

The 5th Competition on Syntax-Guided Synthesis

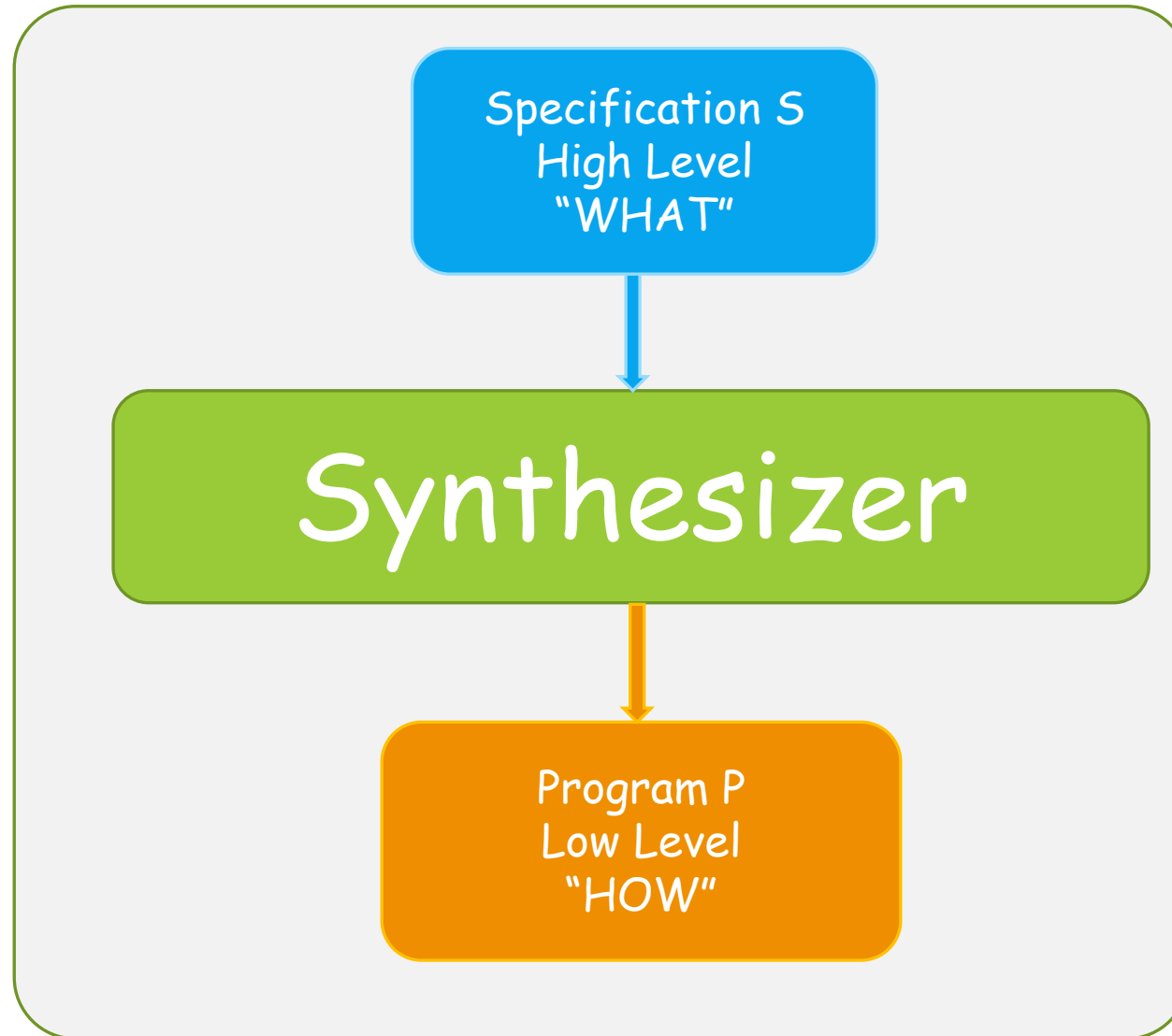


