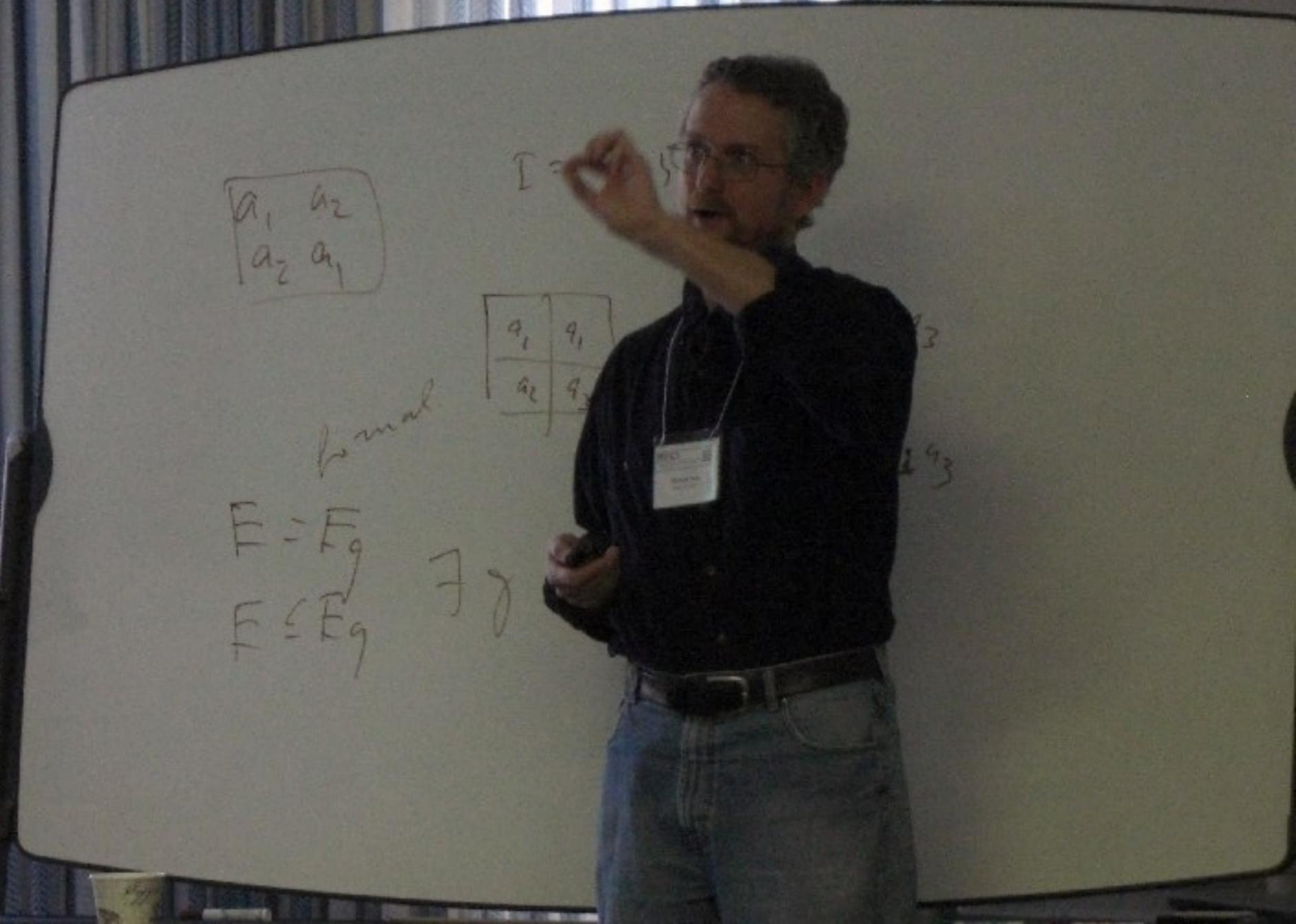


Decision trees

choosing next query.

ave an all 1 row?

number of queries is $\lceil \log_2 n \rceil$.



