The 7th Answer Set Programming Competition

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14th International Conference on Logic Programming
and Non-monotonic Reasoning

Outline

The Seventh ASP Competition

Two years after the 6th event

- Hosted by LPNMR
- Back to the usual timeline, after the two consecutive events due to the FLoC 2014 Olympic Games

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Goals

- Measure the progress of the state of the art in ASP solving
- Improve benchmark suite for robust evaluation
- Study the behavior of different solving techniques
- Re-introduce a controlled form of M&S competition (tentative)

The Seventh Competition Setting

Competition Setting

- System competition and modeling competition on site
- Benchmark classification based on language features
- Benchmarks from past editions
  - $\rightarrow$ The best encodings from 2015
  - $\rightarrow$ Updated instance sets for few domains
  - $\rightarrow$ New benchmarks
- Instance selection process
- New solvers and updated versions

Outline

System Competition Format

Sub-tracks based on language features (maintained)

Track 1 (Basic) normal LP + simple built-ins

Track 2 (Advanced) + choices, aggregates, HCF disjunction, query

Track 3 (Optimization) + weak constraints

Track 4 (Unrestricted) + non-HCF disjunction

Two Categories

- Single-Processor (restricted to 1-CPU Core)
- Multi-Processor (up to 8-CPU Cores)

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Marathon

- The best solver of each team
- Time limit extended by one order of magnitude

  $\rightarrow$ Assess solvers on hard instances

Setup

System Inputs

- Fixed input in ASP-Core-2
- Scripts run with fixed parameters
- Fixed encoding + instance from STD input

System Environment

- Debian Linux 64bit with Intel Xeon E5-4610v2 CPUs
- Time limits
  - Competition: 20 minutes
  - Marathon: 3 hours
- Memory Limit: 12 GB
- Multi-processor track: up to 8 cores (16 virtual CPUs)

Scoring

ASP Competition 2017 Scoring Schema

- Consider number of solved instances for decision problems
- Rank solvers on optimization problems by
  - Capability to find the optimum
  - Solution quality
- Runtime for tiebreaking

Decision, Query, Optimum found

$$\text{Score(Solver, Problem)} = \#\text{Solved(Solver)} * 5$$

Optimization Score considering solution quality

$$\text{Score(Solver, Problem)} = \sum_{\text{Instances } I} \frac{\#\text{NotBetter(Solver}, I) * 5}{\#\text{Participants}}$$

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Additional Criteria

- Problems are equally weighted up to 100 points each
- Incorrect answers: disqualification on per problem basis
- Final scores by summing over all problems

Benchmark Suite

A (non-)monotonic process...

Benchmarks from 2015

- Considered all the domains from 6th edition
- Selected the encoding variant that exhibited better performance in the 6th edition
- Updated instance sets for
  - Graph Colouring
- Hardness-based classification of instances
  - Inspired of SAT Competition and employed in 2015
  - Exploiting best solvers from the 6th competition
  - Robust selection done via ASP!

Benchmark Suite: Domains from past editions (T#1/2)

Domain	App	Problem	Encoding	
Graph Colouring		Decision	2014	**Track #1**
Hanoi Tower		Decision	2014	
Knight Tour with Holes		Decision	2014	
Labyrinth		Decision	2013	
Stable Marriage		Decision	2014	
Visit-all		Decision	2014	
Bottle Filling		Decision	2013	**Track #2**
Combined Configuration	√	Decision	2015	
Consistent Query Answering	√	Query	2015	
Graceful Graphs		Decision	2013	
Incremental Scheduling	√	Decision	2014	
Nomystery		Decision	2014	
Partner Units	√	Decision	2014	
Permutation Pattern Matching		Decision	2014	
Qualitative Spatial Reasoning		Decision	2014	
Reachability		Query	2013	
Ricochet Robots		Decision	2013	
Sokoban		Decision	2014	
Solitaire		Decision	2014	
Weighted-Sequence Problem		Decision	2014	

Benchmark Suite: Domains from past editions (T#3/4)

Domain	App	Problem	Encoding	
*Connected Still Life**		Optimization	2013	**Track #3**
Crossing Minimization	√	Optimization	2014	
Maximal Clique		Optimization	2014	
MaxSAT	√	Optimization	2015	
Steiner Tree	√	Optimization	2015	
System Synthesis	√	Optimization	2015	
Valves Location	√	Optimization	2013	
Video Streaming	√	Optimization	2015	
Abstract Dialectical Frameworks		Optimization	2013	**Track #4**
Complex Optimization	√	Decision	2014	
Minimal Diagnosis	√	Decision	2014	
Strategic Companies		Query	2013	

Benchmark Suite: New domains

Domain	App	Problem	
Crew Allocation	√	Decision	**Tr.#2**
Bayesian Network Learning		Optimization	**Tr.#3**
Markov Network Learning		Optimization	
Resource Allocation	√	Optimization	
Supertree Construction		Optimization	
Traveling Salesperson		Optimization	
Paracoherent Answer Sets		Optimization	**Tr.#4**
Random Disjunctive ASP		Decision	

Benchmark Classification (1)

Run the same solvers as previous classification

- clasp, lp2normal+clasp, wasp1.5
- same setting as competition
- 40 min TO (twice the timeout)

Some numbers

- 8 new domains
- about 2000 runs
- about 30 days of execution

Benchmark Classification (2)

(non-groundable) Instances that could not be grounded by any top-performing system within the timeout.

(very easy) Instances solved by all top-performing systems in less than 20 seconds.

(easy) Instances solved by all top-performing systems in less than 2 minutes.

(medium) Instances solved by all top-performing systems within the timeout.

(hard) Instances solved by at least one among the top-performing systems within 40 minutes.

(too hard) Instances that could not be solved (no solution produced in case of Optimization problems) by any of the top-performing systems within 40 minutes.

Instance Selection

Instance Selection (Criteria)

- 20 instances are included in each domain
- Exclude non-groundable and very easy instances
- Each other class shall contribute 20% to each domain
- Discard domains mostly made of easy instances
- Balance satisfiable and unsatisfiable instances for decision
- Focus on satisfiable instances for optimization
- Random selection from each class + 20% totally random

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- Selection implemented in ASP!

Selection Statistics

Benchmark Suite

- 35 selected problems
- 1 too easy problem discarded
  - Resource Allocation
    → A very smart encoding by Giray Havur & Martin
- No non-groundable instances
- 700 instances selected

