ICCMA 2019

Third International Competition on Computational Models of Argumentation

iccma2019.dmi.unipg.it

S. Bistarelli, F. Santini, L. Kotthoff, C. Taticchi

28th International Joint Conference on Artificial Intelligence (IJCAI-19)

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ICCMA 2015 and 2017

Organization 2015

- Matthias Thimm, Institute for Web Science and Technologies, University of Koblenz-Landau, Germany
- Serena Villata, INRIA Sophia Antipolis, France

Organization 2017

- Sarah A. Gaggl, TU Dresden, Germany
- Thomas Linsbichler, TU Wien, Austria
- Marco Maratea, University of Genova, Italy
- Stefan Woltran, TU Wien, Austria

ICCMA 2019

Organization

- **Stefano Bistarelli**, University of Perugia, Italy
- **Francesco Santini**, University of Perugia, Italy
- **Lars Kotthoff**, University of Wyoming, USA
- **Carlo Taticchi**, GranSasso Science Institute, Italy

ICCMA Steering Committee

- **Matthias Thimm** (President)
- **Federico Cerutti** (Vice-President)
- **Nir Oren** (Secretary)
- **Sarah A. Gaggl**
- **Jean-Guy Mailly**
- **Mauro Vallati**
- **Serena Villata**

Participants 2019

- **Argpref**
  Alessandro Previti and Matti Järvisalo

- **ASPARTIX-V19 (2017, 2015)**
  Wolfgang Dvořák, Anna Rapberger, Johannes P. Wallner and Stefan Woltran

- **CoQuiAAS v3.0 (2017, 2015)**
  Jean Marie Lagniez, Emmanuel Lonca and Jean-Guy Mailly

- **DREDD**
  Matthias Thimm

- **EqArgSolver (2017)**
  Odinaldo Rodrigues

- **Mace4/Prover9**
  Adrian Groza, Liana Toderean, Emanuel Baba, Eliza Olariu, George Bogdan and Oana Avasi

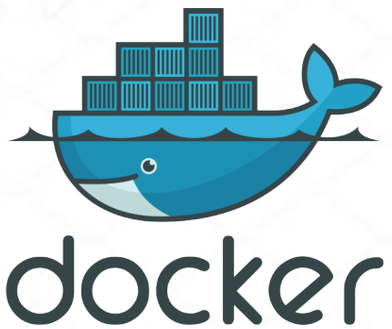
- **PYGLAF (2017)**
  Mario Alviano

- **Yonas**
  Lars Malmqvist

- **µ-toksia**
  Andreas Niskanen and Matti Järvisalo

Novelties

- Dockerised solver
- Use of linebreaks in EE-solutions
- Special track on dynamics
  - to determine which solvers work incrementally
  - to test how much better they tackle the same problems compared to static solvers



Rules - Dynamic Track

- Test solvers dedicated to efficiently recompute a solution after a small change in the original abstract framework

- An instance consists of an initial framework and an additional file storing a sequence of additions/deletions of attacks (at least 15 changes)

- 2 possible options for input

Rules - Dynamic Track

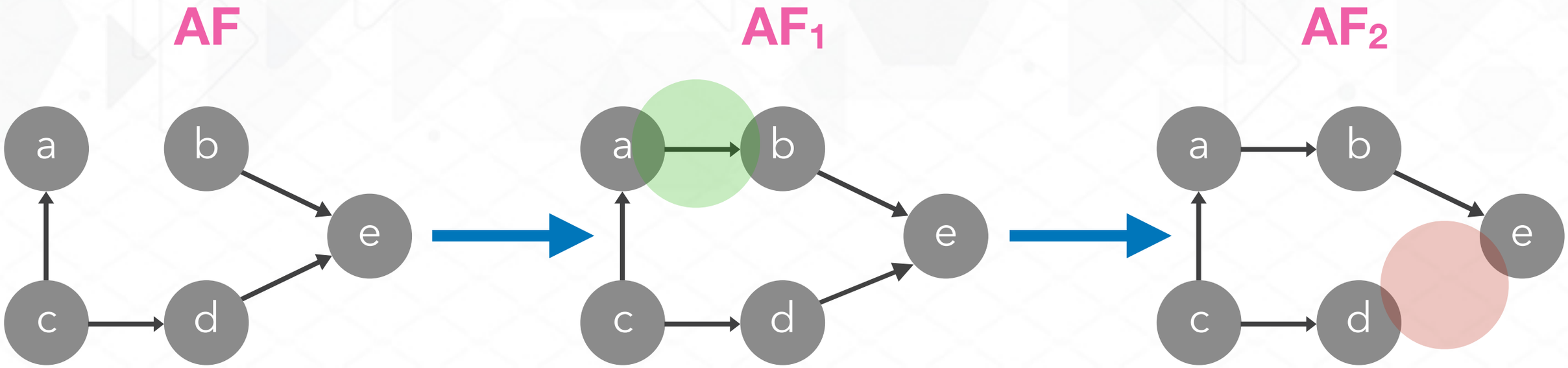
Option 1

- An AF will be passed to solvers together with a list of changes
- Example: +att(a,b). -att(d,e).

Rules - Dynamic Track

Option 2

- An initial AF will be passed to solvers together with a list modified AFs



Rules - Main Track

7 semantics:

- complete (CO)
- preferred (PR)
- stable (ST)
- semi-stable (SST)
- stage (STG)
- grounded (GR)
- Ideal (ID)

4 problems:

- DC-σ: decide credulous acceptability
- DS-σ: decide skeptical acceptability
- SE-σ: determine some σ-extension.
- EE-σ: enumerate all σ-extensions.

24 tasks in total from the combination of problems with semantics (for GR and ID only the problems SE and DC are considered)

Rules - Main Track

- Fixed number of instances corresponding to the task
- Timeout of **10 minutes** each instance
- Possible termination statuses:
  - correct answer
  - incorrect answer
  - invalid answer (syntactically incorrect)
  - crashed (due to memory issues)
  - failed (the run did not produce an answer (usually time-out))

Rules - Main Track

Scoring

- **(0,1] points** for correct results (even incomplete)
- **-5 points** for incorrect results
- **0 points** otherwise (invalid, crashed, failed)

- Scores for each task are summed over the set of tested instances
- Results are also aggregated by semantics and by problem
- Ties are broken by the total time the solver took to return correct results

Rules - Dynamic Track

14 different tasks:

- Complete semantics (SE, EE, DC, DS)
- Preferred semantics (SE, EE, DC, DS)
- Stable semantics (SE, EE, DC, DS)
- Grounded semantics (only SE and DC)

Rules - Dynamic Track

Scoring

- **(0,1] points** for correct results
  (for n changes, n+1 correct and complete results are given)
- **-5 points** if any of the sub-solution is incorrect
- **0 points** otherwise (invalid, crashed, failed)

- Scores for each task are summed over the set of tested instances
- Results are also aggregated by semantics and by problem
- Ties are broken by the total time the solver took to return correct results