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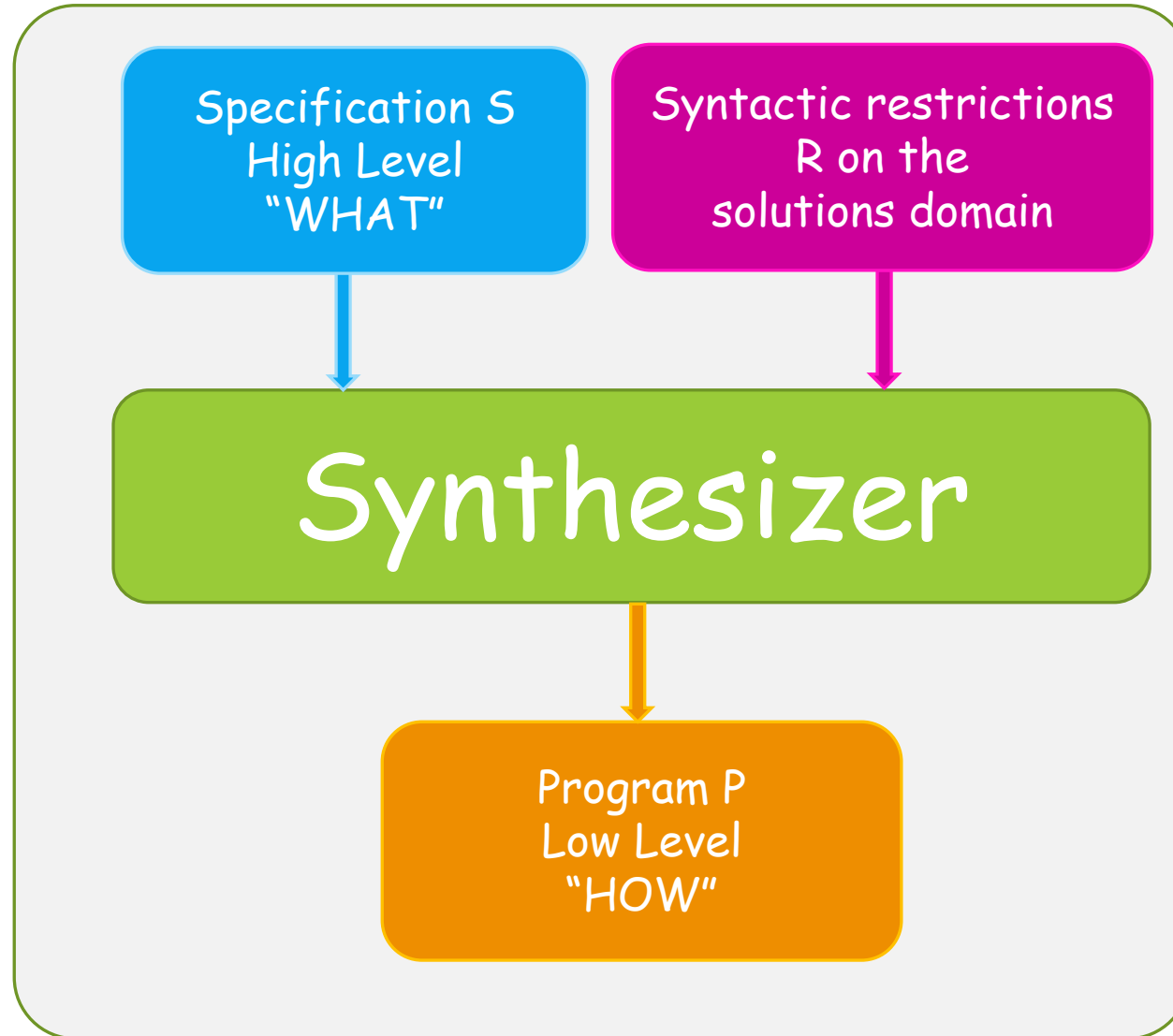
SyGuS

