A 5-min. talk on

Semantics-Guided Synthesis

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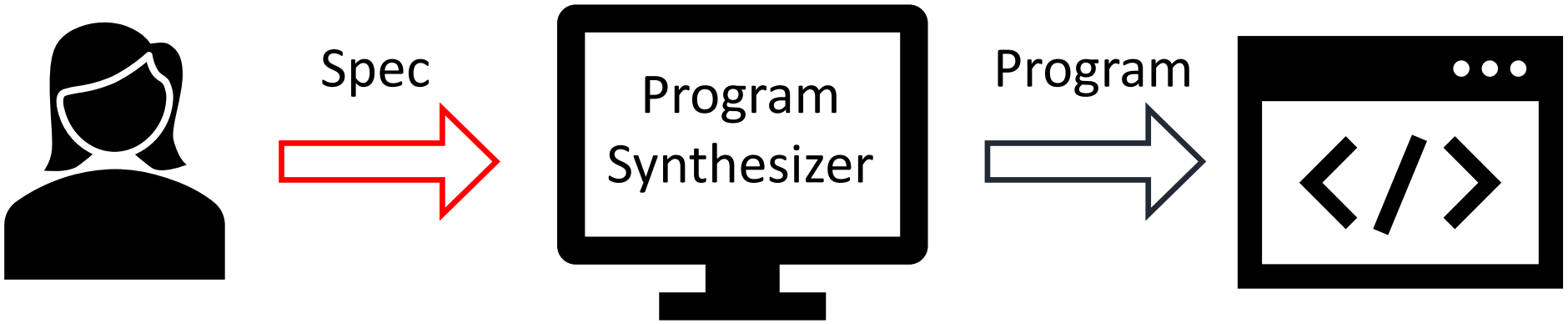
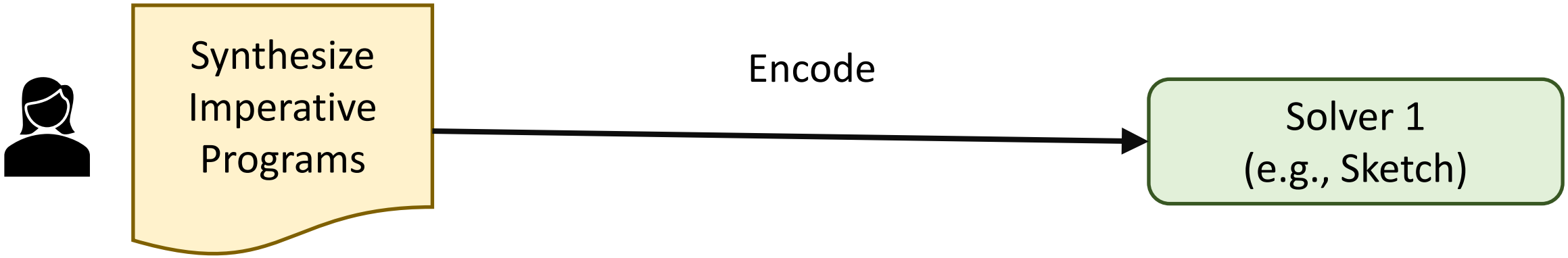
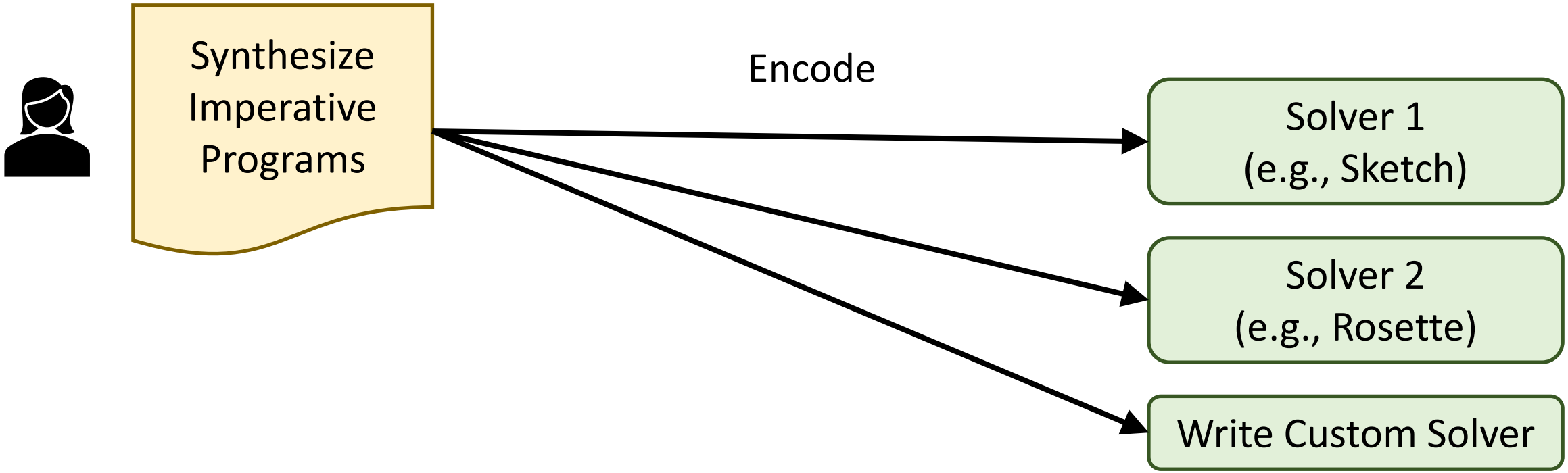
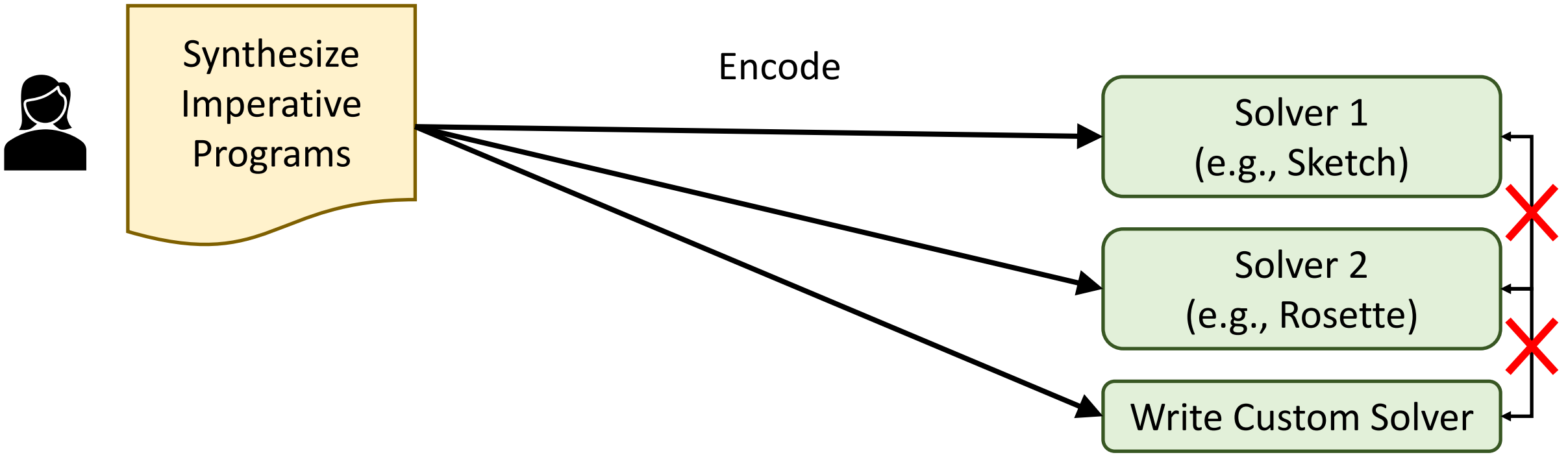
madPL