Benchmarks

From ICCMA 2015:

- GroundedGenerator, SccGenerator, StableGenerator

From ICCMA 2017:

- AdmBuster: a benchmark example for (strong) admissibility
  Martin Caminada and Mikołaj Podlaszewski
- AFBenchGen2: A Generator for Random Argumentation Frameworks
  Federico Cerutti, Mauro Vallati and Massimiliano Giacomin
- Assumption-Based Argumentation Translated to Argumentation Frameworks
  Tuomo Lehtonen, Johannes P. Wallner and Matti Järvisalo
- Planning2AF: Exploiting Planning Problems for Generating Challenging Abstract Argumentation Frameworks
  Federico Cerutti, Massimiliano Giacomin and Mauro Vallati
- SemBuster: a benchmark example for semi-stable semantics
  Martin Caminada and Bart Verheij
- Traffic Networks Become Argumentation Frameworks
  Martin Diller

Benchmarks 2019

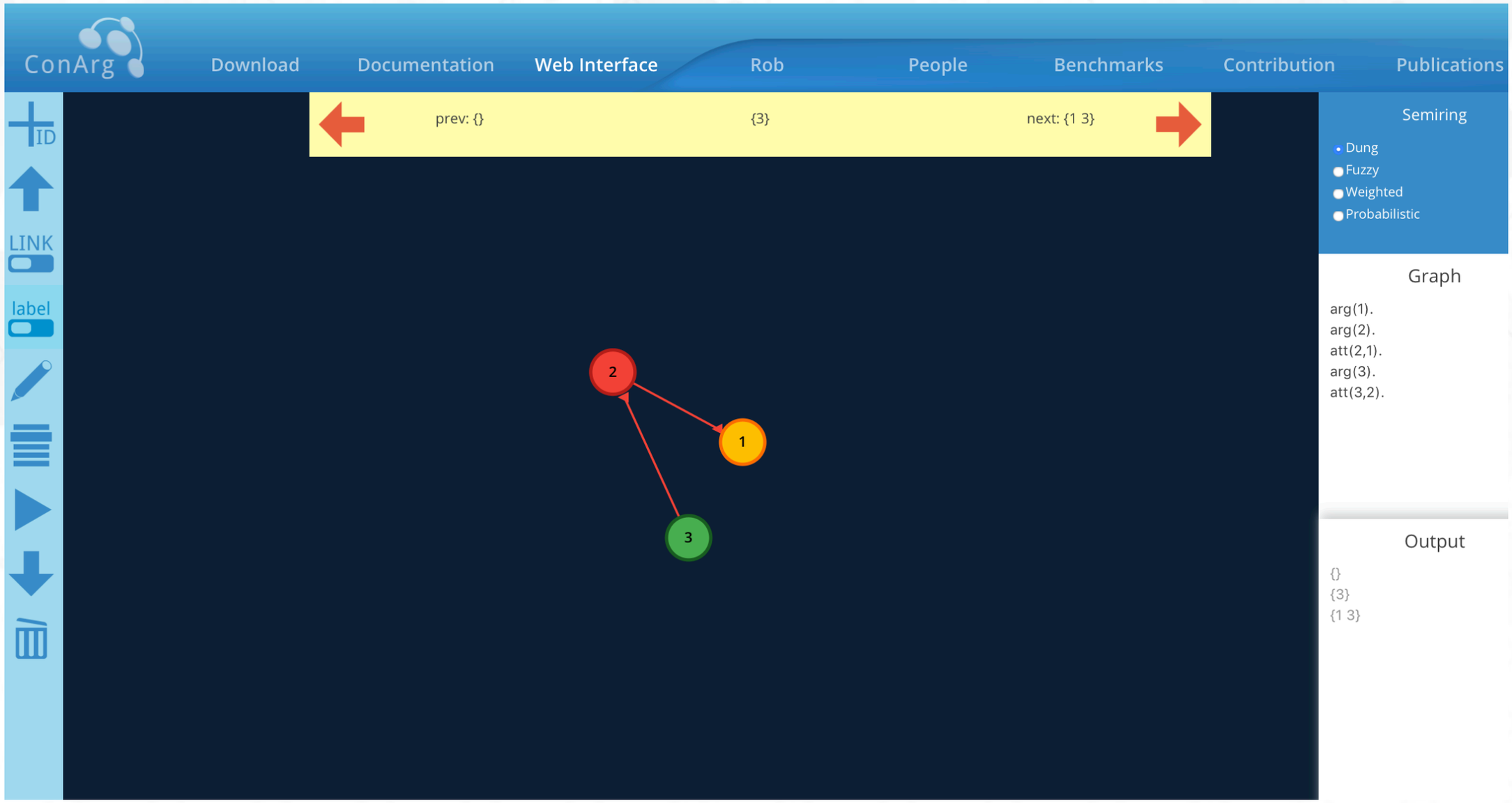
New submissions:

- **Benchmark on Logic-Based Argumentation Framework with Datalog±**
  Bruno Yun and Madalina Croitoru
- **The AFGen Benchmark Generator**
  Billy Spelchan and Yong Gao

Selection

- **326 instances** selected
- Previously tested with ConArg (http://www.dmi.unipg.it/conarg/), using larger time and memory limits than those of the competition

http://www.dmi.unipg.it/conarg/



Settings

System Inputs

- Fixed input in TGF or APX format
- Scripts run with fixed parameters (with memory limit 4Gb and time limit 10min)

