ASPARTIX-D READY FOR THE COMPETITION

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This is the homepage of the International Competition on Computational Models of Argumentation (ICCMA). The competition aims at nurturing research and development of implementations for computational models of argumentation.

The first instance of the competition will be conducted in 2015 and is associated with the workshop "Theory and Applications of Formal Argument" (TAFA’15).

For more information on rules and news see Competition 2015.

Important dates

- Nov 24, 2014: Release of final solver interface
- Jan 30, 2015: Declaration of intent by participants
- Mar 30, 2015: Submission of solvers
- Apr 30, 2015: Submission of system descriptions
- Jul 25-Aug 1, 2015: Presentation of results at TAFA’15

ICCMA steering committee:

- Federico Cerutti, Department of Computing Science, University of Aberdeen, UK
- Nir Oren, Department of Computing Science, University of Aberdeen, UK
- Hannes Strass, Computer Science Institute, Leipzig University, Germany
- Matthias Thimm, Institute for Web Science and Technologies, University of Koblenz-Landau, Germany
- Mauro Vallati, School of Computing and Engineering, University of Huddersfield, UK
- Serena Villata, WIMMICS Research Team, INRIA Sophia Antipolis, France

All members of the steering committee can be reached through the common e-mail address sc@argumentationcompetition.org.

Last updated 14.04.2015, Matthias Thimm
Reasoning Tasks

Computational Tasks:
1. SE - given an AF $F$ determine some extension
2. EE - given an AF $F$ determine all extensions
3. DC - given an AF $F$ and some argument $a$, decide whether $a$ is credulously inferred
4. DS - given an AF $F$ and some argument $a$, decide whether $a$ is skeptically inferred

Semantics:
- CO - Complete Semantics
- PR - Preferred Semantics
- GR - Grounded Semantics
- ST - Stable Semantics
Our Goal

Make ASPARTIX ready for the 1st Argumentation Competition!
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TODO

Find the "best" configuration for each reasoning task.
Agenda

1. What is ASPARTIX?
2. Modifications on Encodings
3. Which Solver and which Options?
4. Benchmarks
5. Tests
6. Results
7. Final Configuration of ASPARTIX-D
8. Future Work
ASP Encodings

Stable Extensions

Given an AF $F = (A, R)$. A set $S \subseteq A$ is a stable extension of $F$, if

- $S$ is conflict-free in $F$
- for each $a \in A \setminus S$, there exists a $b \in S$, such that $(b, a) \in R$

Encoding

$\hat{F} = \{\text{arg}(a) \mid a \in A\} \cup \{\text{att}(a, b) \mid (a, b) \in R\}$

$$\pi_{\text{stable}} = \begin{cases} 
\text{in}(X) & \leftarrow \text{not out}(X), \text{arg}(X) \\
\text{out}(X) & \leftarrow \text{not in}(X), \text{arg}(X) \\
\text{defeated}(X) & \leftarrow \text{in}(Y), \text{att}(Y, X) \\
\end{cases}$$
Modifications for EE

Clingo Syntax

\[ \pi_{\text{stable}} = \begin{cases} 
\{ \text{in}(X) : \text{arg}(X) \} & \leftarrow \text{in}(X), \text{in}(Y), \text{att}(X,Y) \\
\text{defeated}(X) & \leftarrow \text{in}(Y), \text{att}(Y,X) \\
\# \text{show in/1} & \leftarrow \text{not in}(X), \text{not defeated}(X), \text{arg}(X) 
\end{cases} \]

Run with clingo option \texttt{−project}
Modifications for DC

**DC-ST**

For an AF $F = (A, R)$, is $a \in A$ contained in some extension $E \in \text{stable}(F)$
Modifications for DC

**DC-ST**
For an AF $F = (A, R)$, is $a \in A$ contained in some extension $E \in stable(F)$

$$
\pi_{stable} = \begin{cases}
\text{in}(X) & \leftarrow \text{not out}(X), \text{arg}(X) \\
\text{out}(X) & \leftarrow \text{not in}(X), \text{arg}(X) \\
\text{defeated}(X) & \leftarrow \text{in}(X), \text{in}(Y), \text{att}(X, Y) \\
\text{in}(a) & \leftarrow \text{out}(X), \text{not defeated}(X)
\end{cases}
$$