This is a Paper on Program Synthesis…




Synthesize
Imperative
Programs
Encode
Solver 1
(e.g., Sketch)


Synthesize Imperative Programs
Encode
Solver 1 (e.g., Sketch)
Solver 2 (e.g., Rosette)
Write Custom Solver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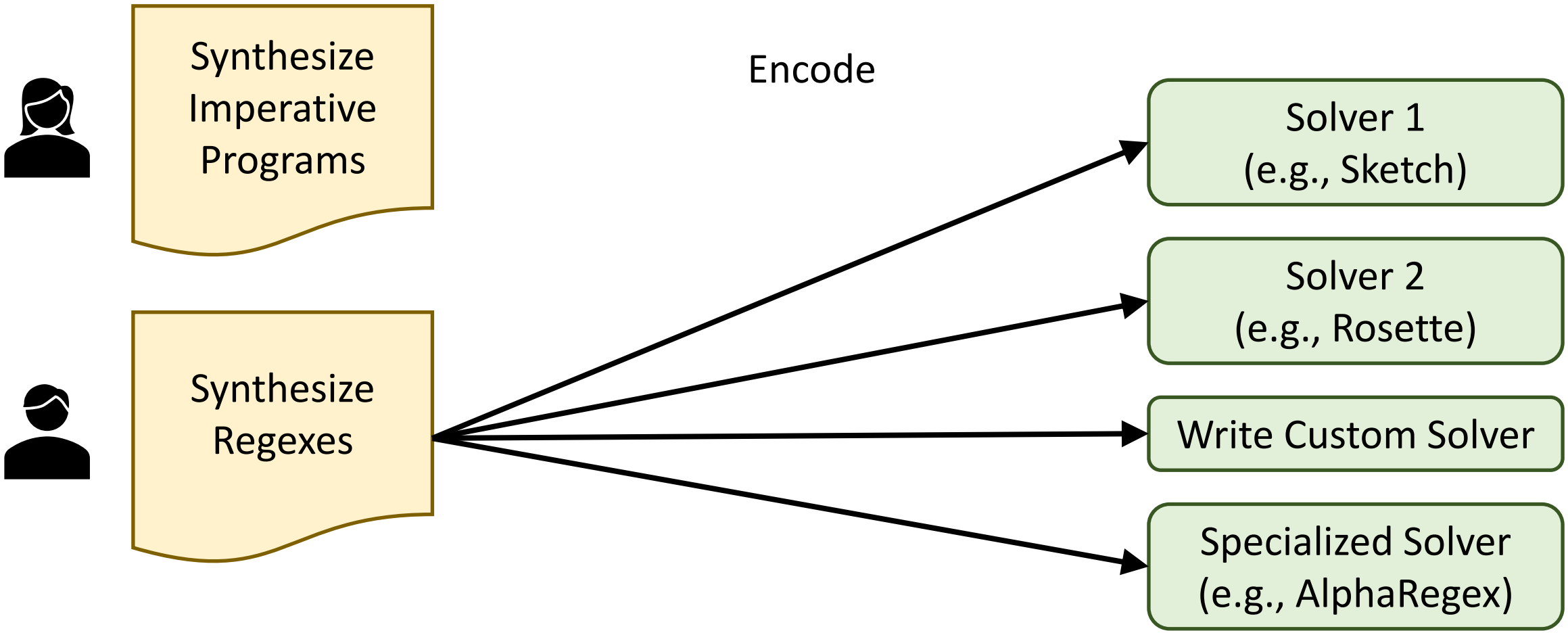
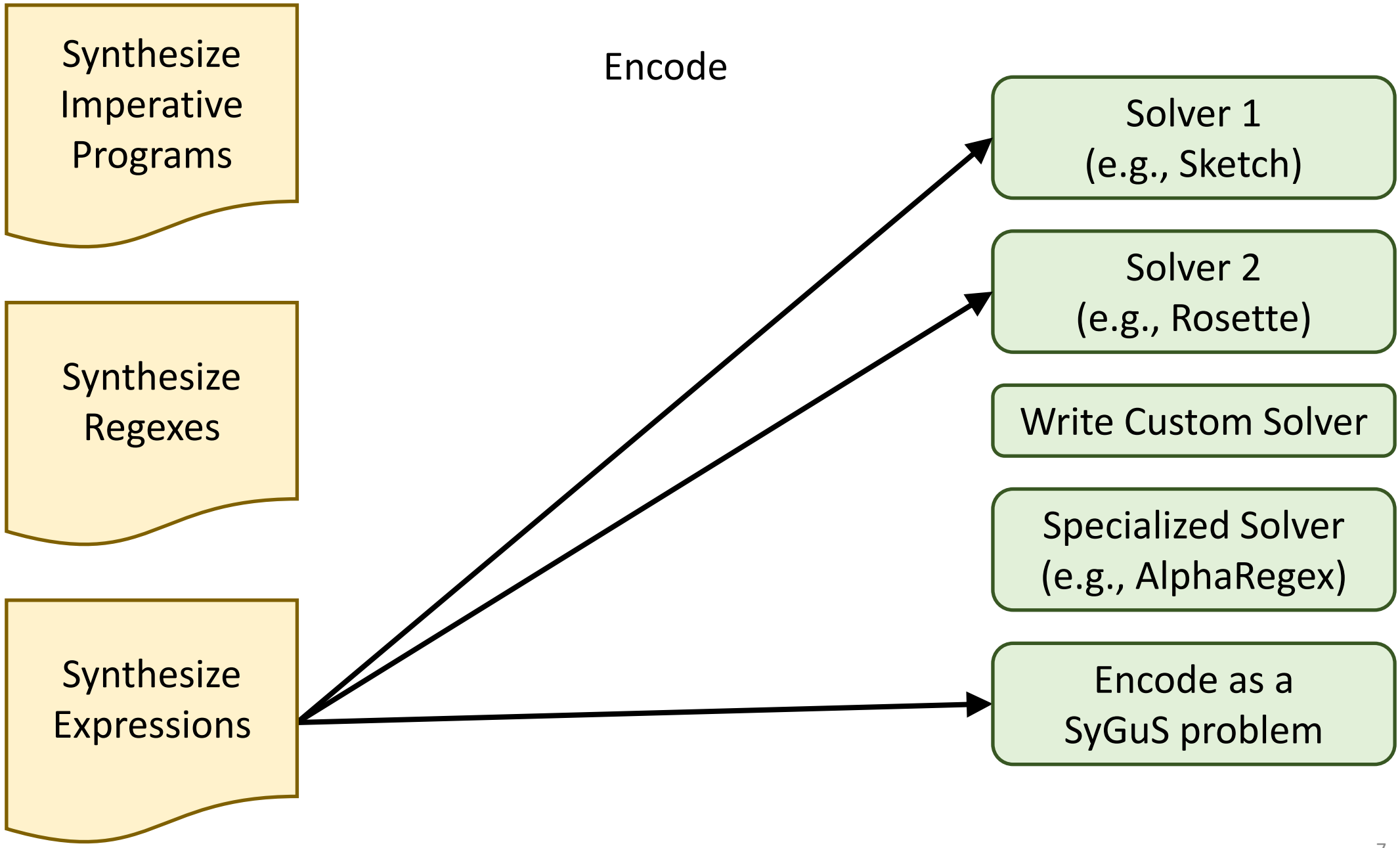