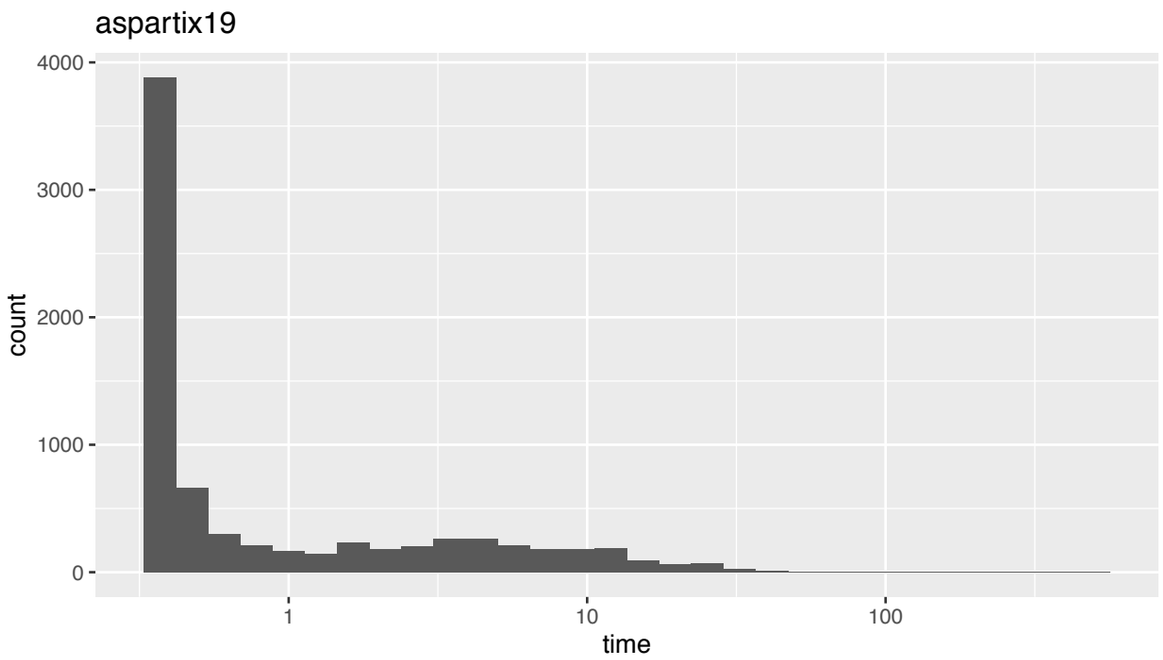
System Environment

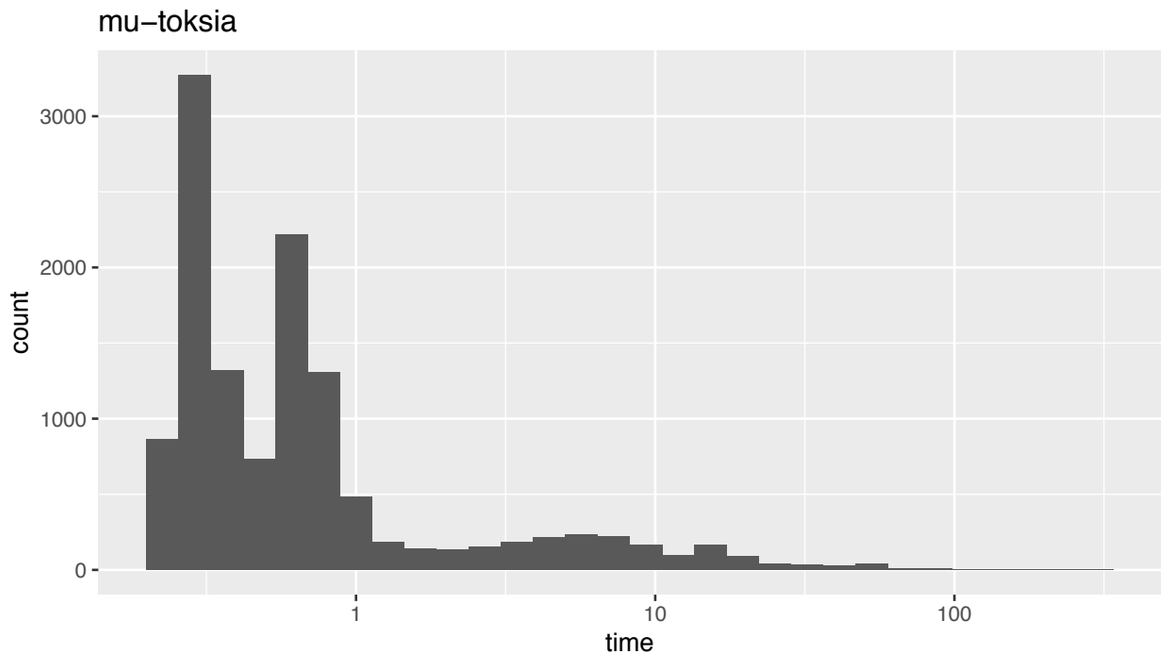
Type	Series	Arch	Count	Sockets	Cores	Threads / Core	Clock (GHz)	RAM (GB)	Local Disk Type	Local Disk Capacity (GB)	IB Network	Operating System
Teton Regular	Intel Broadwell	x86_64	180	2	32	1	2.1	128	SSD	240	EDR	RHEL 7.4