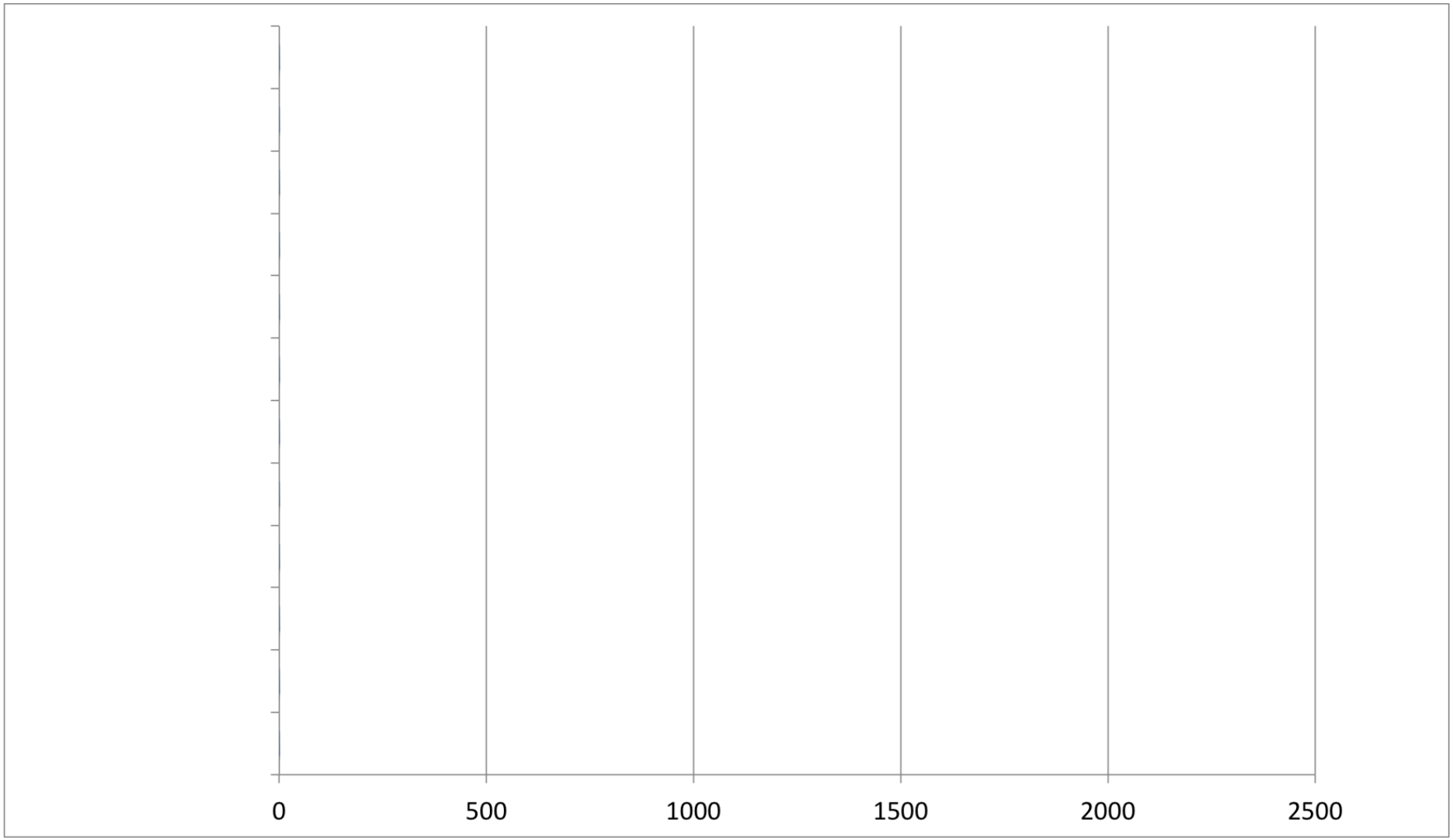
Outline

Participants

The competition featured 14 systems coming from three teams

- **Aalto Team**, Aalto University (9 solvers):
  LP2SAT+LINGELING, LP2SAT+PLINGELING-MT, LP2ACYCASP, LP2ACYCPB, LP2ACYCSAT, LP2MIP, LP2MIP-MT, LP2NORMAL, LP2NORMAL+LP2STS
- **ME-ASP Team**, University of Genoa, University of Sassari, University of Calabria (1 solver):
  ME-ASP2
- **UNICAL Team**, University of Calabria (4 solvers):
  iDLV-CLASP-DLV, iDLV+-CLASP-DLV, iDLV+-s, iDLV+-WASP-DLV

Results: Regular Solved



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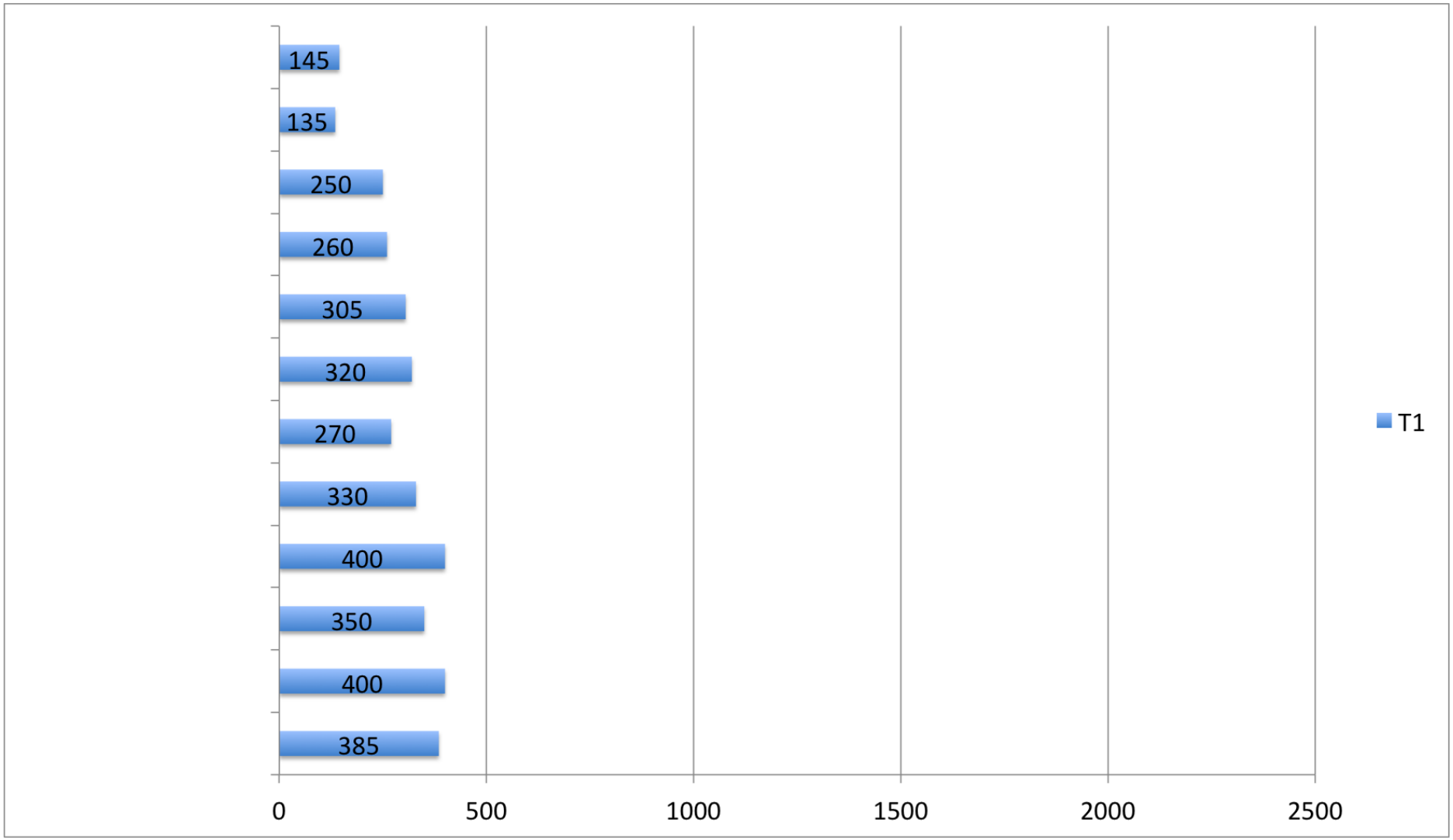

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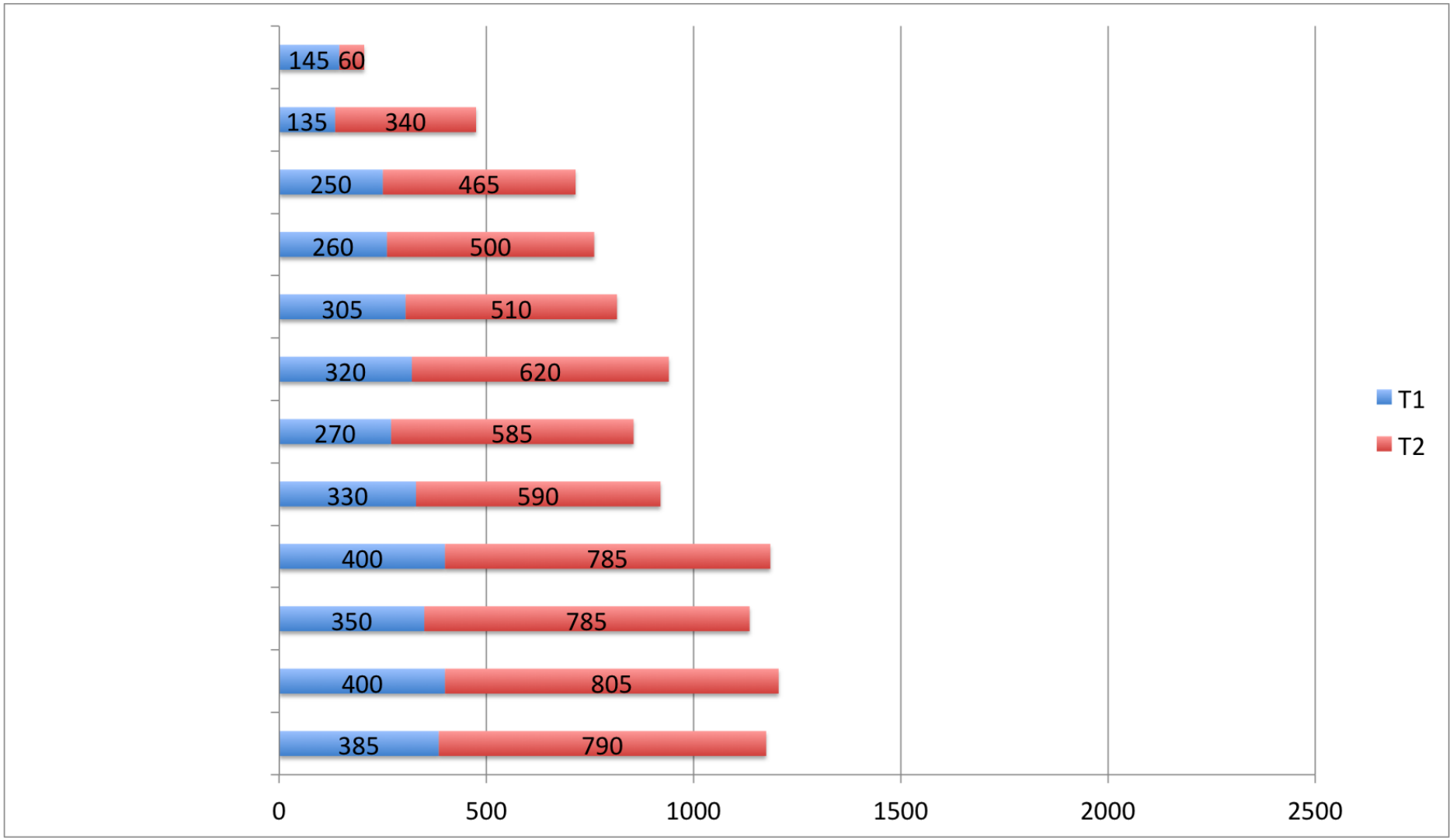