Synthesize Imperative Programs
Synthesize Regexes
Encode
Solver 1 (e.g., Sketch)
Solver 2 (e.g., Rosette)
Write Custom Solver
Specialized Solver (e.g., AlphaRegex)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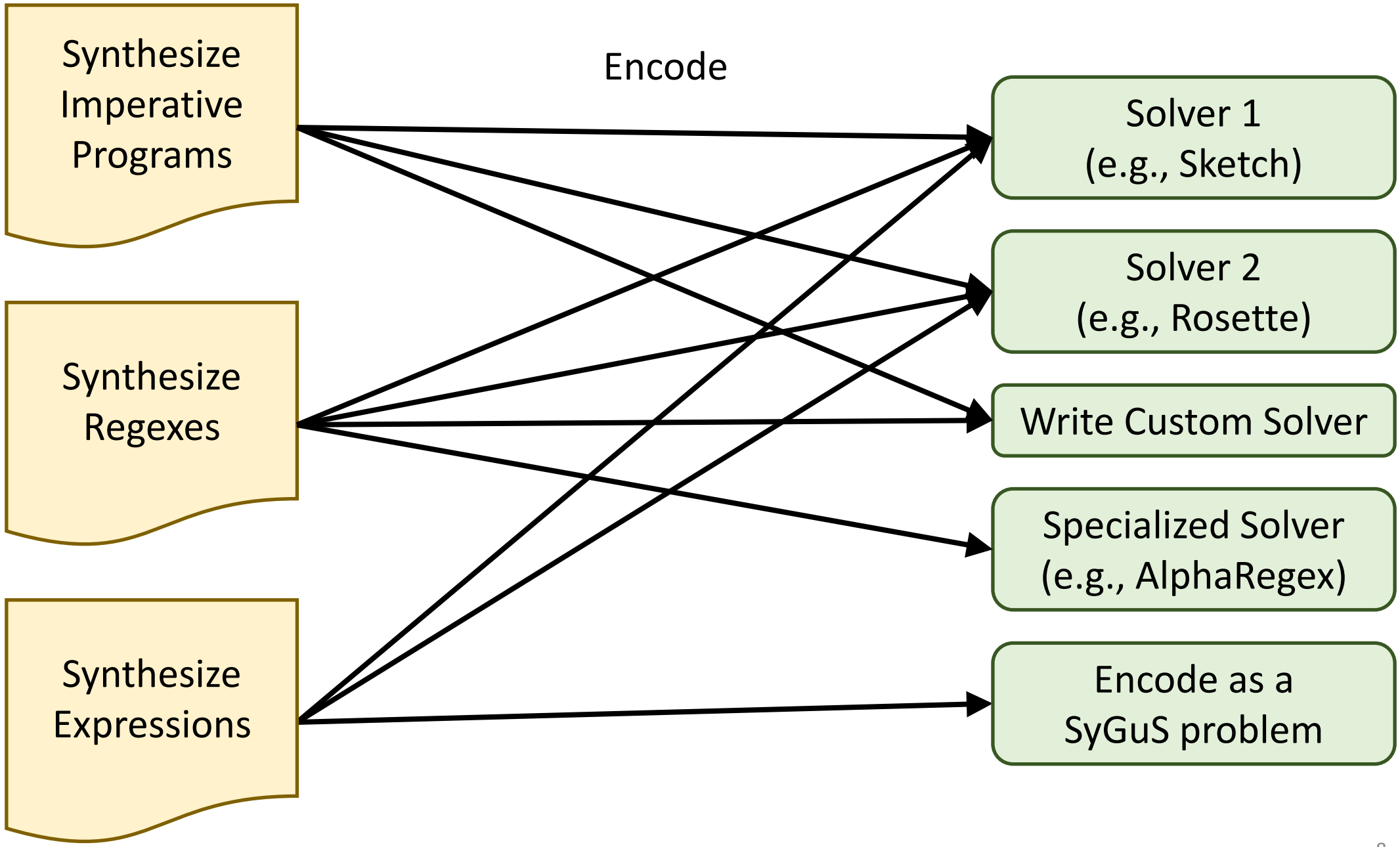
Specialized Solver (e.g., AlphaRegex)
Encode as a SyGuS