Let Clingo compute ONE Answer-Set

If $\pi_{stable}(\hat{F})$ is satisfiable, then return YES;
if $\pi_{stable}(\hat{F})$ is unsatisfiable, then return NO.
Modifications for DS

**DS-ST**

For an AF $F = (A, R)$, is $a \in A$ contained in each extension $E \in stable(F)$

$$\pi_{stable} = \begin{cases} 
  \text{in}(X) & \leftarrow \text{not out}(X), \text{arg}(X) \\
  \text{out}(X) & \leftarrow \text{not in}(X), \text{arg}(X) \\
  \text{defeated}(X) & \leftarrow \text{in}(X), \text{in}(Y), \text{att}(X, Y) \\
  \text{out}(a) & \leftarrow \text{out}(X), \text{not defeated}(X) \\
\end{cases}$$

**Let Clingo compute ONE Answer-Set**

If $\pi_{stable}(\hat{F})$ is satisfiable, then return NO; if $\pi_{stable}(\hat{F})$ is unsatisfiable, then return YES.
Solver Options

clingo 4.3
- NOPARAM
- –project
- –rand-freq=0.05
- –configuration=auto
- –configuration=frumpy
- –configuration=tweety
- –configuration=handy
- –configuration=crafty
- –configuration=trendy

gringo305/clasp
- metasp encodings for preferred and grounded

lp2sat[Gebser et al.(2014)],
riss[Manthey(2014), Manthey(2012)]
- SAT Solver for DC-{ST,CO,GR} and DS-{ST,CO,GR}
Benchmarks

- Benchmarks_SCCs/ECAI* (≈8900 instances)
- Benchmarks_SCCs/KR/* (≈1500 instances)
- dynpartix/examples/benchmarks_1-2011/* (≈4800 instances)
- iccma15_testcases/apx/* (≈100 instances)
- ICCMA_test_cases2/apx/* (≈90 instances)

Total 15490 instances.
Second benchmark set 5830 instances.
We thank the Center for Information Services and High Performance Computing (ZIH) at TU Dresden for generous allocations of computer time.
Results EE-PR

![Solved Frameworks]

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Results EE-PR

Solved Frameworks

Solved Frameworks

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Results EE-PR

Solved Frameworks

Solved Frameworks

Solved Frameworks

RealTime, original-EERP
RealTime, pruned-EERP
RealTime, meta-EERP

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Results EE-GR

Solved Frameworks

RealTime.meta-EEGR
RealTime.project-EEGR

Time in seconds

Solved frameworks
Results with no Significant Difference
Final Configuration

**ASPARTIX-D**
- **GR**: metasp encodings for all reasoning tasks
- **DC-ST** original
- **DC-CO** SAT
- **DC-PR** -configuration=auto
- **DS-ST** original
- **DS-CO** SAT
- **DS-PR** original
- **EE-ST** –project
- **EE-CO** –project
- **EE-PR** metasp
- **SE-ST** –project
- **SE-CO** –project
- **SE-PR** metasp
Future Work

- Fix configurations for other semantics
- GUI for ASPARTIX-D
- Study visualization methods for big frameworks
- Representation of many solutions
- Navigation in solution space
Comparison with Vienna Encodings

- Solved by metasp: 3244 (out of 5830)
- Solved by Vienna: 3325 (out of 5830)
References

Martin Gebser, Tomi Janhunen, and Jussi Rintanen.
Answer Set Programming as SAT modulo Acyclicity.

Norbert Manthey.
Riss 4.27.

Norbert Manthey.
Coprocessor 2.0 – A Flexible CNF Simplifier.

Martin Gebser, Benjamin Kaufmann Roland Kaminski, and Torsten Schaub.
Answer Set Solving in Practice.
doi=10.2200/S00457ED1V01Y201211AIM019.