The Challenge of DIMACS Challenges

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DIMACS 20th Birthday
November 2009
Outline

1. Outline
2. The Challenges
3. Challenge Outline
4. Value of the Challenges
5. Challenge of the Challenges
6. Future and Call for Action!
What is a DIMACS Challenge?

“ The DIMACS Implementation Challenges address questions of determining realistic algorithm performance where worst case analysis is overly pessimistic and probabilistic models are too unrealistic: experimentation can provide guides to realistic algorithm performance where analysis fails. Experimentation also brings algorithmic questions closer to the original problems that motivated theoretical work. It also tests many assumptions about implementation methods and data structures. It provides an opportunity to develop and test problem instances, instance generators, and other methods of testing and comparing performance of algorithms. And it is a step in technology transfer by providing leading edge implementations of algorithms for others to adapt. ”
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In short, a Challenge is a challenge to see how well our theory works computationally.
What It Is Not!

It is Not a Race!

(Well, maybe a little.)
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# The Nine Challenges

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<td>2006</td>
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Challenge Outline

- Get a Committee (and a Coordinator)

Takes about a year or more from start to the Workshop; Volumes have taken a couple of years
Challenge Outline

- Get a Committee (and a Coordinator)
- Problem Definition

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- Instance Library
- Solution Verification code

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- Workshop
- Conference Volume

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What Do We Gain from a Challenge?

We learn about algorithms: Tabu Search doesn’t compete with simulated annealing for clique and coloring.

We learn about instances: All practical graph coloring instances are easy: they have a large, obvious clique!

We get conjectures about random instances: All random satisfiability instances are easy, except for a very narrow range of parameters.
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What Artifacts Do We Get from a Challenge?

We get a file format.
The Famous DIMACS Network Format
We get a library of instances.
We get useable, distributable code.
benchmark graph coloring code
continues to live on
We get a literature review.
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### Snapshot of Where We Are

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There has been little improvement in solving random graph coloring instances in the last 15 years.
How to measure? Workshops have always attracted reasonable numbers.
Important?

How to measure? Workshops have always attracted reasonable numbers.

File formats and instances are useful 15 years later.
How to measure? Workshops have always attracted reasonable numbers.

File formats and instances are useful 15 years later.

Can form the basis for continuing activities: Johnson, Mehrotra and I continue to encourage work on graph coloring.
Conference volumes are well cited. Google scholar count for the 2nd computational challenge: 546 (easily Trick's best, even hits the top 10 for David Johnson)
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### Individual Papers Are Well Cited

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Challenge of Challenges

They take time, energy, commitment, and involve risk.
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Low hanging fruit is taken
Challenge of Challenges

They take time, energy, commitment, and involve risk.

Low hanging fruit is taken ... Maybe
They take time, energy, commitment, and involve risk.

Low hanging fruit is taken ... Maybe

More subgroups (satisfiability now has its own conferences)
But it is easier now!
But it is easier now!

Initial Challenges were done pre-Internet
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Initial Challenges were done pre-Internet

*From the 2nd Challenge Call for Papers:*
But it is easier now!

Initial Challenges were done pre-Internet

*From the 2nd Challenge Call for Papers:*

HOW TO PARTICIPATE. For more information about participating in the Implementation Challenge, send a request for the document "General Information" (available September 15, 1992) to challenge@dimacs.rutgers.edu. Request either LaTeX format (sent through email) or hard copy (sent through U. S. Mail), and include your return address as appropriate. Challenge materials will also be available via anonymous FTP from DIMACS, and we expect most communication with respect to the Challenge to take place over the Internet.
Using Web 2.0 for the Challenges

Much easier to communicate now even compared to 10 years ago (Web 1.0). We can have
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- Specialized systems to keep track of and verify (!) results
- A more distributed coordinating team
ROIS: Registry for Optimization Instances and Solutions

Instances
- Undirected graphs (clique, coloring)
- Distance matrices (traveling tournament problem)

Benchmarks and Solutions
- Maximum Clique
- Graph Coloring
- Traveling Tournament Problem

Contact: Michael Trick trick at cmu.edu

Please note: Extremely preliminary!
### ROIS: Registry for Optimization Instances and Solutions

#### Display Coloring Solutions

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ROIS: Registy for Optimization Instances and Solutions

Add a Solution

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- Reference: 23:GIPaRy96
- Upper Bound (Feasible solution): 
- Lower Bound: 
- Choose File (optional): 
  - Browse...

Add Solution  Reset
Bottom line: a lot of the work can be automated!
Primary Reason for More Challenges

Our work is not done.
Primary Reason for More Challenges

Our work is not done.

*Our primary goal: to define how computational work should be done, reported, and evaluated.*
Primary Reason for More Challenges

Our work is not done.

*Our primary goal: to define how computational work should be done, reported, and evaluated.*

Still a huge amount to do.
Typically the investigator has a bright idea for a new algorithm and wants to show that it works better, in some sense, than known algorithms. This requires computational test, perhaps on a standard set of benchmark problems. If the new algorithm wins, the work is submitted for publication. Otherwise it is written off as a failure. In short, the whole affair is organized around an algorithmic race whose outcome determines the fame and fate of the contestants.

[...] The emphasis on competition is fundamentally anti-intellectual and does not build the sort of insight that in long run conduces to more effective algorithms. It tells us what algorithms are better but not why. The understanding we do accrue generally derives from initial tinkering that takes place in the design stages of the algorithm. Because only the results of the formal competition are exposed to the light of publication, the observations that are richest in information are too often conducted in an informal, uncontrolled manner.”
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(If they are interesting and instructive)
Conclusions and Call for Action!

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