problem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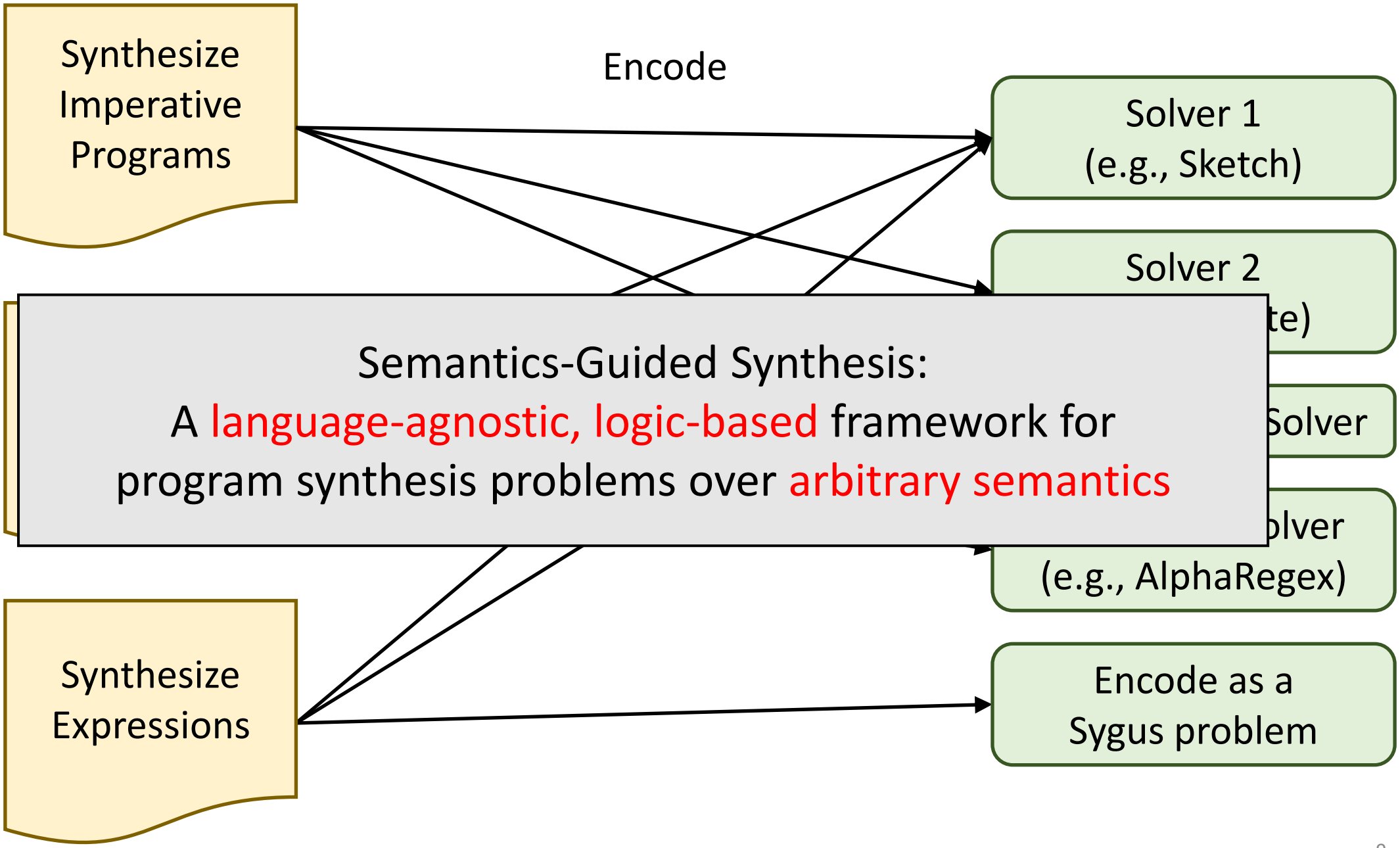
Synthesize Imperative Programs
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Solver
olver (e.g., AlphaRegex)
Semantics-Guided Synthesis:
A language-agnostic, logic-based framework for
program synthesis problems over arbitrary semantics
Synthesize Expressions
Encode as a Sygus problem