General lower bounds on $D(f)$

$D(f) \geq \frac{1}{2} \log 22$ (Fourier degree) (Bose, van Emde Boas, Luszai)

Implications:

- Almost all functions are **irreducible**.
- Together with Siegel's counting argument: When n is a prime power, every weakly symmetric n -variable f satisfying $D(f) \leq \frac{1}{2} \log^2 n$ is irreducible. (Rivest-Vuillemin 1979).



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 Sloan¹ Balázs Szörényi^{2,3} György Turán^{1,2}

¹University of Illinois at Urbana-Champaign

²Hungarian Academy of Sciences, Budapest

³Ruhr-Universität Bochum

January 2009 / Workshop on Boolean Functions
in memory of Peter M. Hirsch

Bob Sloan, Balázs Szörényi, György Turán

2009

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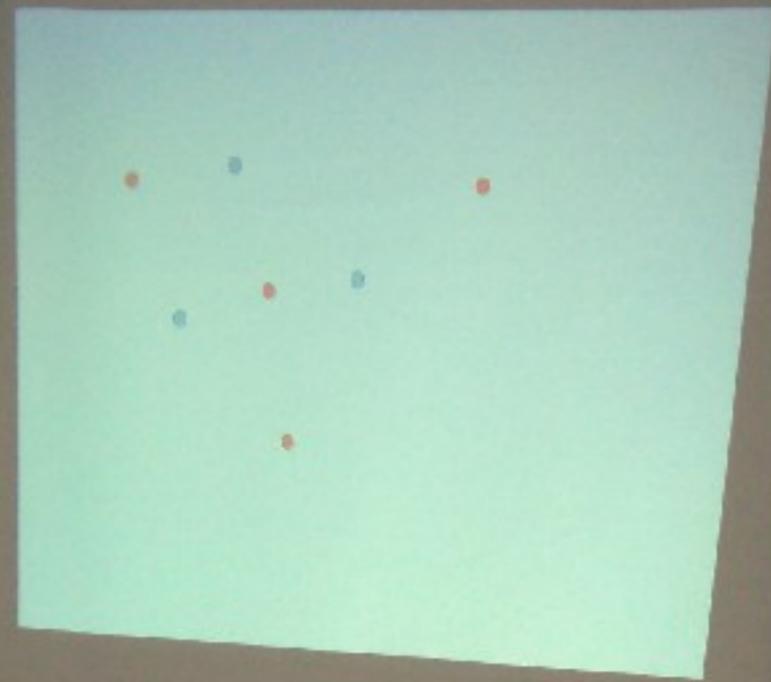
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Outline

- ① Introduction
- ② DNF with many prime implicants
- ③ Cube partitions
 - Neighboring partitions for NJD- k -term DNF
 - General Splitting Problem for Cube Partitions
- ④ Open Problems



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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.

$S \text{ sup } f \Rightarrow \exists t \text{ intervals } \# X$

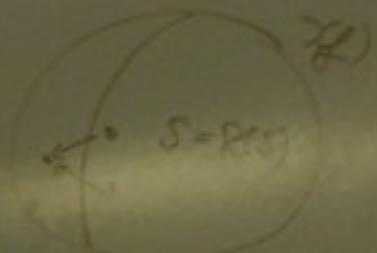
$S \text{ intervals } \# X = \exists t \# f$

$S > f$

$S \leq f$

$\exists t \# X \Rightarrow S \# t = 0$

$A \vee X > A \vee B$
 $B \vee X > A \vee B$



Negative implicants

- Let f be a Horn function.
- Let \mathcal{X} be an exclusive set of implicants of f , such that no two clauses in $\mathcal{E} = \mathcal{I}(f) \setminus \mathcal{R}(\mathcal{X})$ are resolvable.
- Then there exists an integer k , and pairwise disjoint essential sets $Q_1, \dots, Q_k \subseteq \mathcal{E}$, such that for every CNF \mathcal{C} representing f :
 - $|\mathcal{C} \cap Q_j| = 1, j = 1, \dots, k$
 - \mathcal{C} does not contain other elements of \mathcal{E} .





