

# The 12th QBF Solvers Evaluation (QBFEVAL'19)

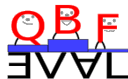
Luca Pulina<sup>1</sup>, Martina Seidl<sup>2</sup>, and Ankit Shukla<sup>2</sup>

<sup>1</sup>IDEA Lab, University of Sassari (Italy)

<sup>2</sup>Johannes Kepler University, Linz (Austria)



The 22nd International Conference on  
Theory and Applications of Satisfiability Testing  
Lisbon, July 12, 2019



# QBFEVAL'19 at a Glance

- 3 tracks
- 10 systems (27 configurations) submitted by 8 teams
- Evaluation performed in two stages
- Judges: Olaf Beyersdorff and Christoph Wintersteiger.



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All details (except the results) were presented and discussed at the QBF Workshop



# Outline

- 1 The Setup: Tracks, Solvers and Formulas
- 2 And the winners are
- 3 Conclusions



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# Tracks & Participants

- 1 Prenex Conjunctive Normal Form (PCNF)
  - ▶ 5 solvers in 13 configurations
- 2 Prenex Non-Conjunctive Normal Form (PNCNF)
  - ▶ 4 solvers in 9 configurations
- 3 DQBF Track
  - ▶ 3 solvers in 5 configurations



# Submitted Solvers

Solver	Track	Author(s)
CAQE (bloqger-qdo, hqspre, pre)	PCNF	M. N. Rabe, L. Tentrup
dCAQE	DQBF	M. N. Rabe, L. Tentrup
DepQBF (pre_QxQBH, prefix_opt_qdo)	PCNF	F. Lonsing
GhostQ (cegar, plain)	PCNF, PNCNF	W. Klieber
Hiqger (1, 2, 3)	PCNF	A. Van Gelder, S. Wood
HQS (default, ql, ql+fs)	DQBF	R. Wimmer, A. Ge-Ernst, C. Scholl
iProver	DQBF	K. Korovin
QBF Portfolio	PNCNF	H. Hoos, T. Peitl, F. Slivovsky, S. Szeider
QuAbs (caqe, caqe-hqspre, default)	PNCNF	J. Hecking-Harbusch, L. Tentrup
QUTE (default, opt500, rrs)	PCNF	T. Peitl, F. Slivovsky
QUTE	PNCNF	T. Peitl, F. Slivovsky



# The Dataset

- Prenex CNF Track: **559** instances
- Prenex non-CNF Track: **341** instances
- DQBF Track: **334** instances (327 were considered for the result)

Available at [http://www.qbflib.org/QBFEVAL19\\_DATASET.zip](http://www.qbflib.org/QBFEVAL19_DATASET.zip)





# Scores, Resources and Infrastructure

- **Score**
  - ▶ Total amount of solved formulas
  - ▶ Total runtime in case of tie
  
- **Resources** per formula and solver
  - ▶ Runtime limit: **900 seconds**
  - ▶ Memory limit: **32GB**
  
- **Infrastructure** StarExec cluster

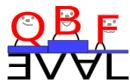


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# Prenex-CNF Track

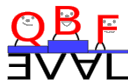


# Prenex-CNF Track



Qute

T. Peitl, F. Slivovsky



# Prenex-CNF Track



DepQBF F. Lonsing



Qute T. Peitl, F. Slivovsky



# Prenex-CNF Track



CAQE M. Rabe, L. Tentrup



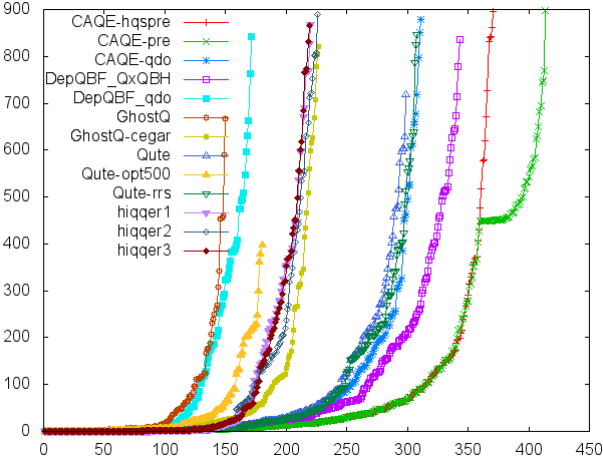
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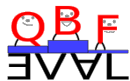
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# Detailed Results