Synthesize Imperative Programs

Synthesize Regexes

Synthesize Expressions

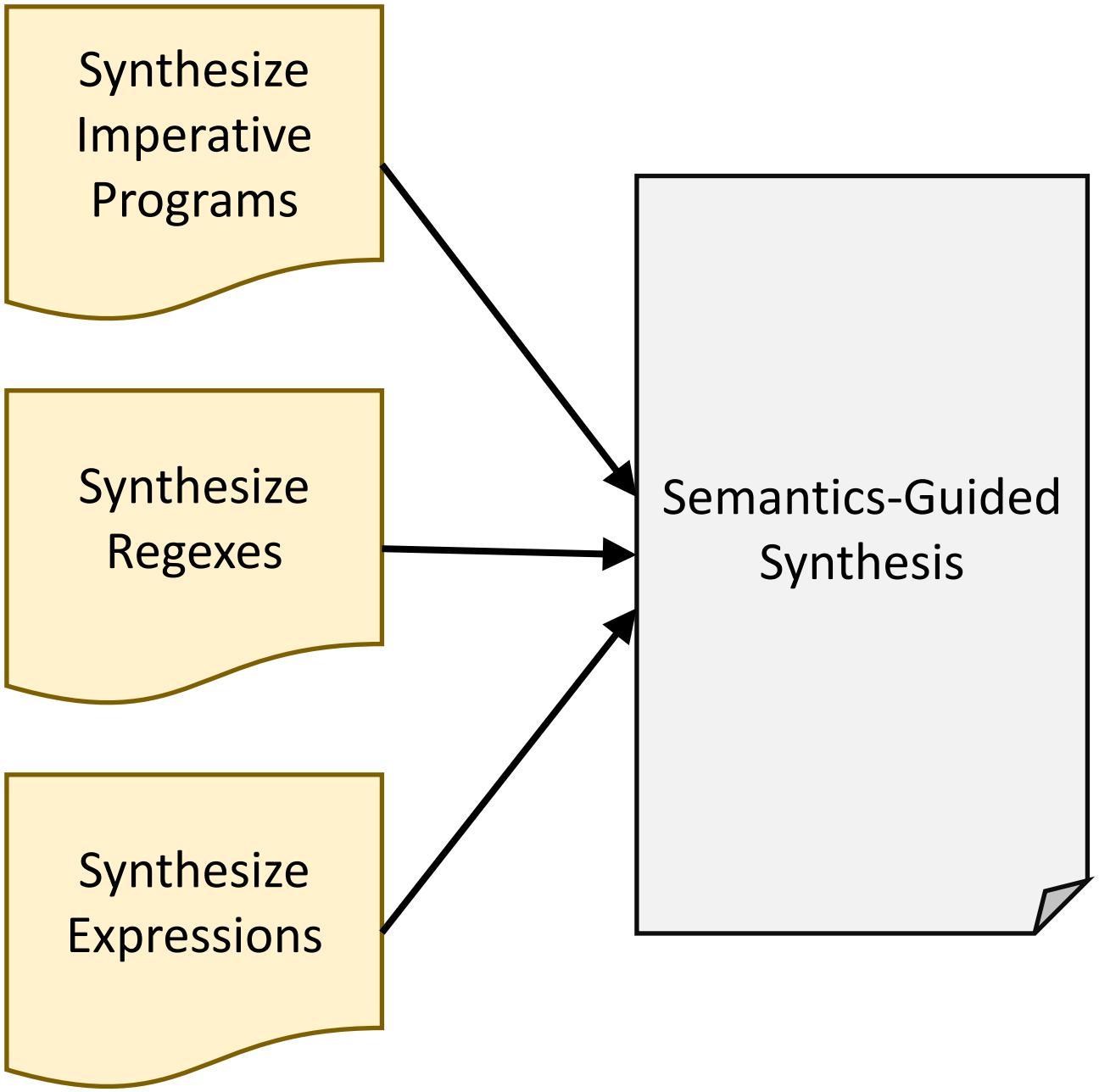
Semantics-Guided Synthesis

General Semgus Solver 1 (e.g., Messy)

General Semgus Solver 2 (e.g., Messy-Enum)