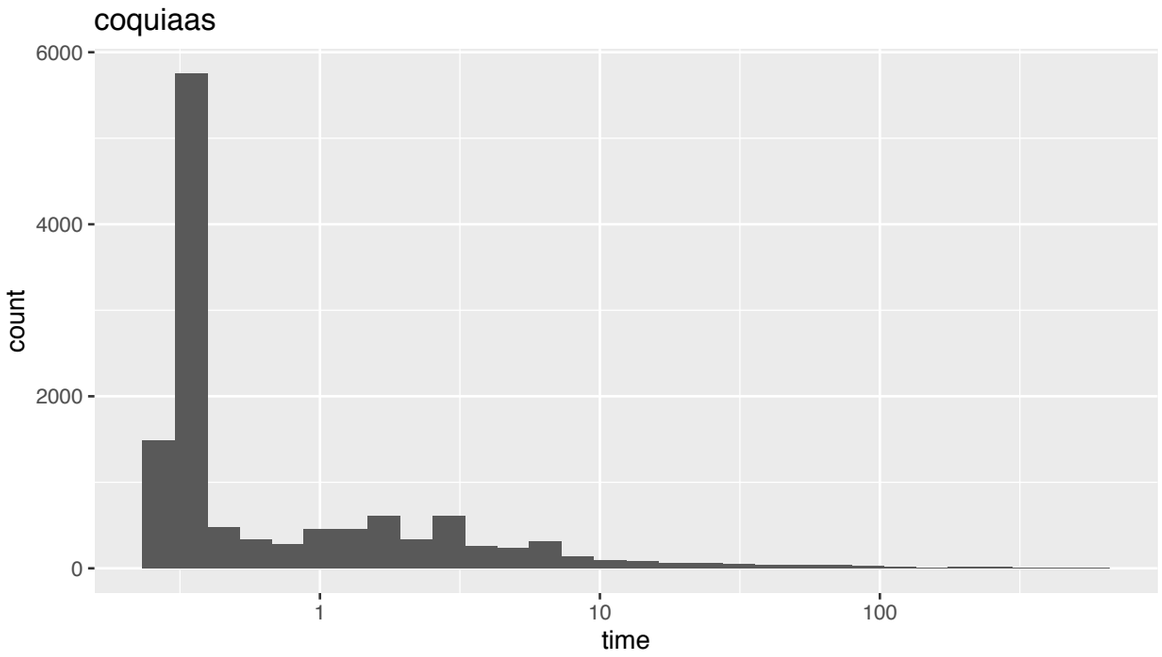
Participants

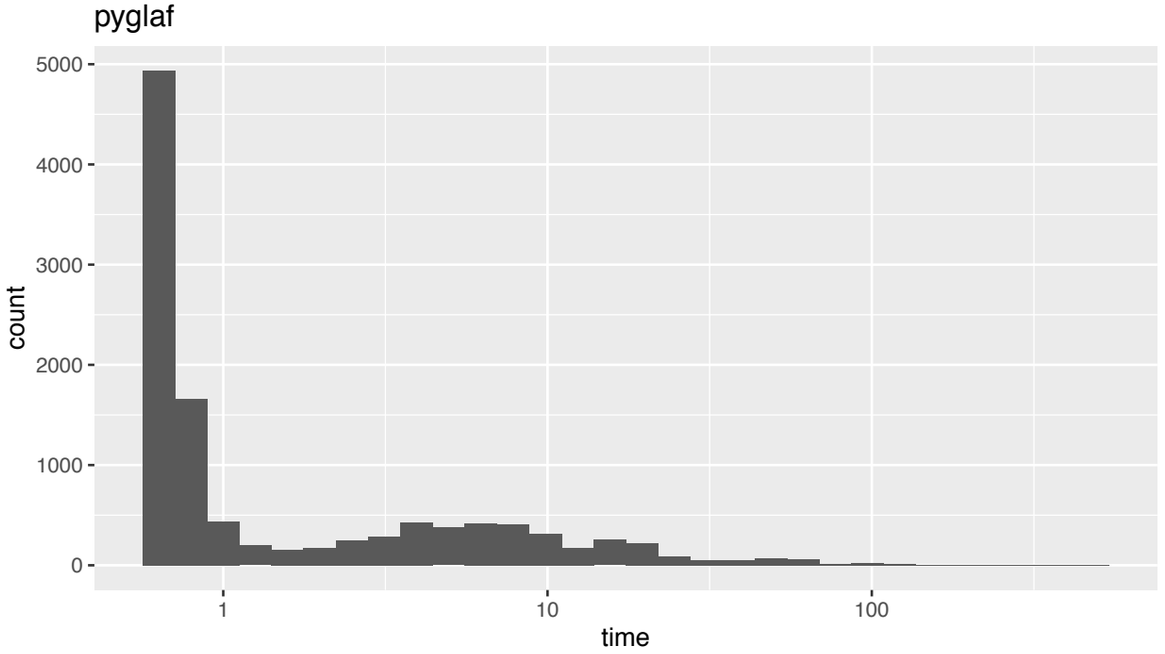
	Dynamic	CO				PR				ST				SST				STG				GR		ID	
		DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	SE	DC	SE
DREDD		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
CoQuiAAS v3.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PYGLAF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ASPARTIX-V19		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yonas		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
Argpref																								✓	✓
EqArgSolver		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
µ-toksia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mace4/Prover9		✓	✓	✓																					

time comparison of the solver participating to all the tracks (only correct answers)