Idea and Definition
in a Nutshell

Program Synthesis



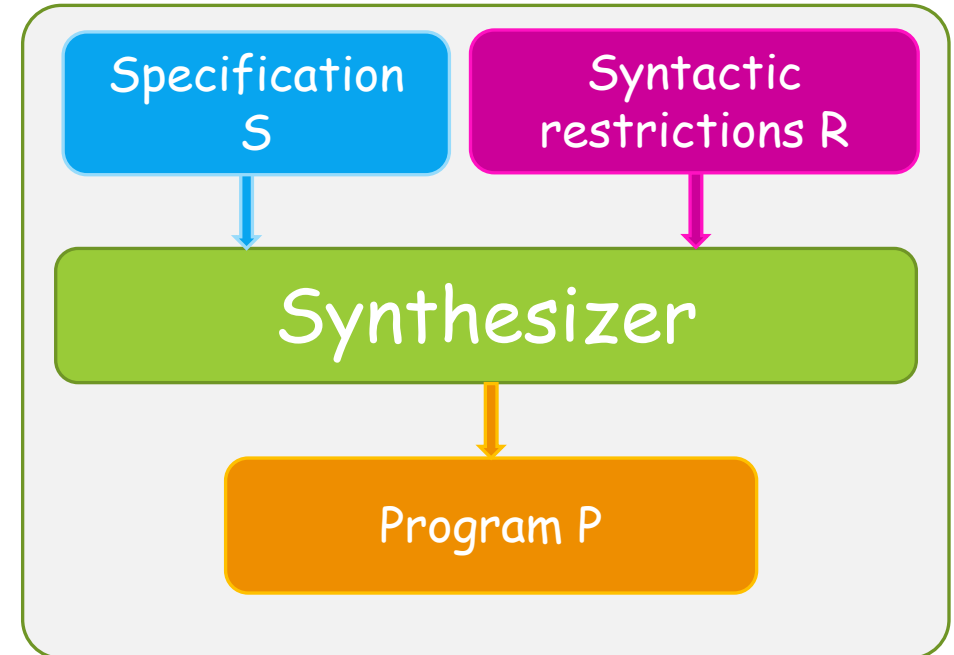
Recent Trends in Synthesis



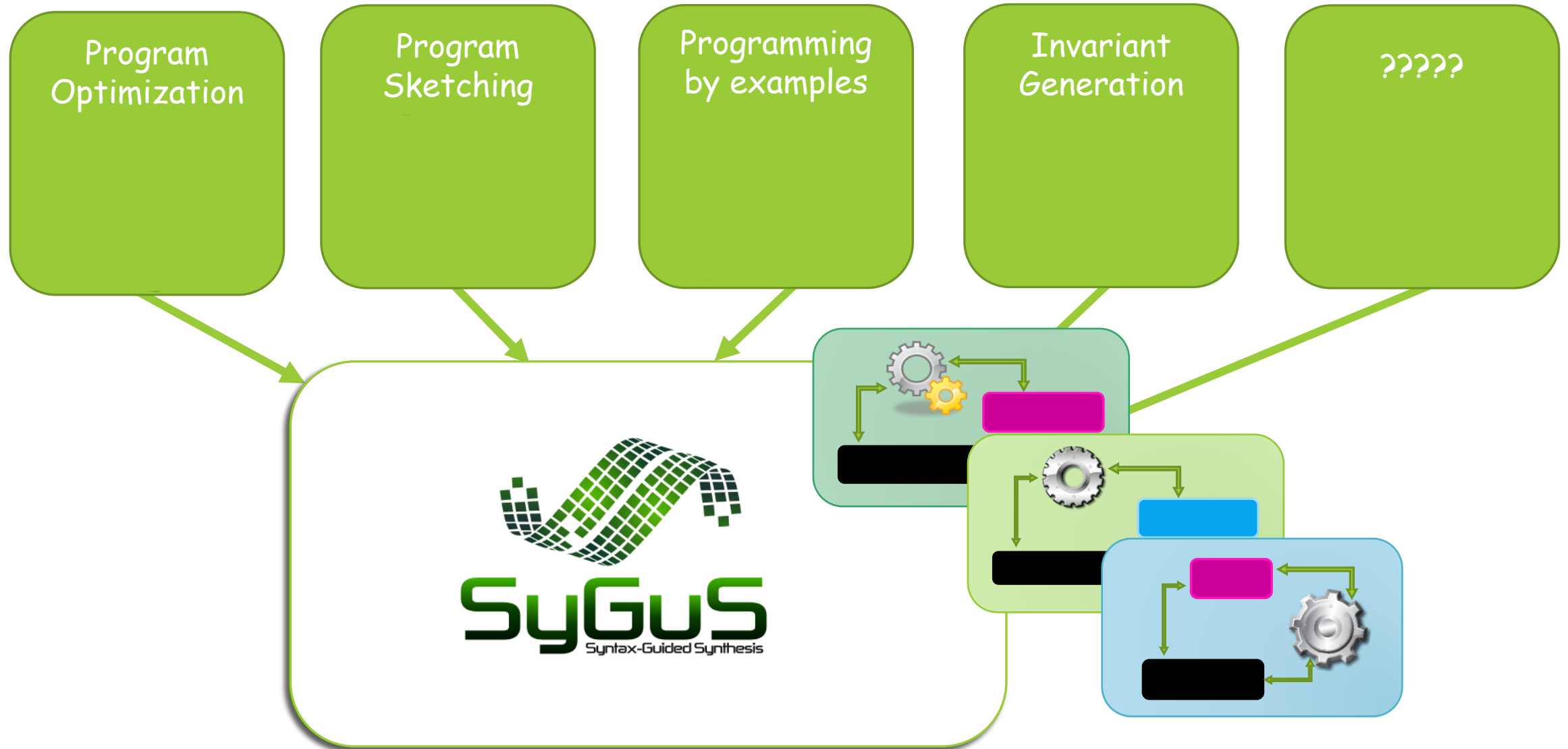
Syntax Guided Synthesis - Idea

Motivation:

- Tractability
- Combine
human expert insights with
computers exhaustiveness & rapidness
- Benefit progress SAT & SMT Solvers

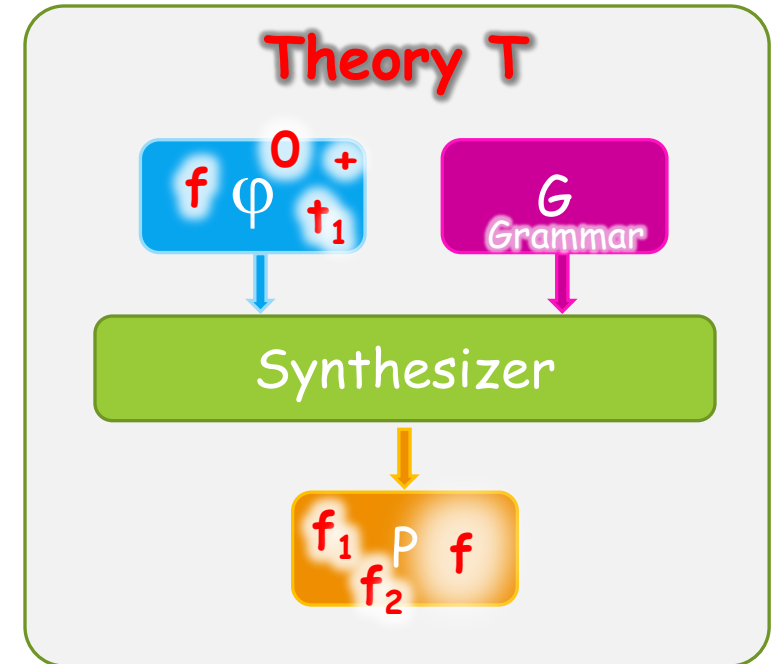


SyGuS - The Vision

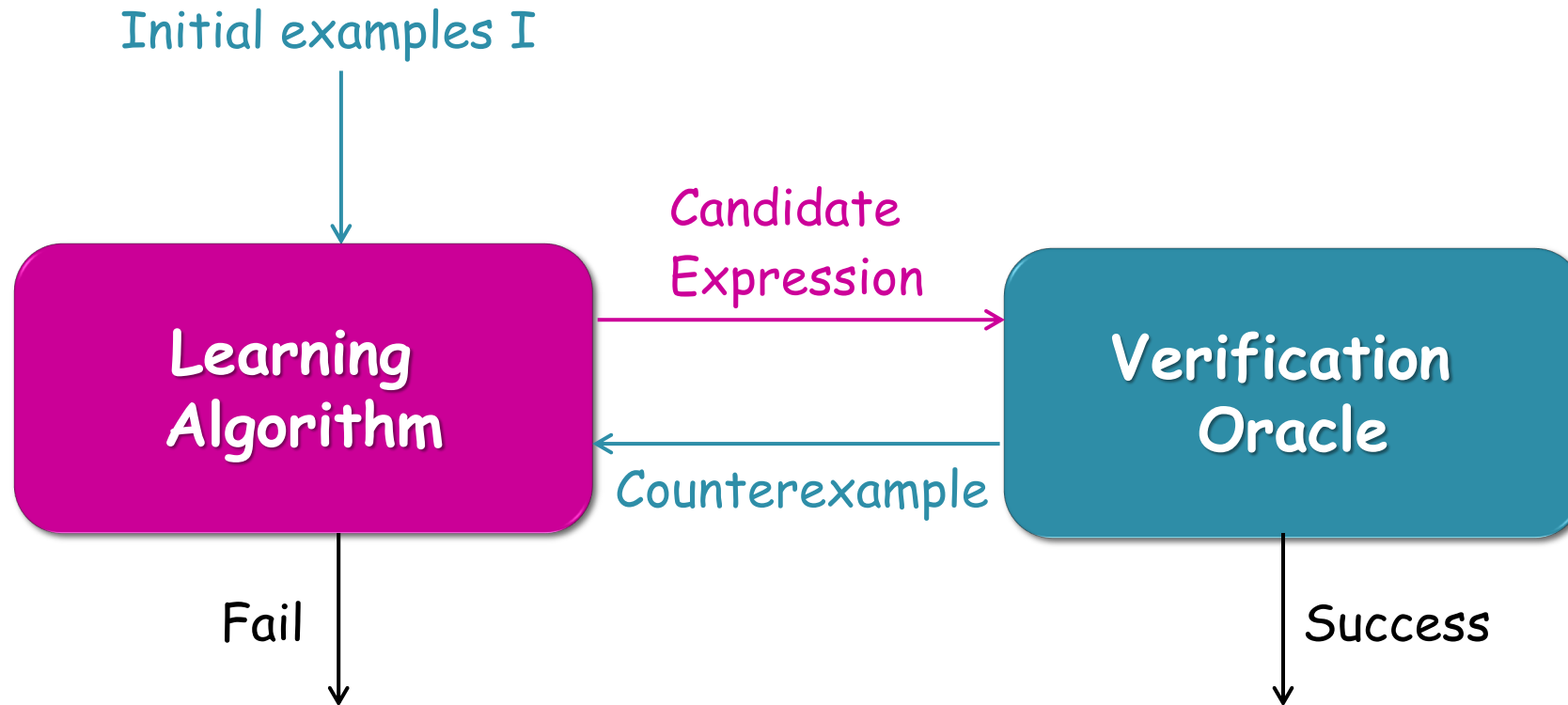


Syntax-Guided Synthesis (SyGuS) Problem

- Fix a background **theory T** : fixes types and operations
- Function to be synthesized: **name f** along with its type
 - ❖ General case: multiple functions to be synthesized
- Inputs to SyGuS problem:
 - ❖ **Specification φ**
Typed formula using symbols in T + symbol f
 - ❖ **Context-free grammar G**
Characterizing the set of allowed **expressions** $[[G]]$ (in theory T)
- **Computational problem:**
Find **expression e** in $[[G]]$ such that $\varphi[f/e]$ is valid (in theory T)



SyGuS as Active Learning



Concept class: Set $[[G]]$ of expressions

Examples: Concrete input values

SyGuS-Comp18

The 5th competition on Syntax Guided
Synthesis

Solvers

- **CVC4 2018** - Andrew Reynolds (Univ. of Iowa), Haniel Barbosa (Univ. of Iowa), Andres Nötzli (Stanford), Cesare Tinelli (Univ. of Iowa) and Clark Barrett (Stanford)
- **Horndini** - Deepak D'Souza (IISc Bangalore), P. Ezudheen (IISc Bangalore), P . Madhusudan - (UIUC), Pranav Garg (Amazon), Daniel Neider (MPI-SWS) and Shubham Ugare (IIT Guwahati)
- **DryadSynth** - KangJing Huang (Purdue Univ.) , Xiaokang Qiu (Purdue Univ.) , Qi Tian (Nanjing University), and Yanjun Wang (Purdue Univ.)
- **LoopInvGen** - Saswat Padhi (UCLA) ,Todd Millstein (UCLA) and Rahul Sharma (MSR)
- **EUSolver 2017** - Arjun Radhakrishna (MSR) and Abhishek Udupa (MSR)