Custom Semgus Solver

Domain Specific Semgus Solver



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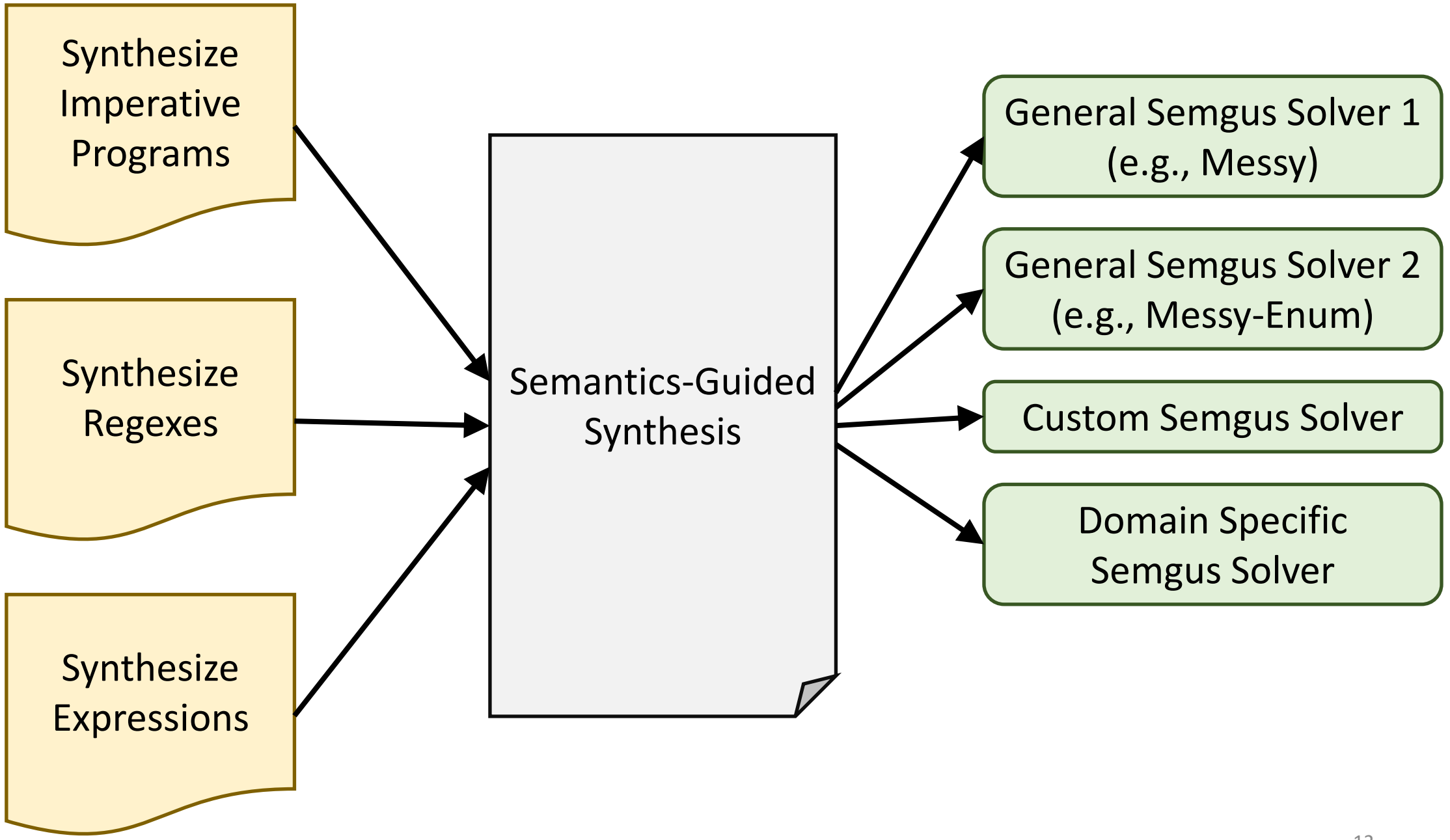
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