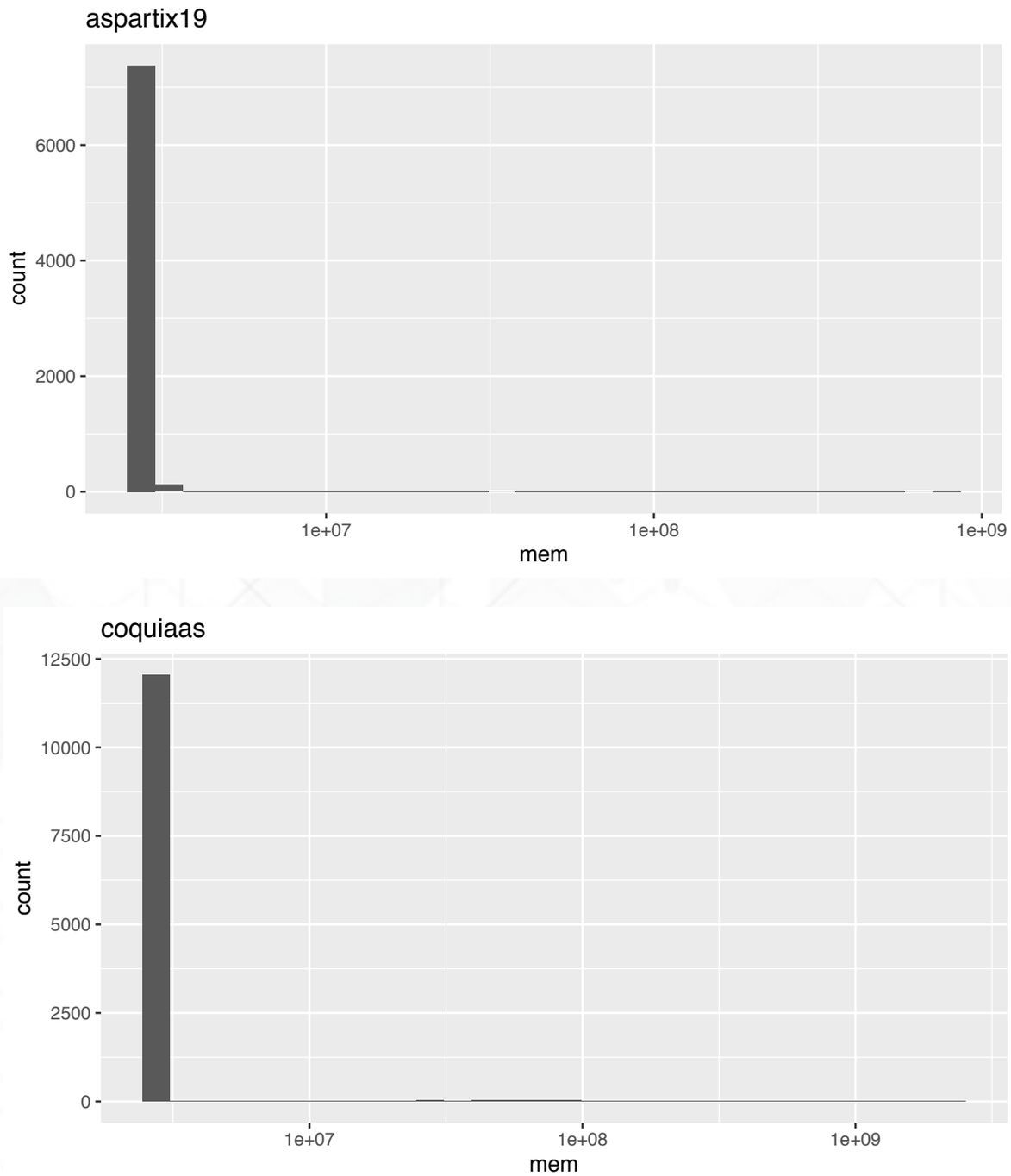


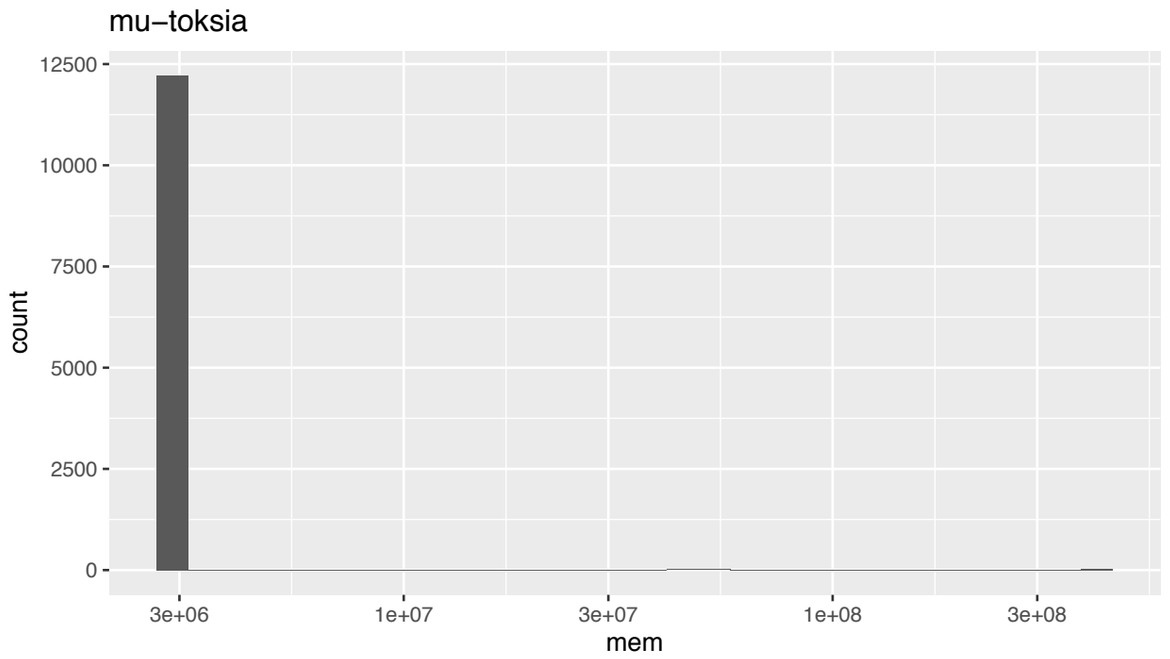


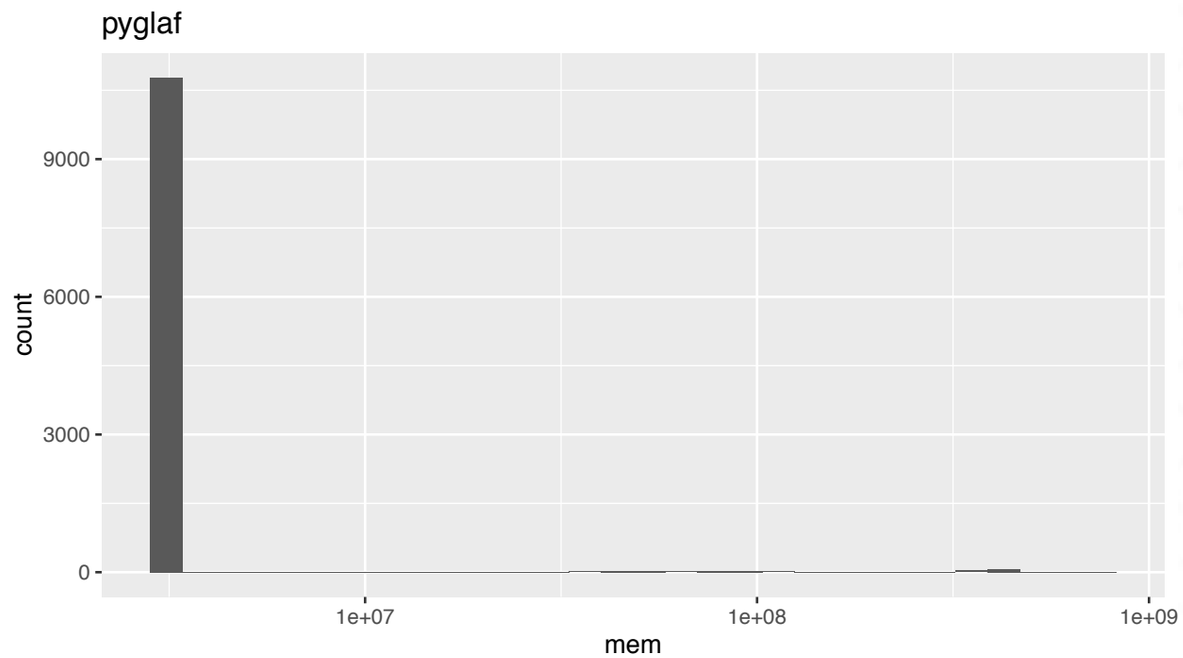




memory usage comparison of the solver participating to all the tracks (only correct answers)







Results

Main Track

Results - Main Track

Rankings by semantics - CO

1. mu-toksia
2. aspartix19
3. pyglaf
4. coquiaas
5. eqargsolver
6. yonas
7. taas-dredd

CO										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1304	0	0	0	0	0	0	2873.198	94019584	1304
coquiaas	1302	0	0	0	0	2	0	5060.037	969428992	1302
eqargsolver	1166	0	0	0	0	138	0	97244.536	474550272	1166
mu-toksia	1304	0	0	0	0	0	0	1309.272	90816512	1304
pyglaf	1304	0	0	0	0	0	0	4660.723	50774016	1304
taas-dredd	987	10	203	0	0	104	0	77462.209	99794944	-163.190
yonas	1200	0	0	0	0	86	18	238724.722	9999351808	1035.829

Results - Main Track

Rankings by semantics - PR

1. mu-toksia
2. coquiaas
3. aspartix19
4. eqargsolver
5. pyglaf
6. yonas
7. taas-dredd

PR										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1299	0	5	0	0	0	0	4346.610	92950528	1274
coquiaas	1301	0	0	0	0	3	0	6601.919	93622272	1301
eqargsolver	1166	0	0	0	0	138	0	96887.766	3063808	1166
mu-toksia	1304	0	0	0	0	0	0	1405.415	89145344	1304
pyglaf	1257	0	47	0	0	0	0	5656.699	82247680	1022
taas-dredd	863	15	236	0	0	190	0	143690.076	99987456	-436.032
yonas	1009	177	1	0	0	94	23	363580.659	9979367424	836.678

Results - Main Track

Rankings by semantics - ST

1. mu-toksia
2. aspartix19
3. pyglaf
4. coquiaas
5. eqargsolver
6. yonas
7. taas-dredd

ST										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1304	0	0	0	0	0	0	2111.697	86528000	1304
coquiaas	1303	0	0	1	0	0	0	1978.757	65941504	1303
eqargsolver	1160	0	0	0	0	144	0	100895.672	3059712	1160
mu-toksia	1304	0	0	0	0	0	0	999.592	78954496	1304
pyglaf	1304	0	0	0	0	0	0	4863.809	98836480	1304
taas-dredd	791	13	278	0	0	222	0	170496.572	99676160	-718.032
yonas	915	185	12	0	1	163	28	411195.085	9995333632	700.669