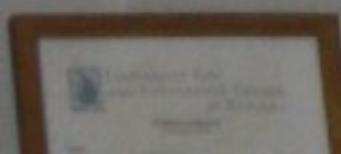
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An Improved Branch-and-Cut Algorithm for Maximum Monomials

Noam Golding
RUTCOR
Rutgers University

Joint work
Jonathan Eckstein, MS
Rutgers University

January 20,



and
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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

RU

Logical Analysis Of Data (LAD) Applied To Mass Spectrometry Data To Predict Rate Of Decline Of Kidney Function

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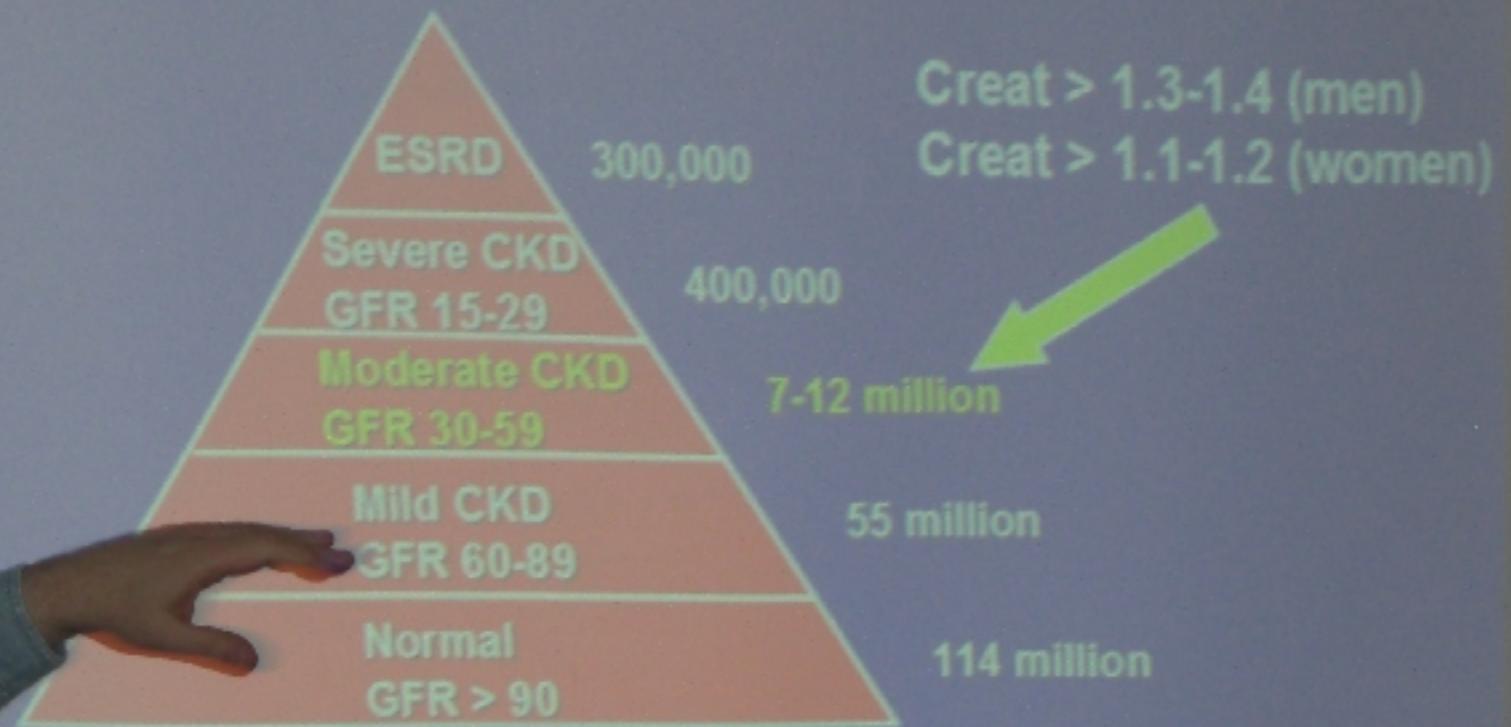
²RUTCOR, Rutgers Center for Operations Research, Piscataway, NJ

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

January, 2009



Prevalence of Renal Disease in US (Age > 20 yrs, NHANES III)