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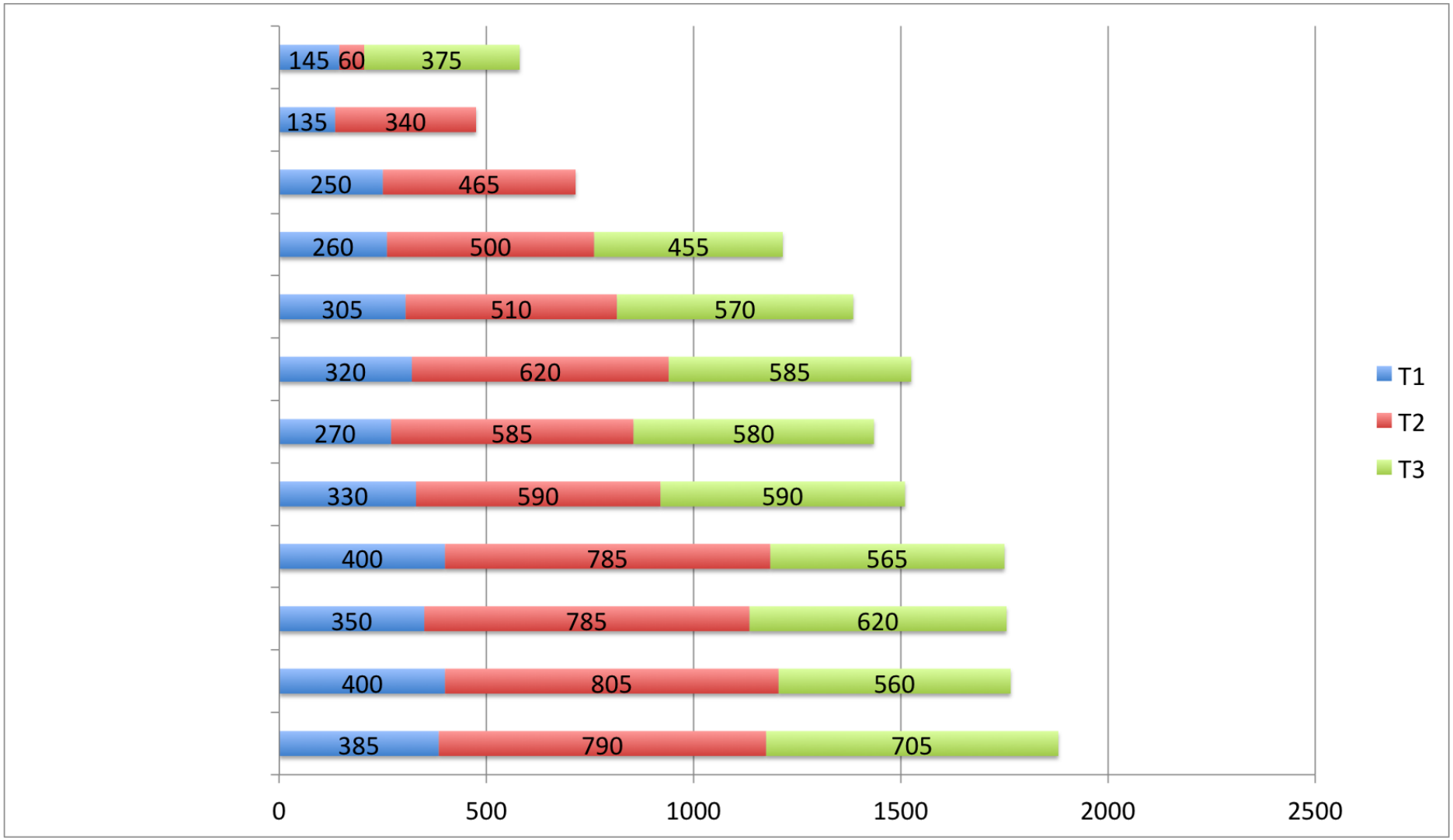

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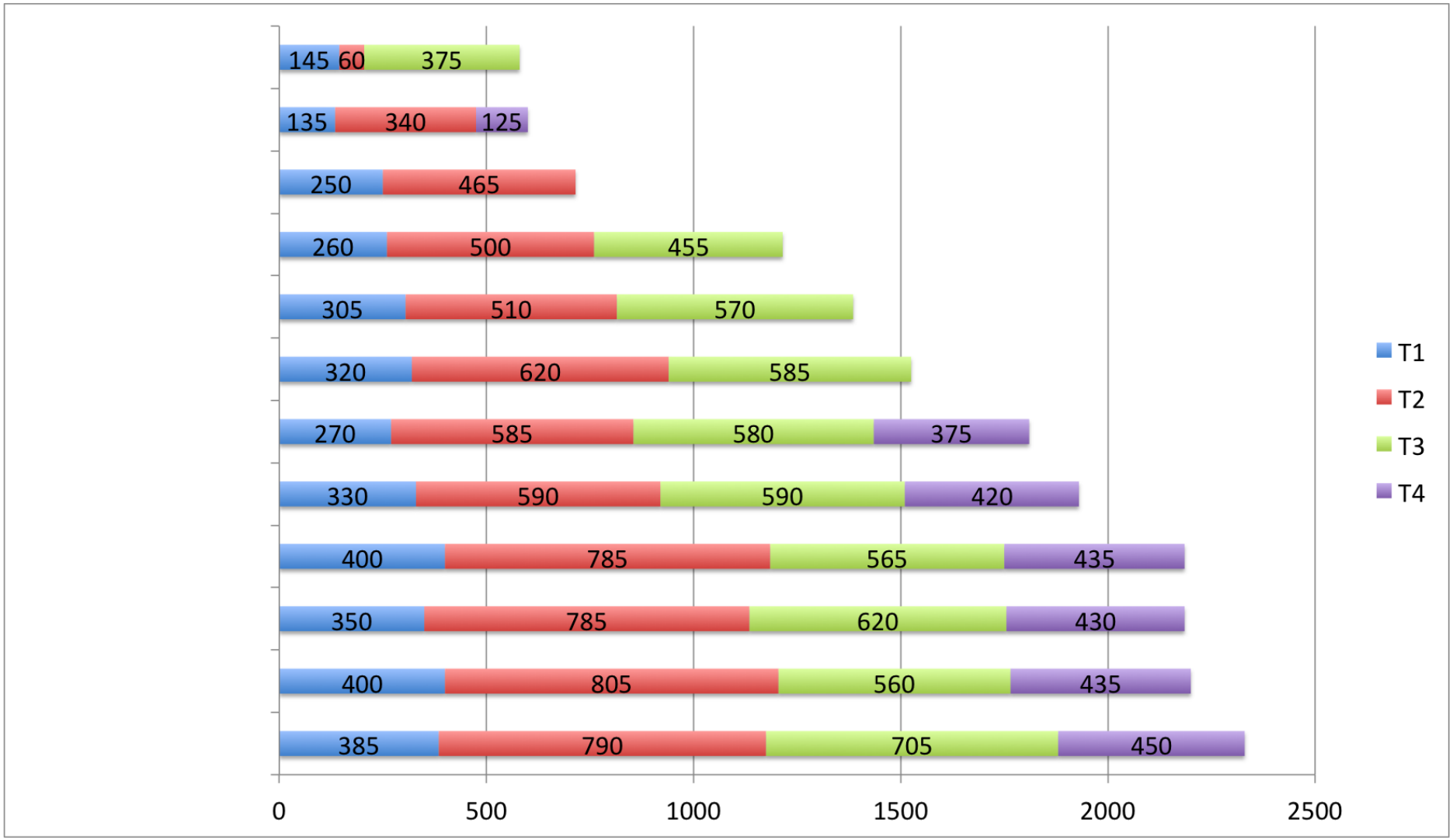