Results - Main Track

Rankings by semantics - SST

1. mu-toksia
2. pyglaf
3. coquiaas
4. aspartix19

SST										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1138	21	139	0	5	1	0	4868.853	59879424	428.699
coquiaas	1298	0	0	1	0	5	0	8137.338	94203904	1298
mu-toksia	1303	0	0	0	0	1	0	3226.112	88989696	1303
pyglaf	1303	0	0	0	0	1	0	6317.506	92397568	1303

Results - Main Track

Rankings by semantics - STG

1. mu-toksia
2. pyglaf
3. coquiaas
4. aspartix19

STG										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1215	24	65	0	0	0	0	3841.746	87470080	882.219
coquiaas	1289	0	0	1	0	14	0	15855.341	99647488	1289
mu-toksia	1303	0	0	0	0	1	0	3191.954	75272192	1303
pyglaf	1300	0	2	0	0	2	0	7479.289	95862784	1290

Results - Main Track

Rankings by semantics - GR

1. mu-toksia
2. eqargsolver
3. coquiaas
4. aspartix19
5. yonas
6. taas-dredd
7. pyglaf

GR										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	652	0	0	0	0	0	0	930.546	3080192	652
coquiaas	652	0	0	0	0	0	0	434.905	3055616	652
eqargsolver	652	0	0	0	0	0	0	256.632	3059712	652
mu-toksia	652	0	0	0	0	0	0	238.776	3059712	652
pyglaf	360	0	292	0	0	0	0	1900.577	409772032	-1100
taas-dredd	502	0	150	0	0	0	0	218.212	3059712	-248
yonas	652	0	0	0	0	0	0	5736.522	3055616	652

Results - Main Track

Rankings by semantics - ID

1. mu-toksia
2. argpref
3. coquiaas
4. pyglaf
5. aspartix19

ID										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
argpref	652	0	0	0	0	0	0	4241.309	46161920	652
aspartix19	648	0	1	0	0	3	0	5232.252	82718720	643
coquiaas	651	0	0	0	0	1	0	3615.624	86106112	651
mu-toksia	652	0	0	0	0	0	0	1594.610	93822976	652
pyglaf	650	0	0	0	0	2	0	8133.248	82640896	650

Results - Main Track

Rankings by problem - SE

1. mu-toksia
2. pyglaf
3. aspartix19
4. coquiaas

SE										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	2279	0	0	0	0	3	0	7373.381	82718720	2279
coquiaas	2275	0	0	1	0	6	0	9804.689	97746944	2275
mu-toksia	2282	0	0	0	0	0	0	2085.454	93466624	2282
pyglaf	2281	0	0	0	0	1	0	11037.043	85348352	2281

Results - Main Track

Rankings by problem - EE

1. mu-toksia
2. pyglaf
3. coquiaas
4. aspartix19

EE										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1590	0	34	0	5	1	0	5830.886	94019584	1397.918
coquiaas	1620	0	0	0	0	10	0	16179.240	97386496	1620
mu-toksia	1628	0	0	0	0	2	0	6456.604	90816512	1628
pyglaf	1627	0	0	0	0	3	0	10827.353	98836480	1627

Results - Main Track

Rankings by problem - DC

1. mu-toksia
2. coquiaas
3. aspartix19
4. pyglaf

DC										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	2098	43	141	0	0	0	0	6760.712	823296000	1393
coquiaas	2276	0	0	1	0	5	0	8969.938	99647488	2276
mu-toksia	2282	0	0	0	0	0	0	2008.174	93822976	2282
pyglaf	1975	0	306	0	0	1	0	11283.370	88715264	445

Results - Main Track

Rankings by problem - DS

1. mu-toksia
2. coquiaas
3. pyglaf
4. aspartix19

DS										
Solver	**#Corr**	**#Cra**	**#Inc**	**#Fail**	**#Inv**	**#TO**	**#OOM**	**Time**	**Memory**	**Score**
aspartix19	1593	2	35	0	0	0	0	4239.923	92950528	1418
coquiaas	1625	0	0	1	0	4	0	6730.054	98684928	1625
mu-toksia	1630	0	0	0	0	0	0	1415.499	71610368	1630
pyglaf	1595	0	35	0	0	0	0	5864.085	85712896	1420

Results - Main Track

Overall results

1. mu-toksia
2. coquiaas
3. aspartix19
4. pyglaf

Solver	#Corr	#Cra	#Inc	#Fail	#Inv	#TO	#OOM	Time	Memory	Score
aspartix19	7560	45	210	0	5	4	0	24204.902	94019584	6487.918
coquiaas	7796	0	0	3	0	25	0	41683.921	99647488	7796
mu-toksia	7822	0	0	0	0	2	0	11965.731	93822976	7822
pyglaf	7478	0	341	0	0	5	0	39011.851	98836480	5773

Results

Dynamic Track

Results - Dynamic Track

Overall

1. mu-toksia
2. coquiaas
3. pyglaf

Solver	#Corr	#Cra	#Inc	#Fail	#Inv	#TO	#OOM	Time	Memory	Score
coquiaas	4511	0	20	2	0	31	0	44369.573	98557952	4411
mu-toksia	4537	652	20	0	1	6	0	22487.878	80859136	4437
pyglaf	3578	0	980	0	0	6	0	22697.238	99147776	-1322

overall soundness (over 326 instances per track)

	Dynamic	CO				PR				ST				SST				STG				GR		ID	
		DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	SE	DC	SE
DREDD		50	5	145	3	50	65	118	3	61	96	118	3									✓	145		
CoQuiAAS v3.0	20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PYGLAF	980	✓	✓	✓	✓	14	33	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2	✓	✓	292	✓	8	✓
ASPARTIX-V19		✓	✓	✓	✓	✓	5	✓	✓	✓	✓	✓	✓	74	29	✓	37	65	✓	✓	✓	✓	✓	✓	✓
Yonas		✓	✓	✓	✓	✓	1	✓	✓	✓	12	✓	✓									✓	✓		
Argpref																								✓	✓
EqArgSolver		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
µ-toksia	20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mace4/Prover9		✓	✓	✓																					