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



JOHN
John...
John



PONTCARE
 $S(z)$
 $S(T)$



Poincaré
 $S(t)$
 $s(t)$

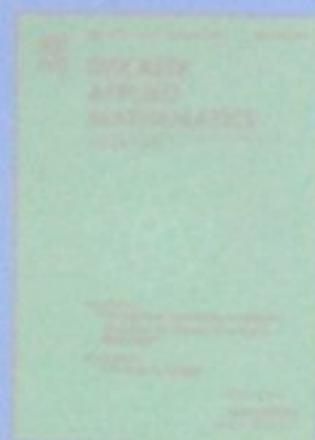




Boolean Functions I've Known and Not Known: Memories of Peter L. Hammer



Fred Roberts
Rutgers University





RUTCOR 1983-1987 Those were the days...

Yves Crama
HEC Management School
University of Liège Belgium



RUTCOR 1983-1987

Those were the days...

Yves Crama
HEC Management School
University of Liège Belgium



The Contributions of Peter L. Hammer to Algorithmic Graph Theory

Martin Charles Golumbic (University of Haifa)

Abstract

Peter L. Hammer cultivated or coauthored more than 240 research papers during his professional career. Of these, about 20% concern graph theory – alone about equal to the whole career of most people!

Together with colleagues, his work includes introducing the families of threshold graphs and split graphs, graph parameters such as the Dilworth number and the spectrum of a graph, and the open circle construction to compute the stability number of a graph.

In this talk, I will survey some of the fundamental contributions of Peter L. Hammer in graph theory and algorithmics and how they have led to the development of new research areas.





The Contributions of Peter L. Hammer to Algorithmic Graph Theory

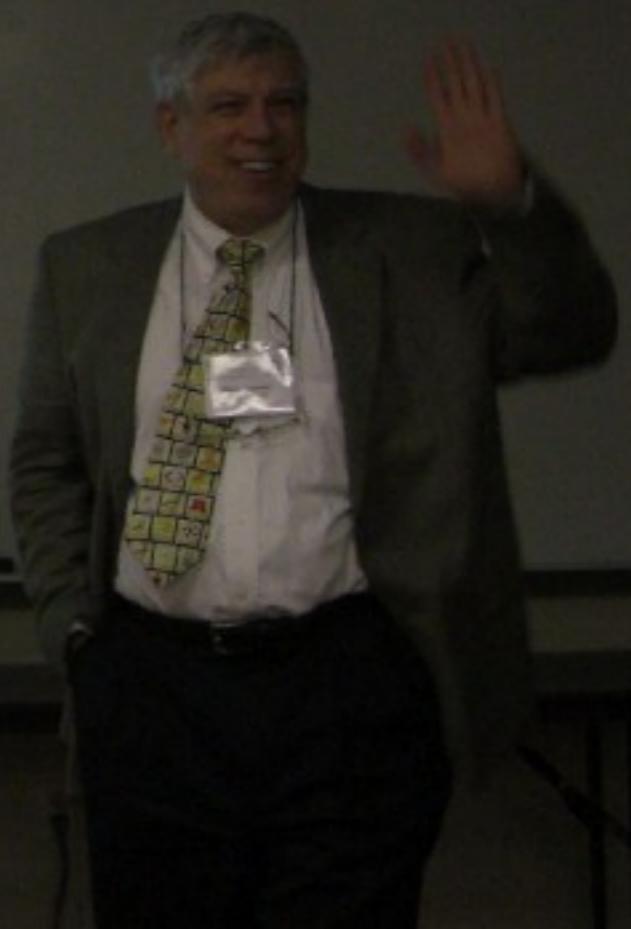
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Some Observations on Boolean Logic and Optimization

John Hooker
Carnegie Mellon University

January 2004



Some Observations on Boolean Logic and Optimization

John Hooker
Carnegie Mellon University









EXIT





EXIT













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Geffrion







Marie L'Ecuyer
Montreal



FEEDBACK FROM

"Thank you for taking the time
and application procedures."

"Want to see what a CEO
and the different types."

"Work for the time you have
with others - networking."