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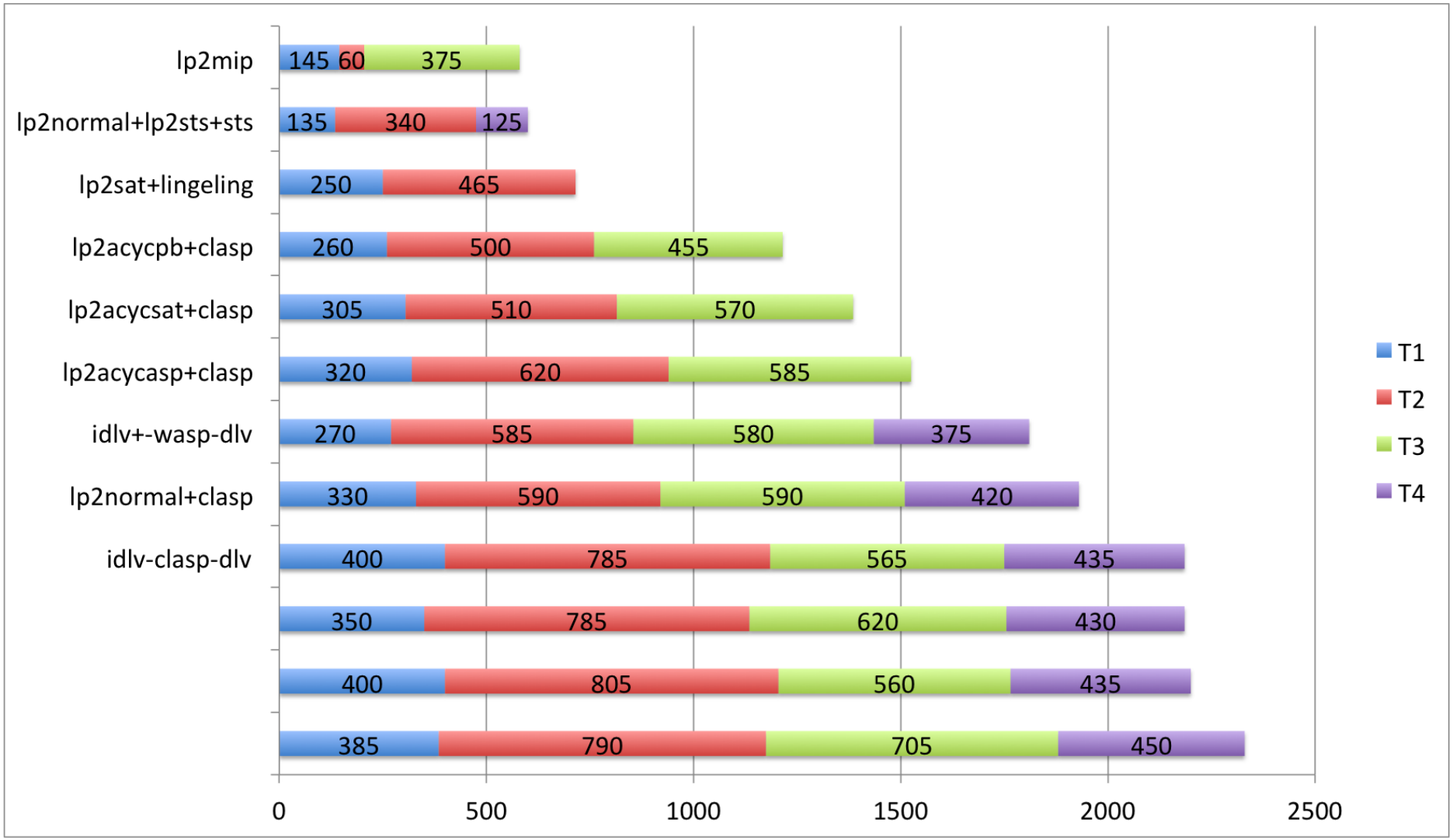