Tracks

- General
- Inv
- CLIA
- PBE Strings
- PBE Bitvectors

*Extensions
suggestions?*

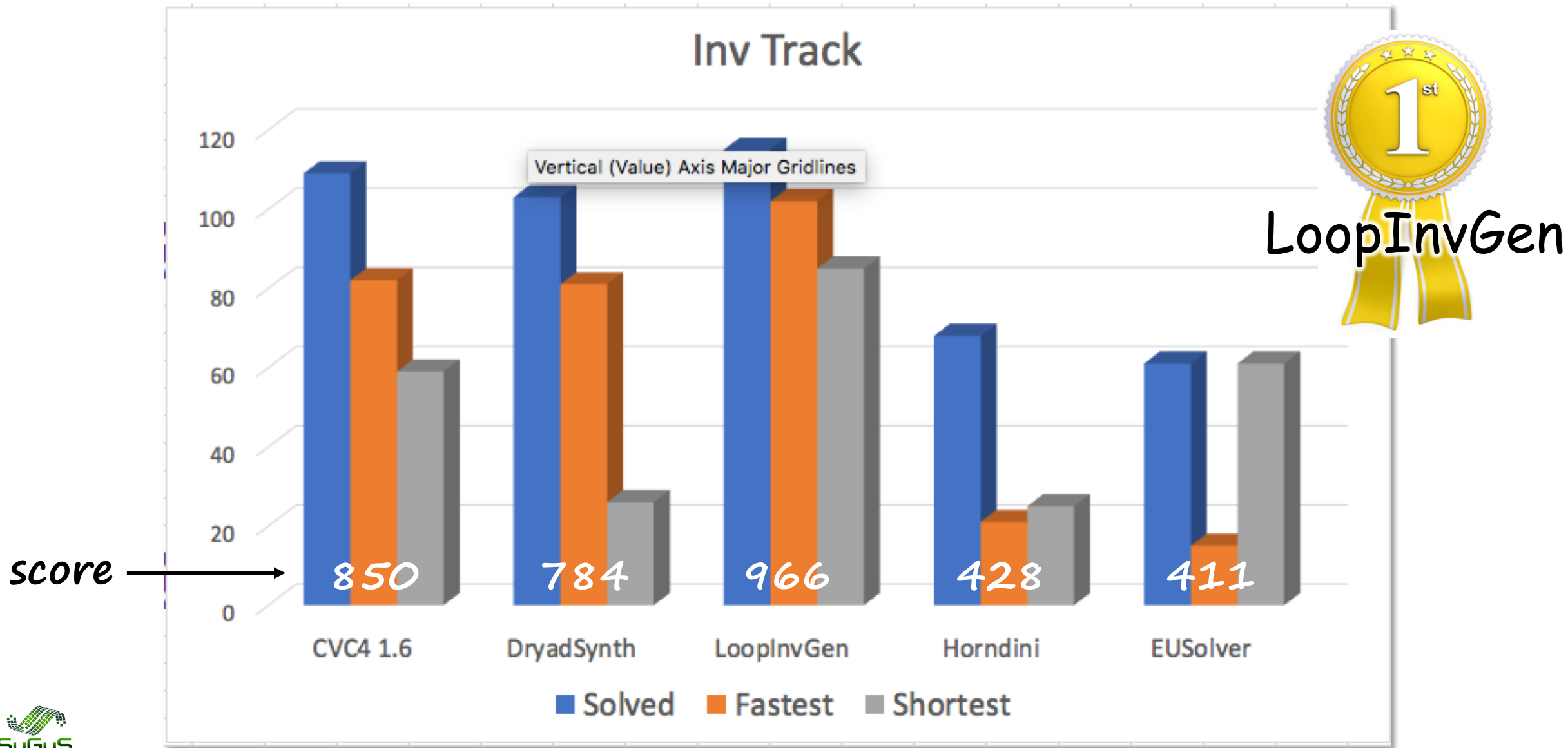
Tracks Participation

- **CVC4-2018:** all 5 tracks
- **EUSolver-2017:** all 5 tracks
- **DryadSynth:** CLIA and INV tracks
- **LoopInvGen:** INV track
- **Horndini:** INV track

New Benchmarks

- General (29)
by Qinheping HU and Loris D'Antoni (Univ. of Wisconsin-Madison)
- Invariant Generation (21+32)
by Saswat Padhi (UCLA) + Kangjing Huang (Purdue Univ)
- Conditional Linear arithmetic (15)
by Kangjing Huang (Purdue Univ)
- PBE Strings (10)
by Woosul Lee (Penn)

Inv Track (127)



CLIA Track (88)