# Prenex-NonCNF Track





# Prenex-NonCNF Track



Qute

T. Peitl, F. Slivovsky



# Prenex-NonCNF Track



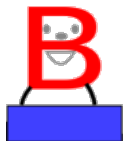
GhostQ W. Klieber



Qute T. Peitl, F. Slivovsky



# Prenex-NonCNF Track



QuAbs J. Hecking-Harbusch, L. Tentrup



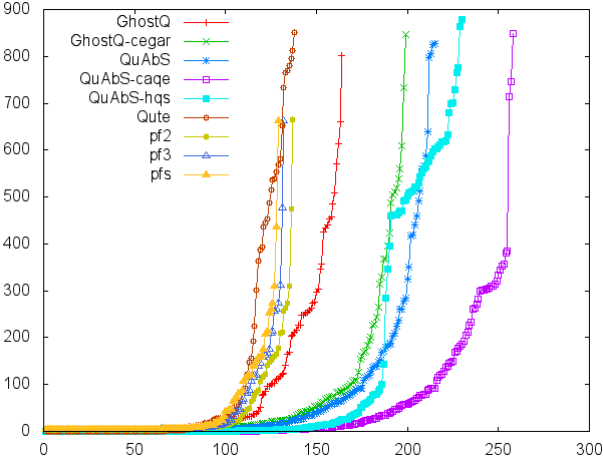
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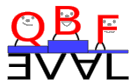
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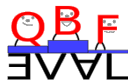


# DQBF Track





IProver K. Korovin



# DQBF Track



dCAQE M. Rabe, L. Tentrup



IProver K. Korovin



# DQBF Track



HQS

R. Wimmer, A. Ge-Ernst, C. Scholl



dCAQE

M. Rabe, L. Tentrup



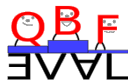
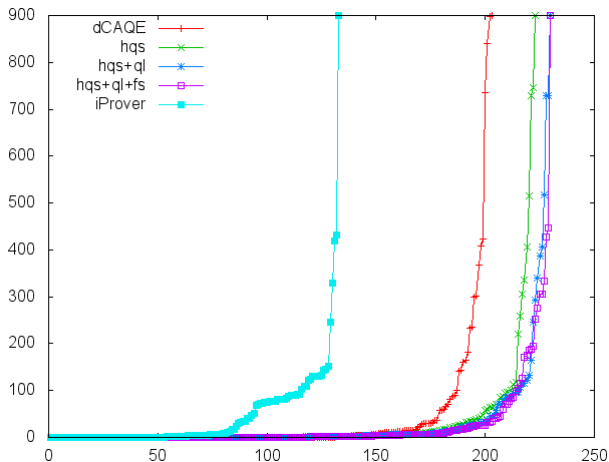
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# Detailed Results



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# Conclusions

- QBFEVAL has a very stable field of participants
- Results **soon available at [www.qbfeval.org](http://www.qbfeval.org)**
  - ▶ Detailed description of solvers and instances
  - ▶ Further insights into setup & data



# Conclusions

- QBFEVAL has a very stable field of participants
- Results **soon available at [www.qbfeval.org](http://www.qbfeval.org)**
  - ▶ Detailed description of solvers and instances
  - ▶ Further insights into setup & data
- Tasks for the QBF Community
  - ▶ Certification for DQBF
  - ▶ More benchmarks especially for Prenx NonCNF & DQBF



# Acknowledgments

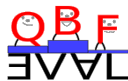
**Participants** All solver and benchmark submitters!

**Judges** O. Beyersdorff, C. Wintersteiger.

**StarExec** A. Stump



**Thank you!**



# Prenex non-CNF Track – Results

- The winner solved **258** (out of 341) instances
  - ▶ 76% of the dataset
- 4 solvers (out of 9) solved at least 50% of the dataset
- All solvers solved at least 25% of the dataset



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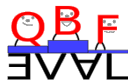
- The winner solved **258** (out of 341) instances
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- 4 solvers (out of 9) solved at least 50% of the dataset
- All solvers solved at least 25% of the dataset
  
- The VBS solved 277 instances (81% of the dataset)
- 8 solvers (out of 9) contributed to the VBS
  - ▶ Major contributor: 25%
  - ▶ 4 solvers contributed for more than 5%





# DQBF Track – Results

- The winner solved **229** (out of 334) instances
  - ▶ 69% of the dataset
- 4 solvers (out of 5) solved at least 50% of the dataset



# DQBF Track – Results

- The winner solved **229** (out of 334) instances
  - ▶ 69% of the dataset
- 4 solvers (out of 5) solved at least 50% of the dataset
- The VBS solved **245** instances
- 3 solvers (out of 5) contributed to the VBS
  - ▶ Major contributor: 53% (is the winner)



# DQBF Track – Discrepancies

- tentrup\_ltl2dba\_U1\_system\_16
- tentrup\_load\_balancer\_unreal2\_system\_4
- tentrup\_amba\_decomposed\_arbiter\_system\_8
- tentrup\_amba\_decomposed\_tburst4\_system\_16
- tentrup\_lilydemo07\_system\_16
- tentrup\_amba\_decomposed\_decode\_environment\_16
- tentrup\_lilydemo04\_environment\_8

“Problematic” instances have been removed