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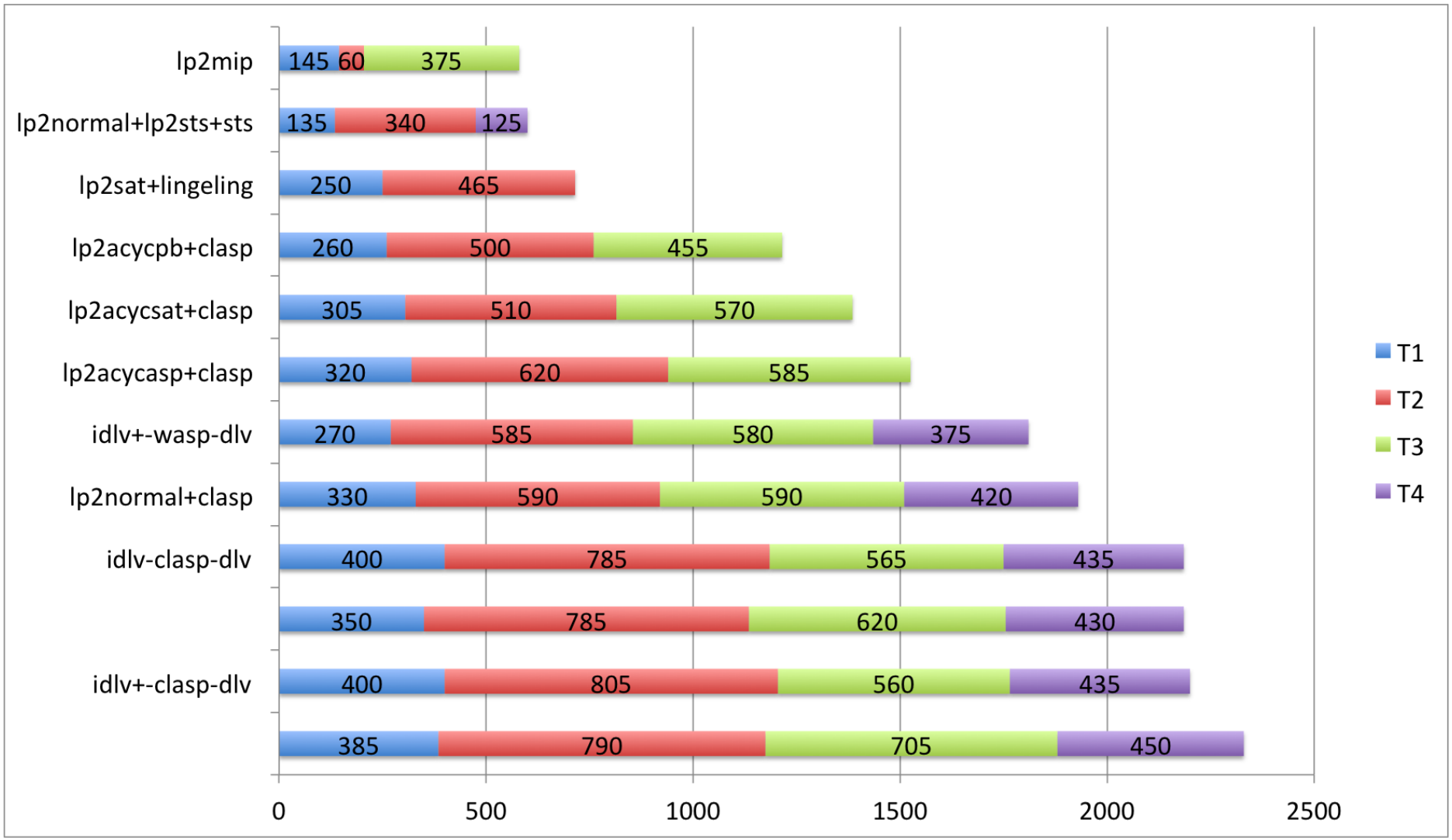
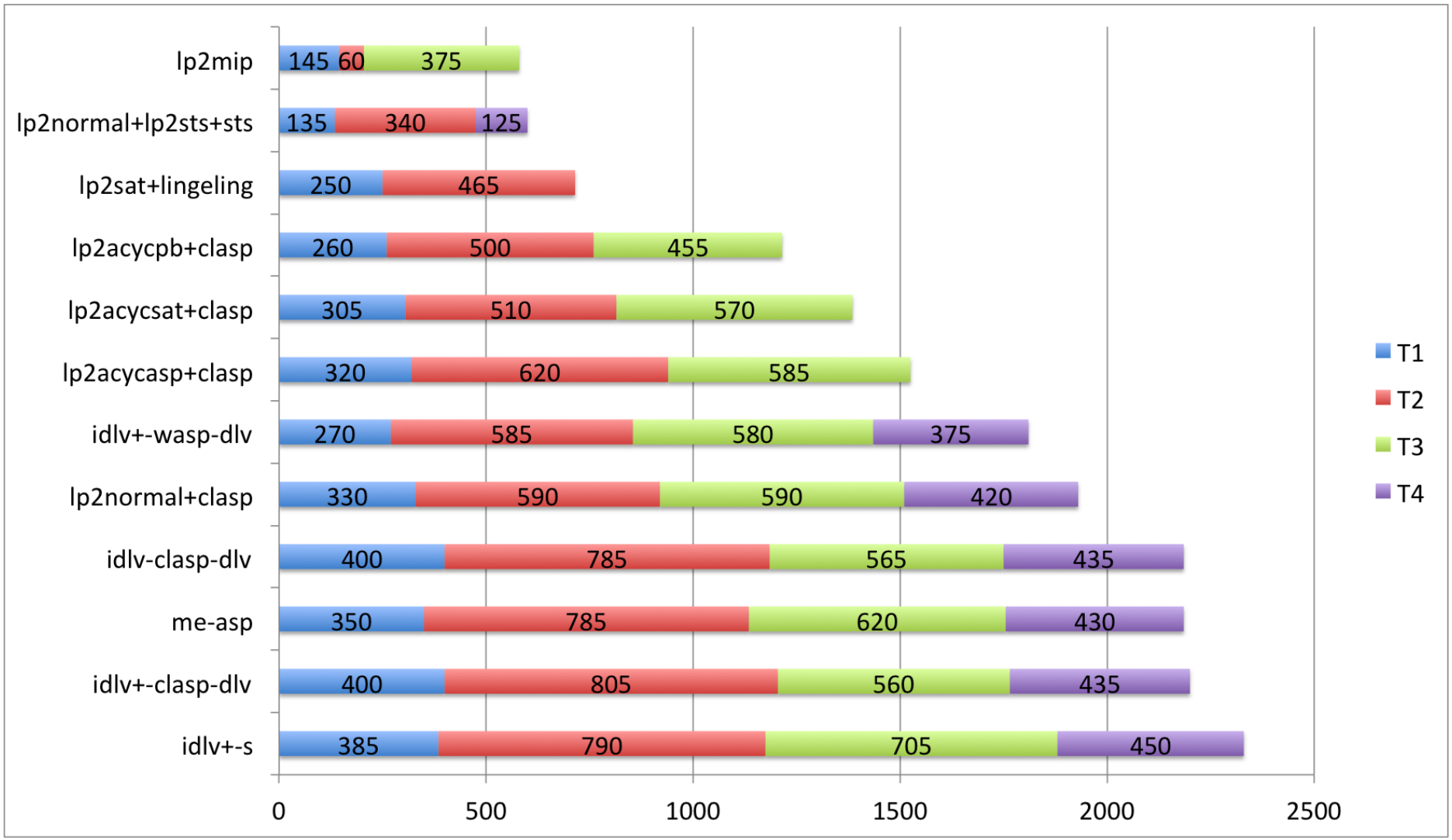
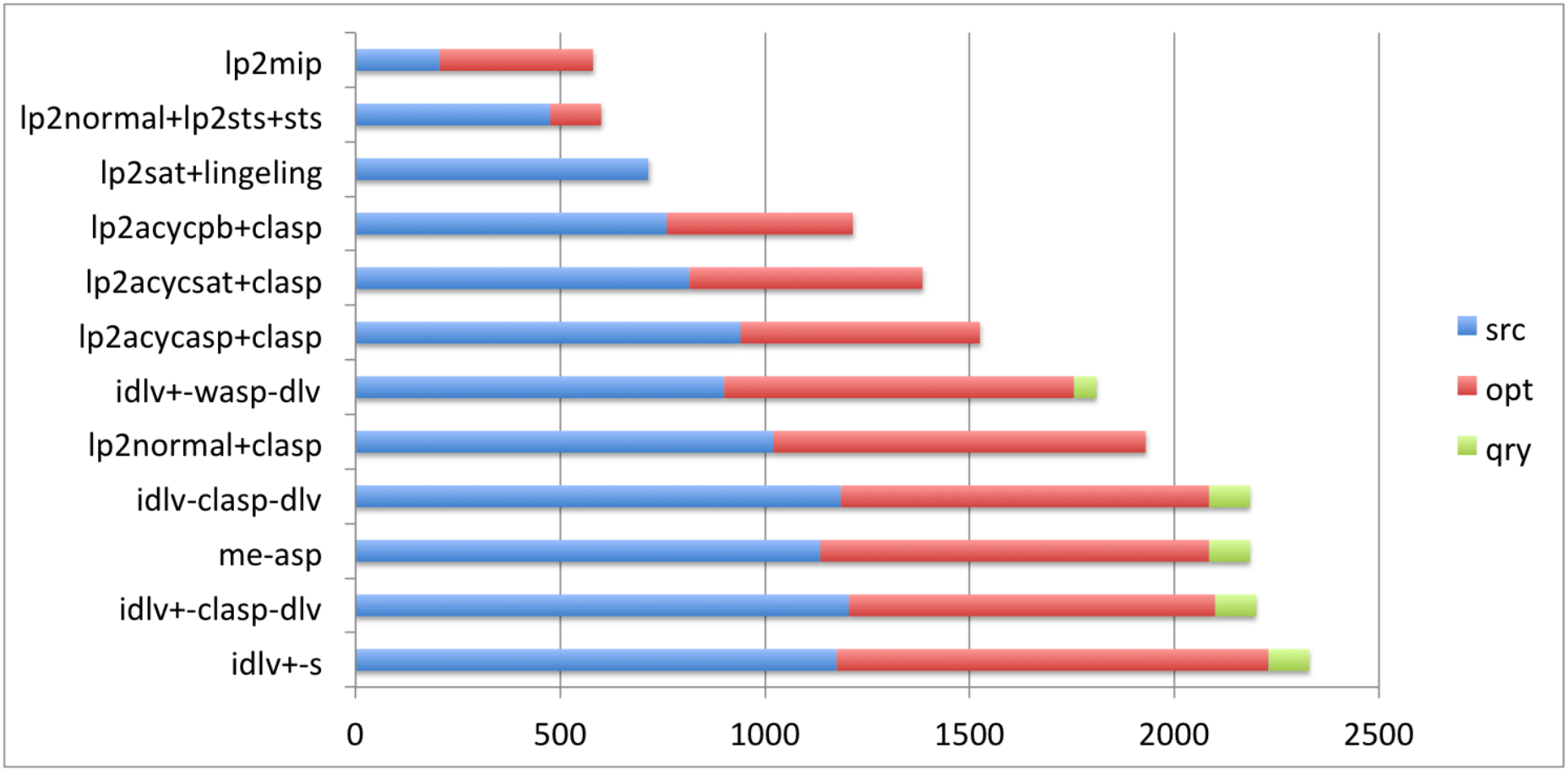