Overall time-out, OOM, invalid, crashed

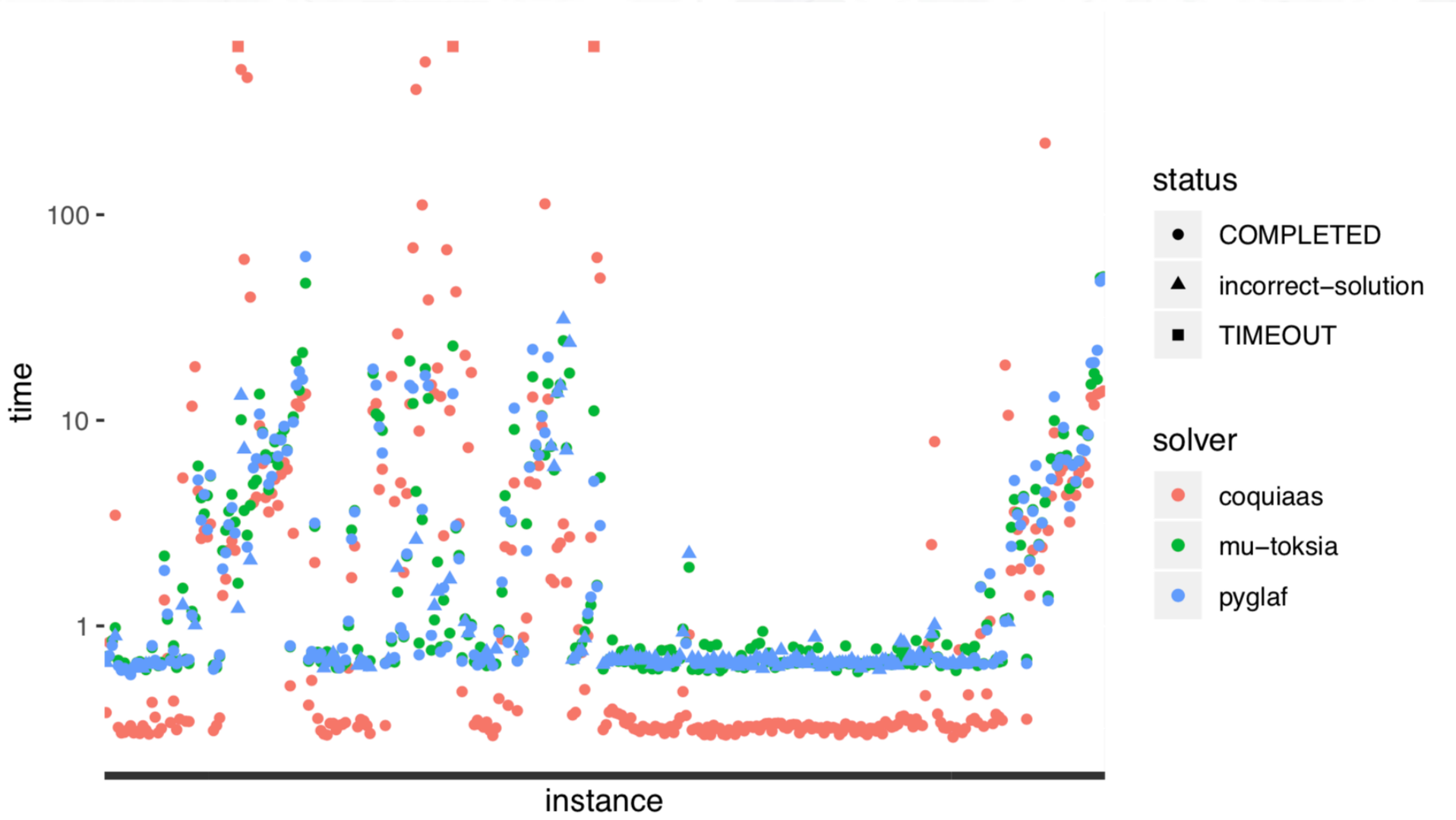
	Dynamic	CO				PR				ST				SST				STG				GR		ID	
		DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	SE	DC	SE
DREDD		14	✓	✓	90	14	14	72	90	153	69	70	70									✓	✓		
CoQuiAAS v3.0	✓	✓	✓	✓	2	✓	✓	1	2	✓	✓	1	✓	2	1	1	2	4	4	3	4	✓	✓	✓	1
PYGLAF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1	✓	✓	✓	2	✓	✓	1	1
ASPARTIX-V19		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	6	✓	✓	✓	✓	✓	✓	✓	3
Yonas		79	✓	✓	25	76	✓	15	26	13	1	15	23									✓	✓		
Argpref																								✓	✓
EqArgSolver		33	33	36	36	33	33	36	36	36	33	36	36									✓	✓		
µ-toksia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1	✓	✓	✓	✓	✓	✓	✓	✓
Mace4/Prover9		✓	✓	✓																					

overall results

	Dynamic	CO				PR				ST				SST				STG				GR		ID	
		DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	DS	SE	EE	DC	SE	DC	SE
DREDD		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
CoQuiAAS v3.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PYGLAF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ASPARTIX-V19		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yonas		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
Argpref																								✓	✓
EqArgSolver		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		
µ-toksia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mace4/Prover9		✓	✓	✓																					

Suggestions for future ICCMA events

- Take into account that some solvers are very fast in calculating solutions, but receive lower score if some instances are not solved



Suggestions for future ICCMA events

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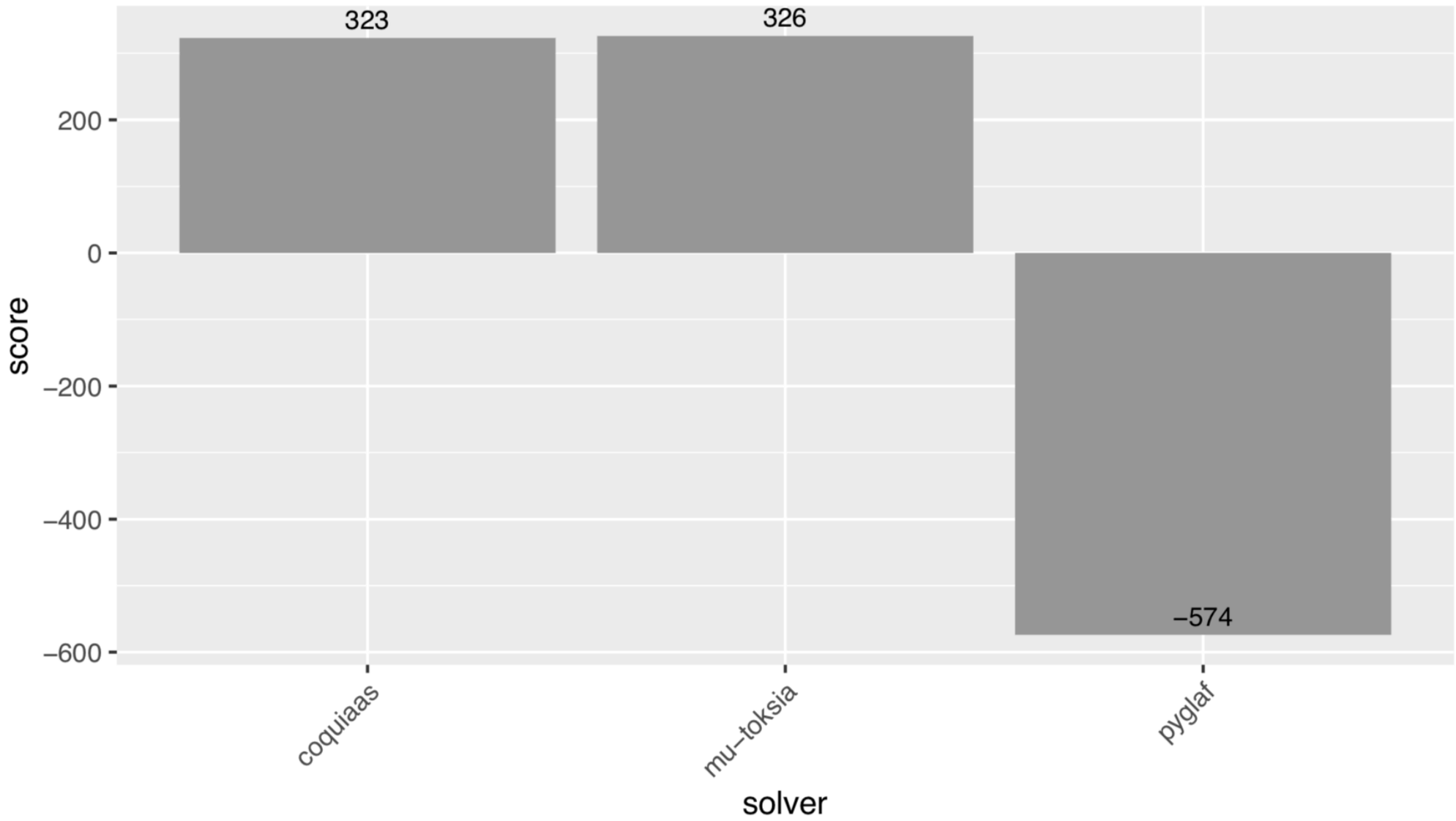