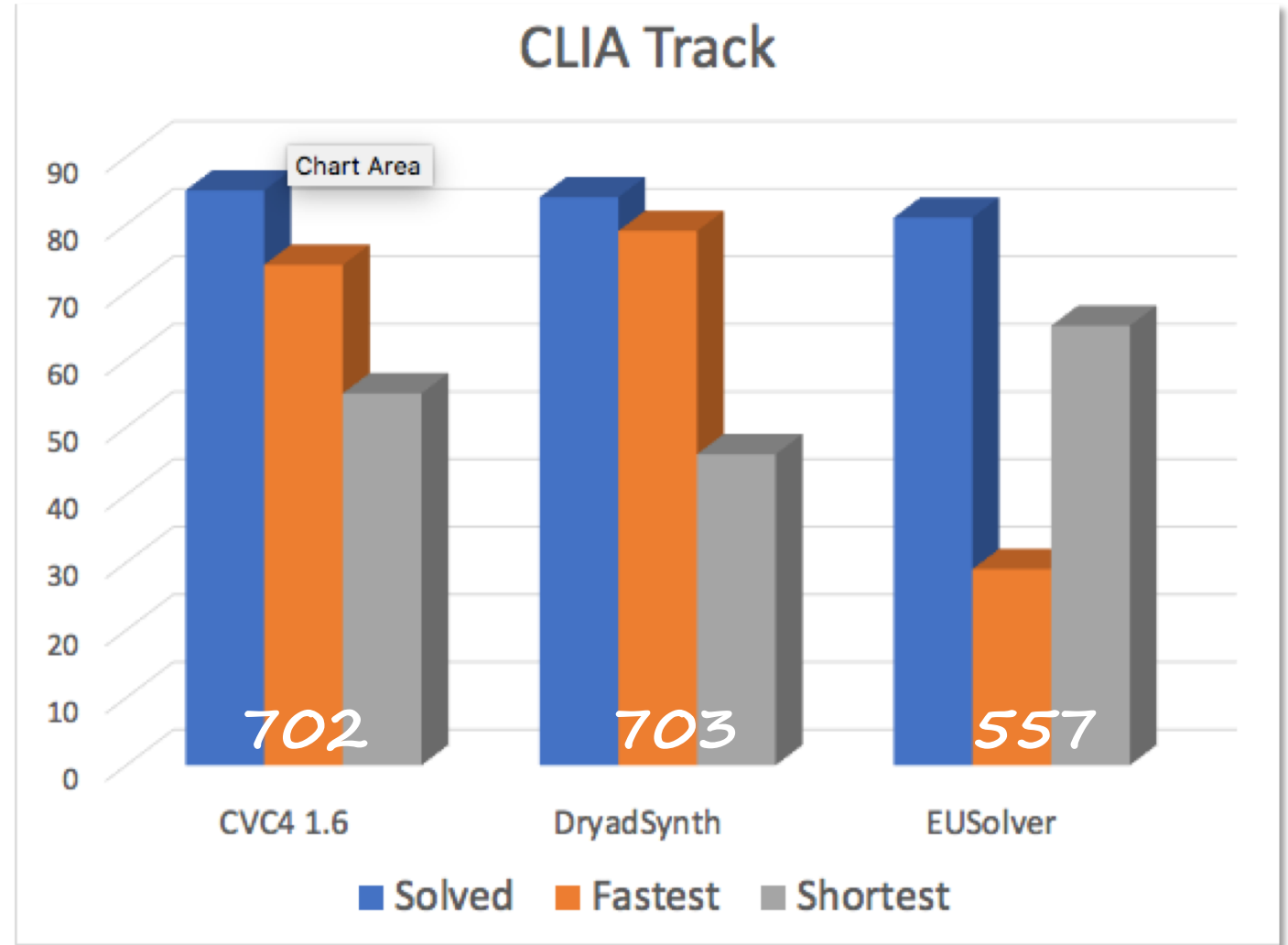


DryadSynth
& CVC4

Last year
CVC4
solved
73/73

Last year
DryadSynth
solved
32/73

*Outstanding
improvement!*

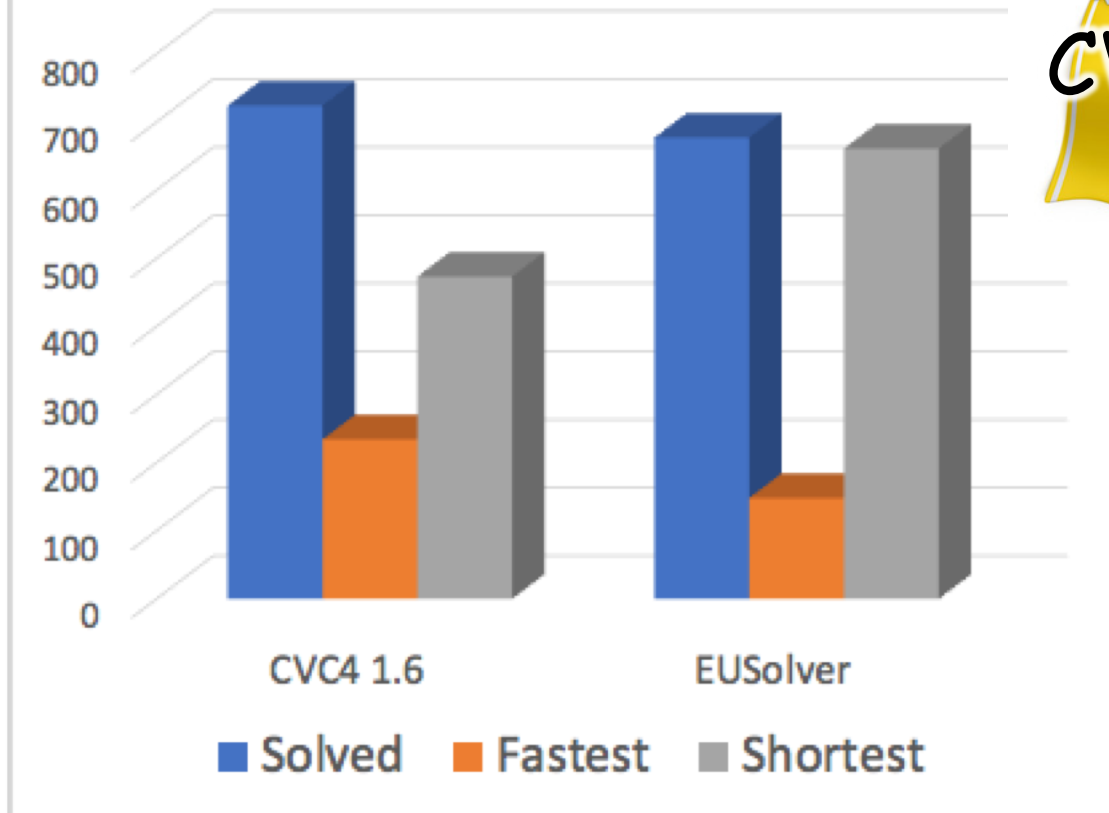