Results: Regular Solved



Results: Regular Solved By Task



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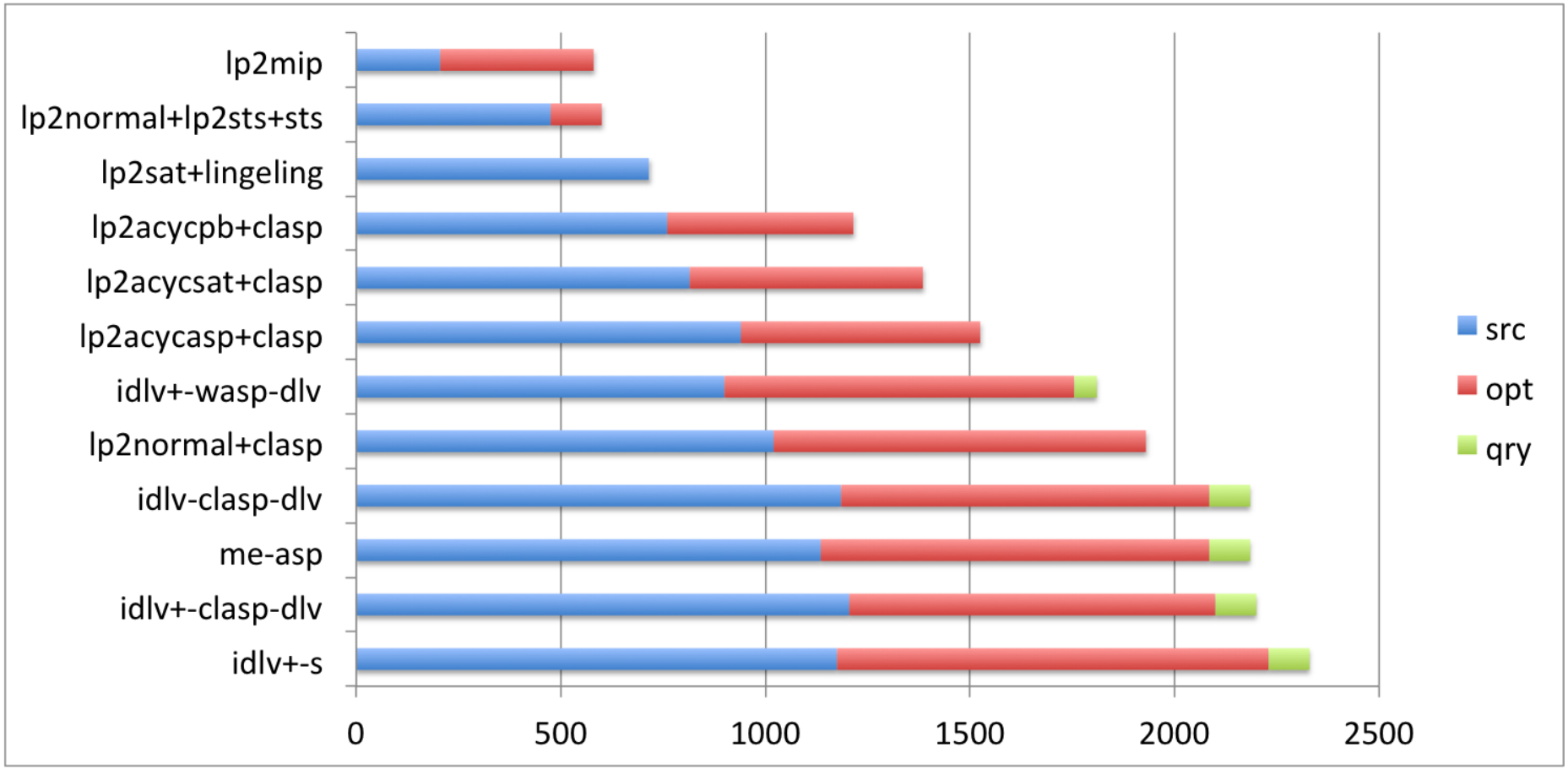
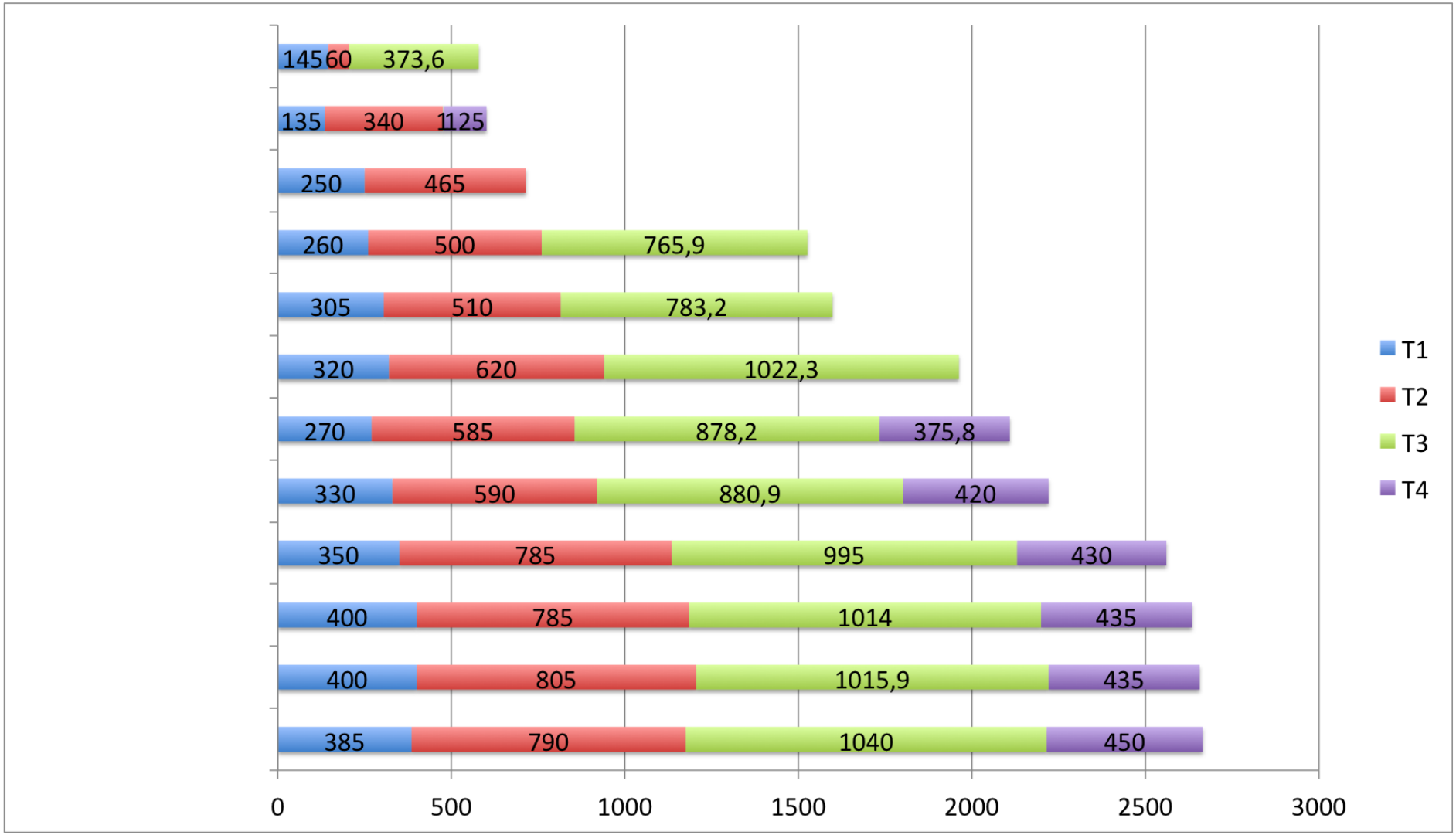


Mostly search and optimization!

Results: By Solution Quality Score



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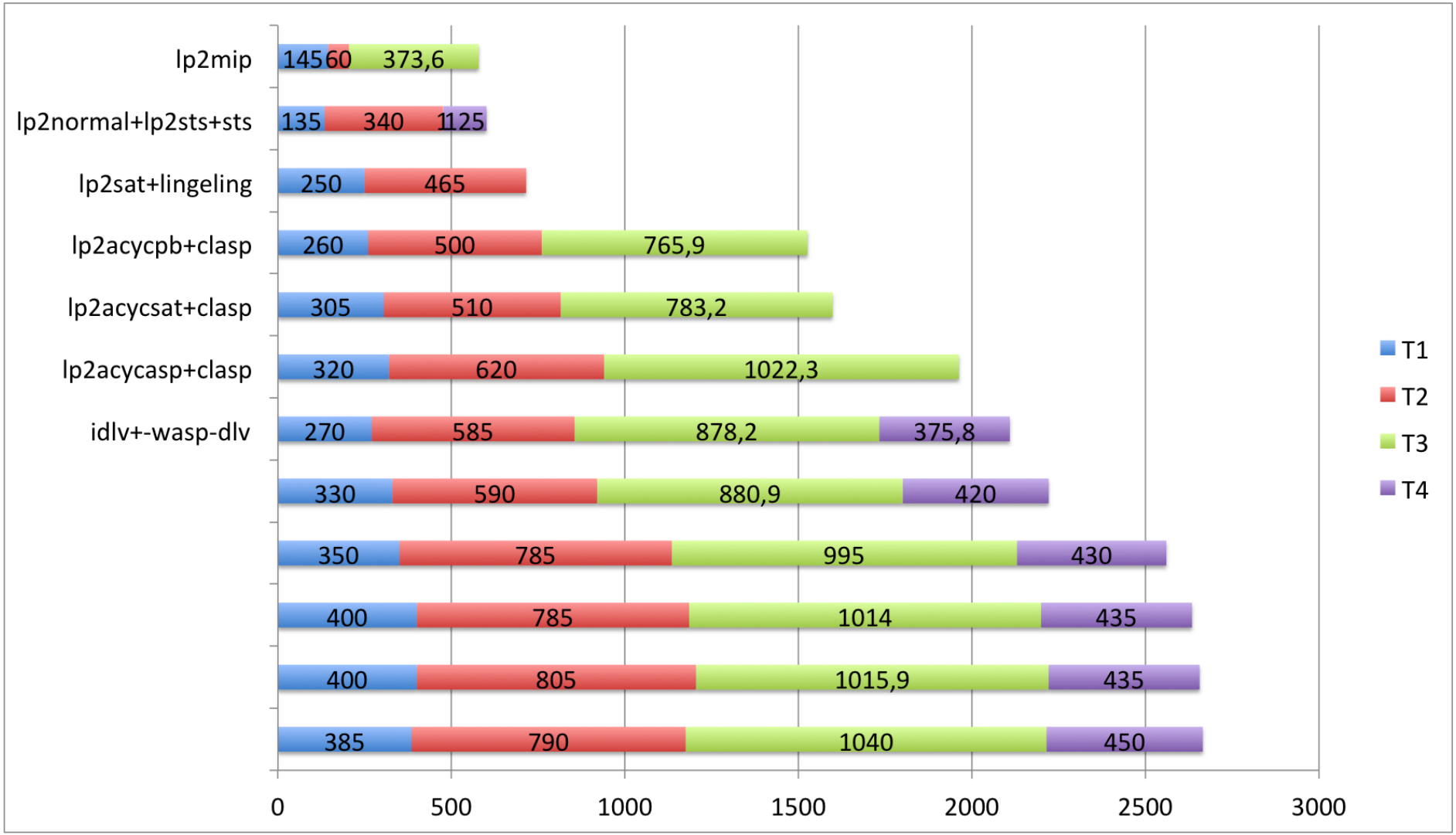