"More negotiation time on how
and on negotiating would be great."

"Key meetings between the
cycles, and the ideas following
equal importance."

"Having a woman in academic
leadership in academia is another
service I get will be excellent."

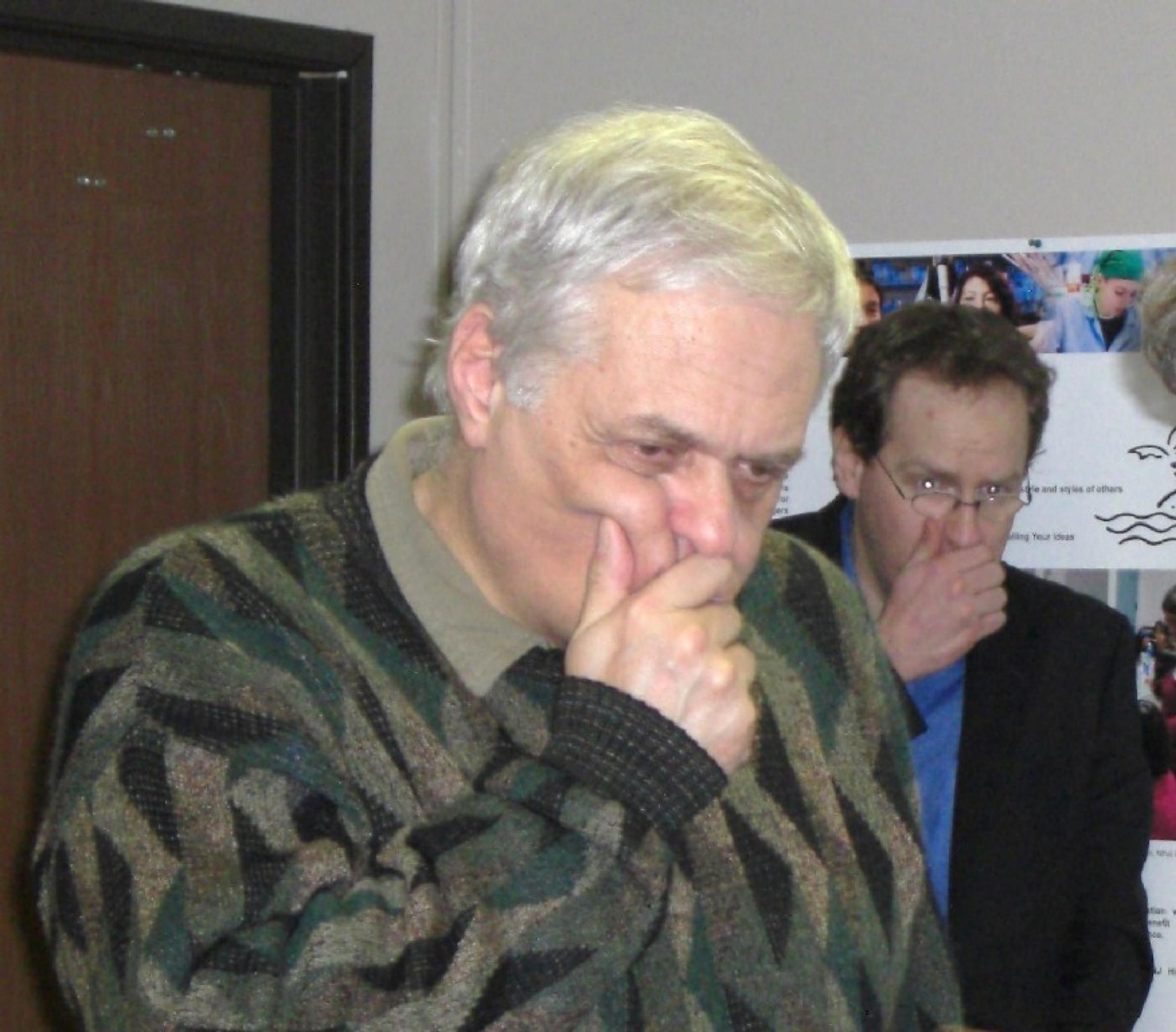


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