PBE: Stings (118) Bitvectors (750)

#4 last year

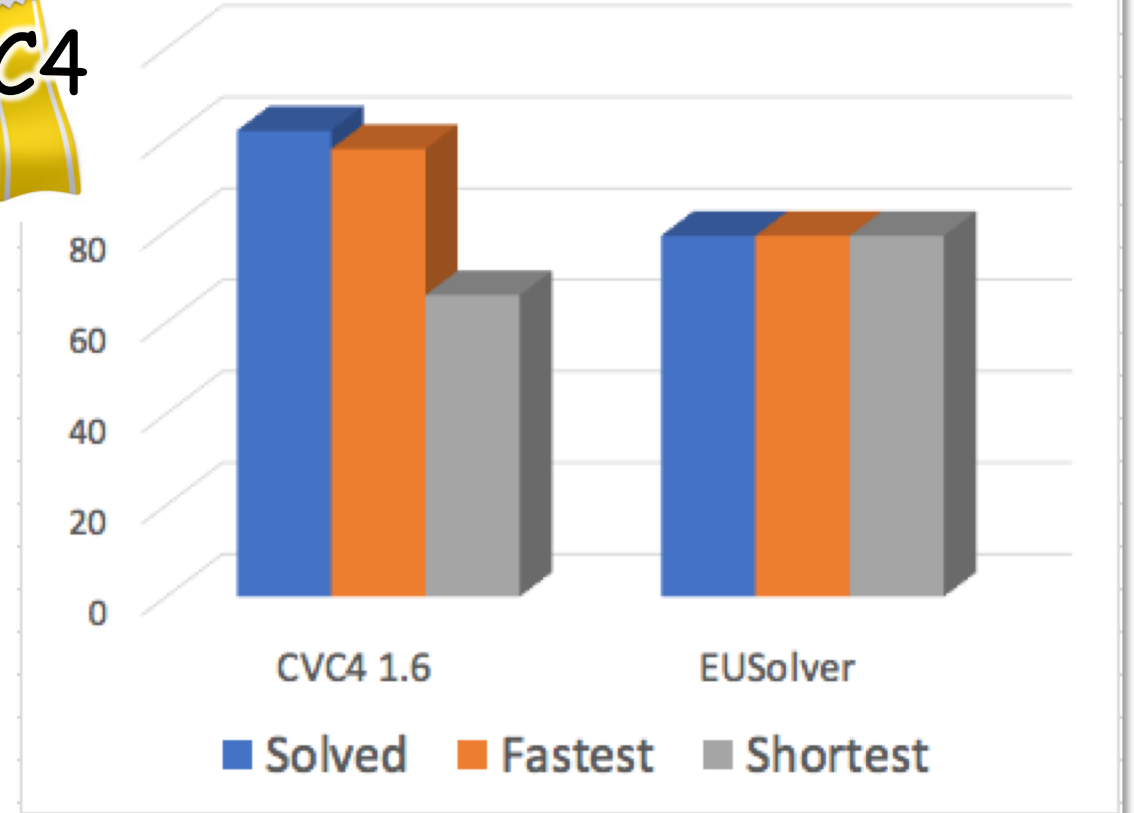


PBE Bitvectors



#1 last year

PBE Strings



General Track (598)



Great improvement from last year (#2)