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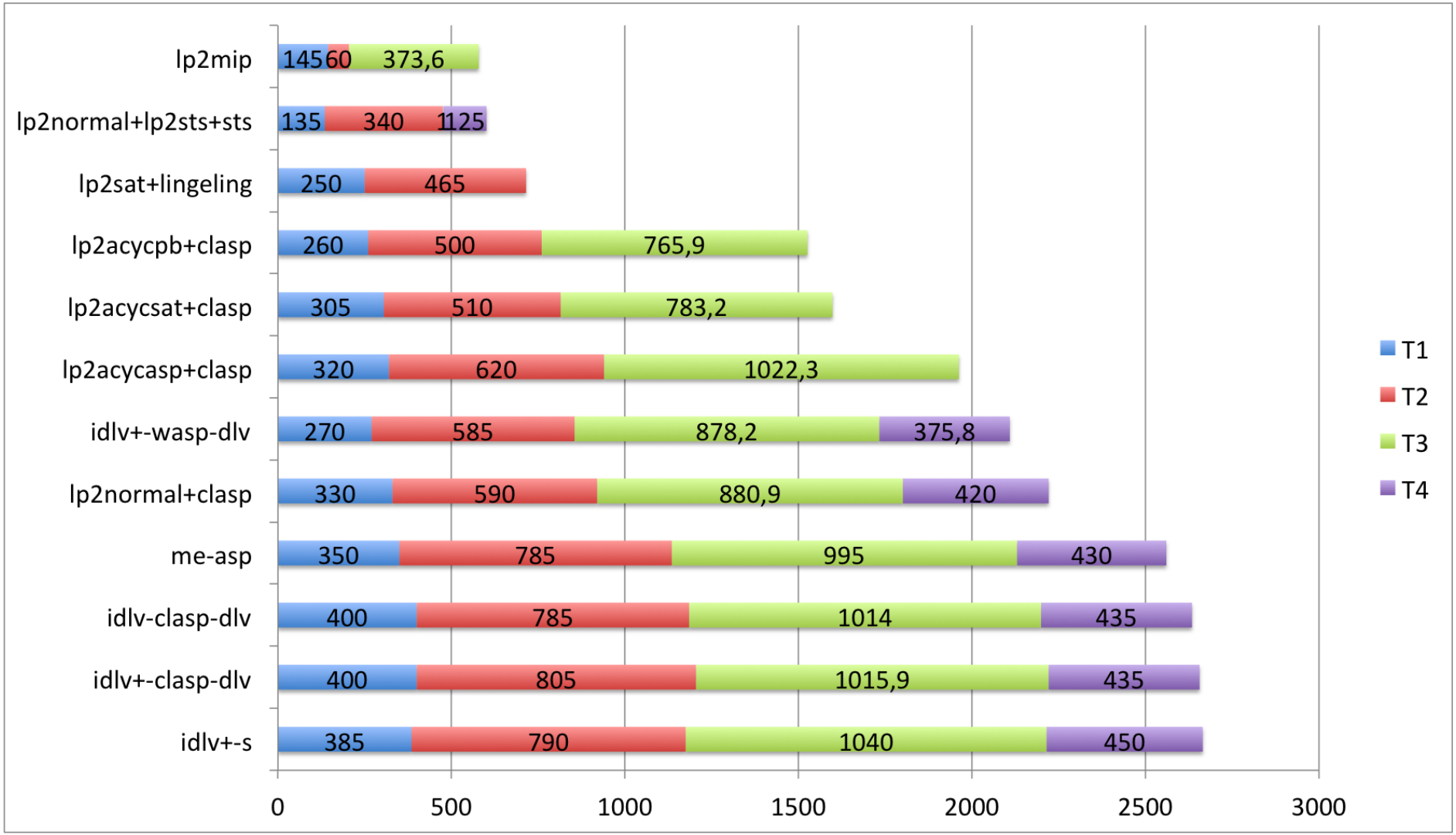
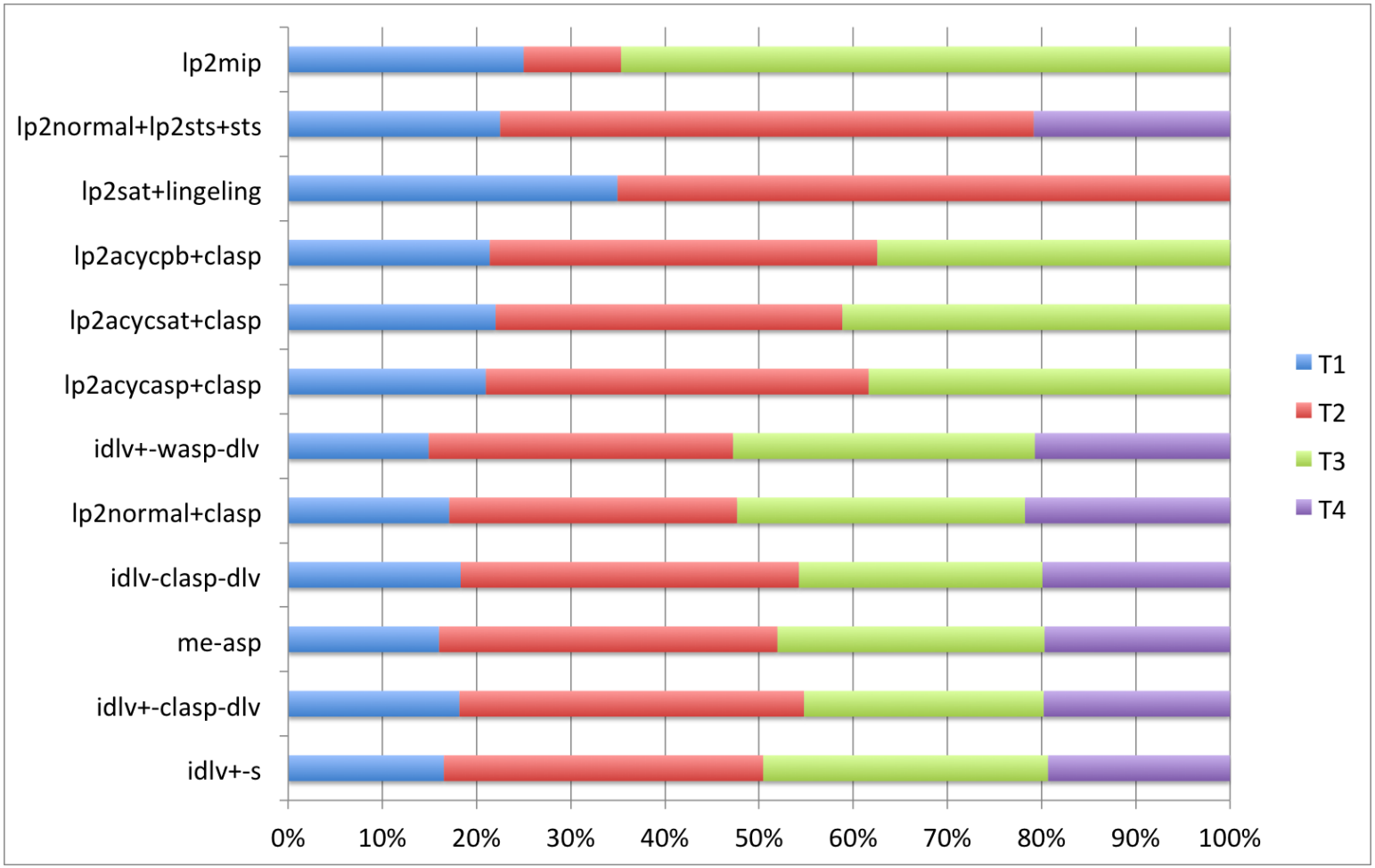
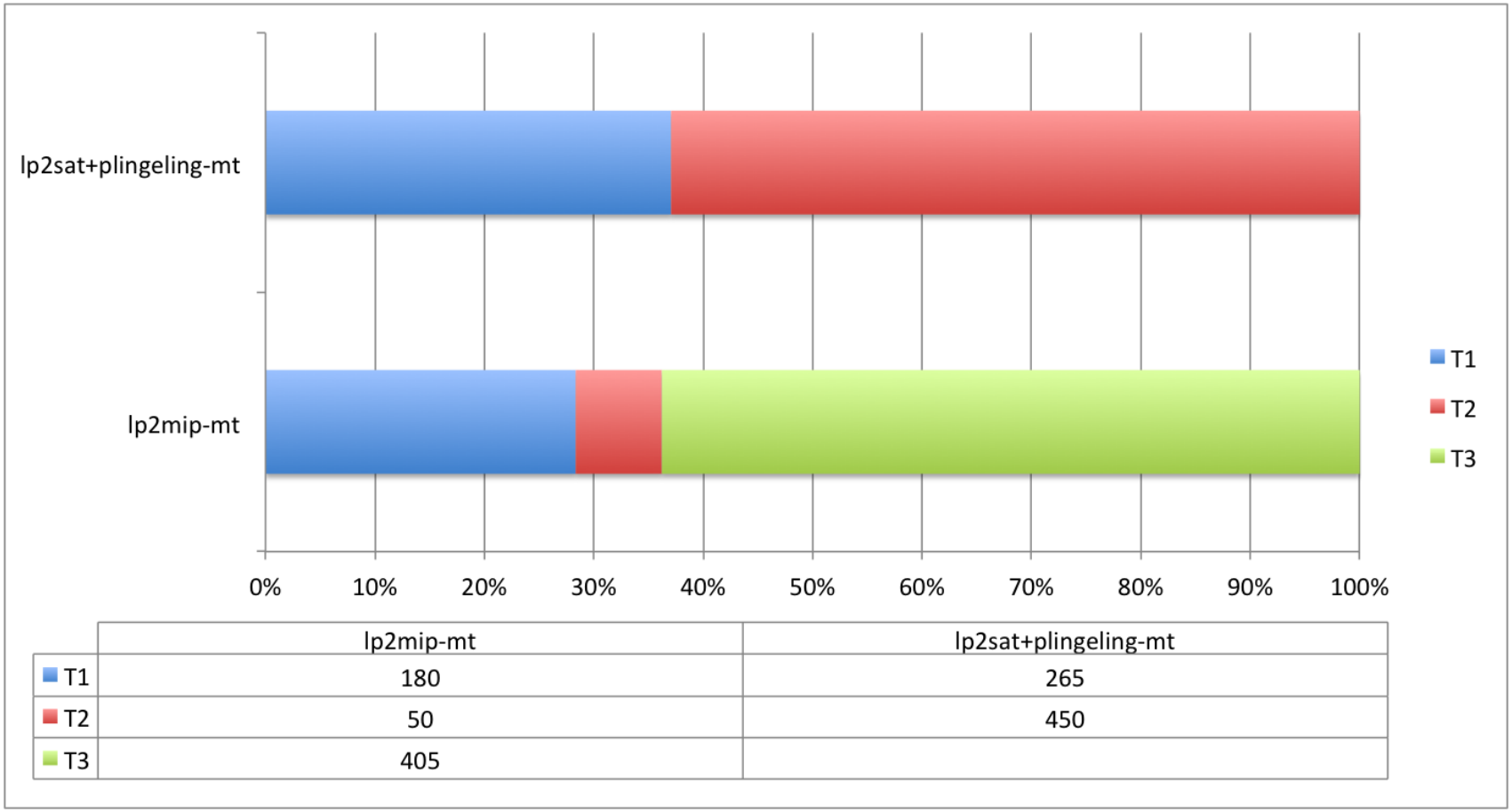