Suggestions for future ICCMA events: Shapley value ranking?

Algorithm	Shapley Value	Marginal Performance
pyglaf	6747	6285
taas-dredd	6259	4110
argpref	3443	662
mace4-prover9	2798	0
aspartix19	1904	1045
yonas	1904	65
eqargsolver	1589	0
coquiaas	117	0
mu-toksia	109	0

Thanks

- to all participants
- to all who submitted new solvers and benchmarks
- to IJCAI for hosting ICCMA
- to the Advanced Research Computing Center (ARCC) at the University of Wyoming

Results and details available at: **iccma2019.dmi.unipg.it/results.html**

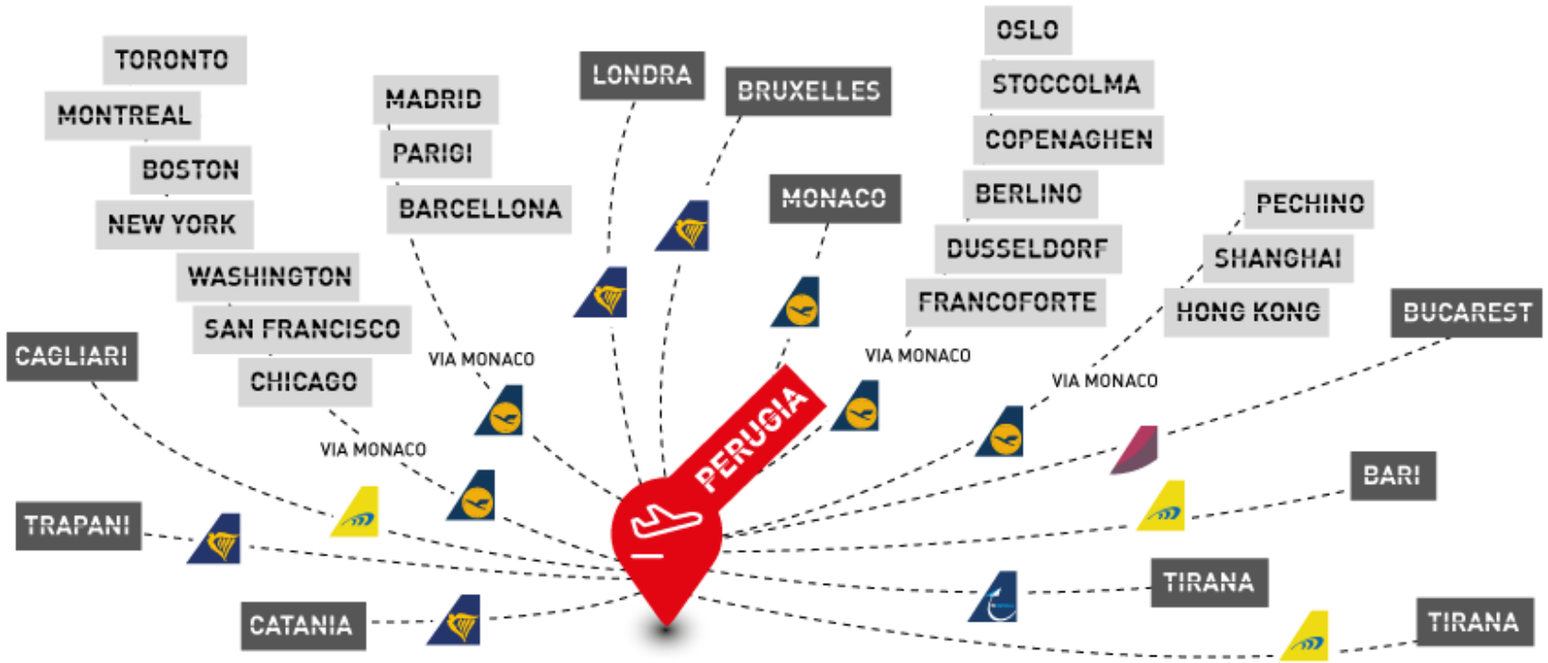
City of Perugia, Italy

COMMA2020@ Perugia, September 2020

City of Perugia

Capital city of the region of Umbria in central Italy

Flight connections to Perugia



See also
http://www.airport.umbria.it/ita/mappa-destinazioni

Train/bus connections to Perugia

See also

http://www.perugiaonline.com/reach_perugia_by_train.html

City of Perugia

Rich history and artistic treasures

City of Perugia

Beauty and charm from the beginning
right through to modern times

COMMA 2020 @ Perugia, September 2020

University of Perugia










COMMA 2020 @ Perugia, September 2020

Conference Venue

Possibility of Excursions nearby (Assisi in the picture)

Assisi










COMMA 2020 @ Perugia, September 2020

COMMA2020 Web site

You will find informations about:

- ❑The conference program
- ❑The venue
- ❑Accomodation
- ❑Cities of Perugia and Assisi
- ❑University of Perugia
- ❑Organization

http://comma2020.www.dmi.unipg.it/

ICCMA 2019

Third International Competition on Computational Models of Argumentation

S. Bistarelli, F. Santini, L. Kotthoff, C. Taticchi

28th International Joint Conference on Artificial Intelligence (IJCAI-19)