Results: Regular Percentages



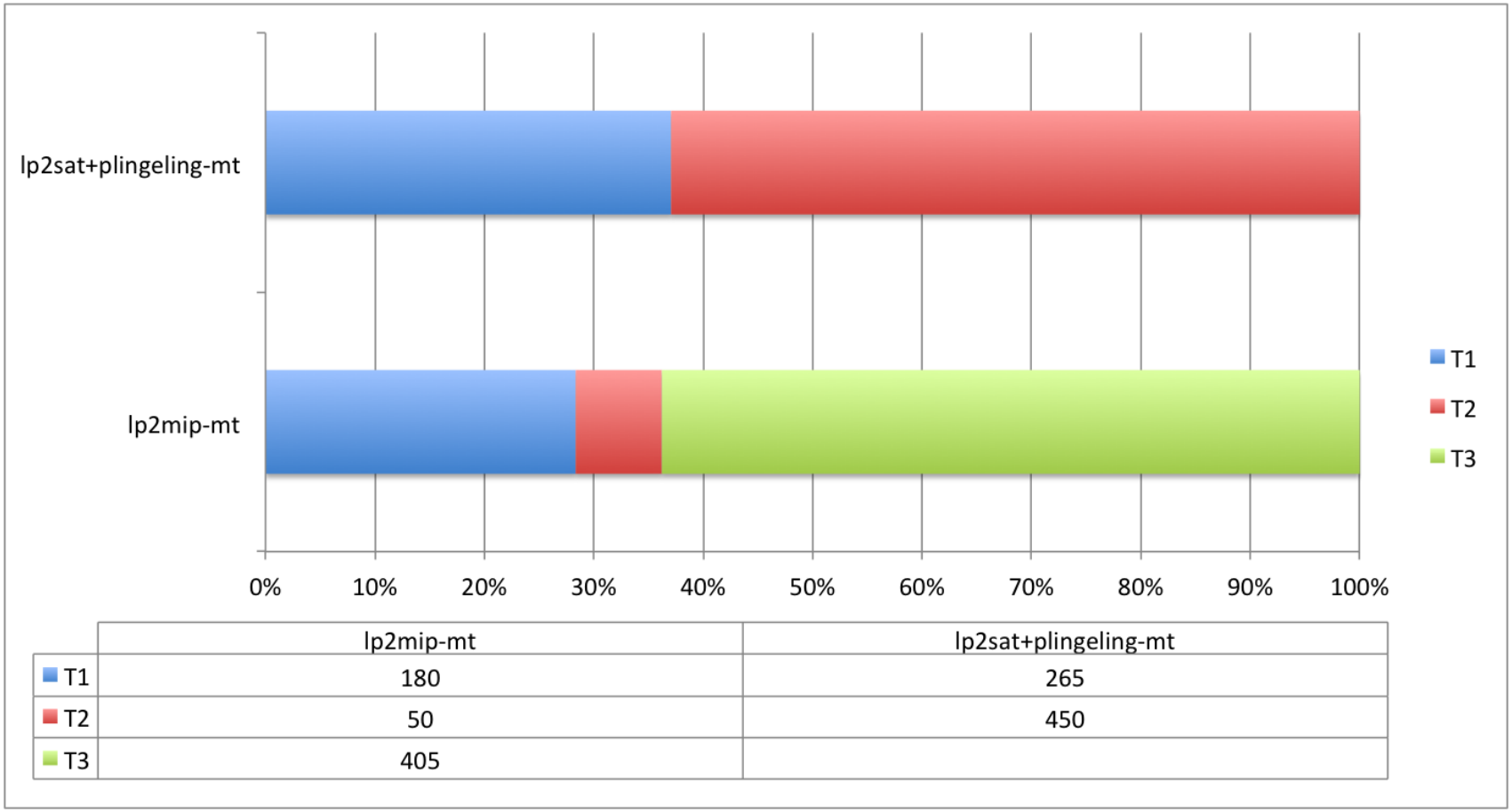
Mostly search and optimization!

Results: Multi Processor Track



	lp2mip-mt	lp2sat+plingeling-mt
T1	180	265
T2	50	450
T3	405	

Results: Multi Processor Track



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T1	180	265
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lp2SAT is the winner!

Marathon Track

Marathon Track

- ...still running
- Winners will be notified next month!!

(Implemented) Suggestions from Previous Event

Scoring

- Less dependent on number of participants
- More emphasis on solved (optimal) solutions

  $\rightarrow$ 5 points is too much for non-optimal witnesses
- Two rankings?

Model and Solve Competition

- Only one domain

  $\rightarrow$ Thanks Potassco!

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- Two rankings? $\leftarrow$ DONE!

Model and Solve Competition $\leftarrow$ DONE!

- Only one domain

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- Only one willing to participate!

  $\rightarrow$ Adam Smith

Suggestions for future ASP events (1)

Further Simplify Output

- Avoid using exit codes with custom semantics

  $\rightarrow$ Easy choice for SAT, not for ASP solver scripts!
- Embrace POSIX-compatible convention

  $\rightarrow$ Zero for success and non-zero for error

Benchmark Suite

- Don't stop adding ASP-oriented real-world applications
- Maintain classification by language features
- Maintain some more easy domains

Suggestions for future ASP events (2)

Reasoning Tasks

- Brave Reasoning
- Answer Set Counting
- Extended language features

Extend the ASP Development community

- ASPLib web site
- Lower the entrance barrier for newcomers

Offline Modeling Competition

- Change the competition format
- Make it a competition for students
- Involve some big company
- Have a prize in money

Suggestions for future ASP events (3)

Suggestions from the PAoASP panel

- More reasoning tasks: counting, etc.
- Grounding/Lazy grounding
- Continuous evaluation
- Emphasize knowledge representation
- Extend the standard $\rightarrow$ New Tracks
- Starexec

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Further suggestions

- Fresh (wo)men power
- Different structure of the OC

  $\rightarrow$ Easier to pass the relay baton

Thanks

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Finally, do not forget award ceremony!