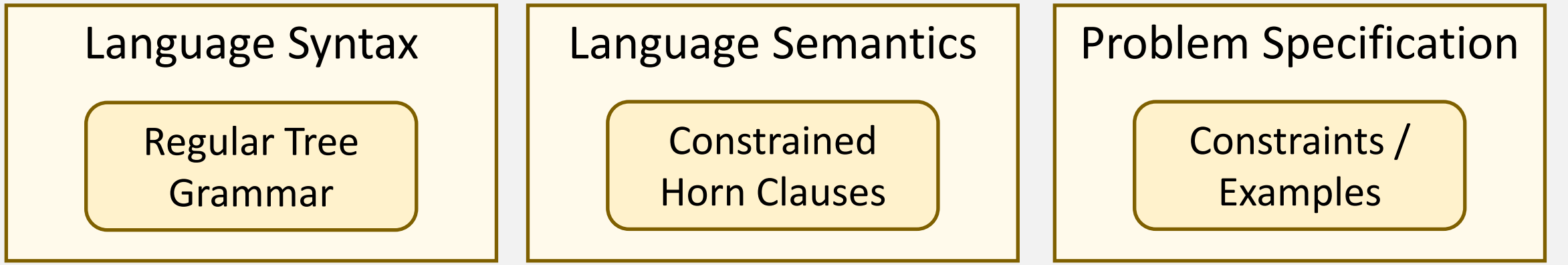
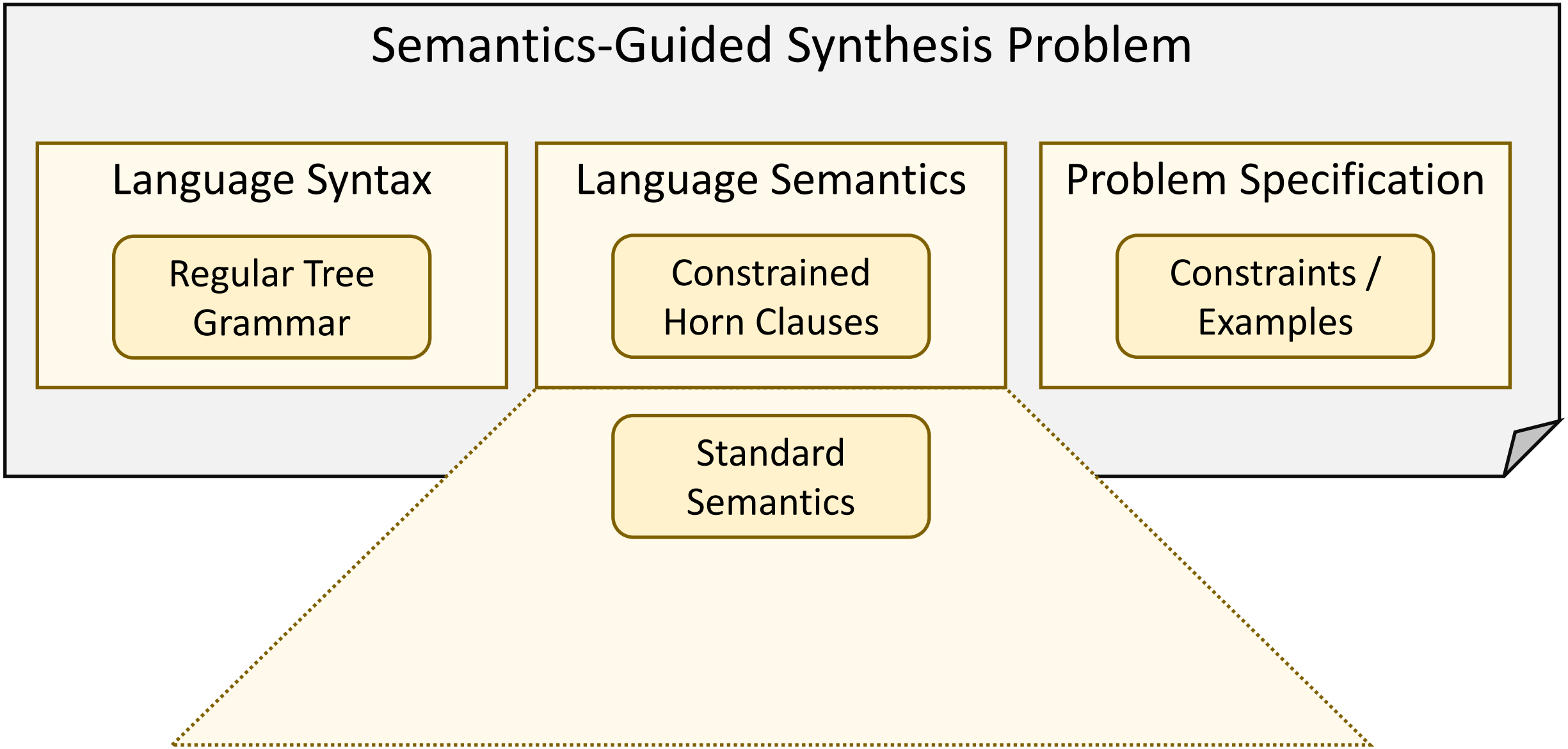
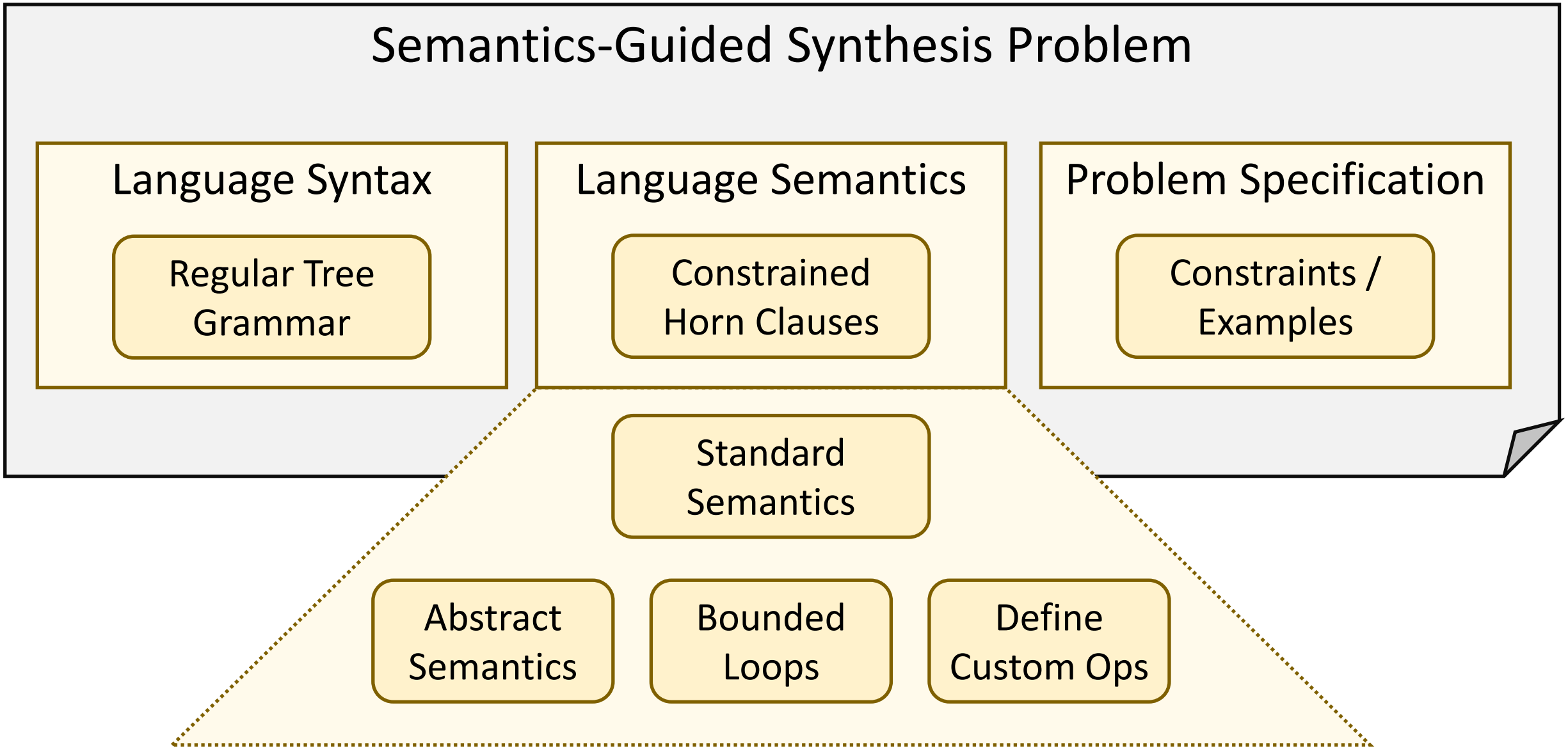
Custom Semgus Solver
Domain Specific Semgus Solver

Semantics-Guided Synthesis Problem




Semantics-Guided Synthesis Problem
Language Syntax
Regular Tree Grammar
Language Semantics
Constrained Horn Clauses
Problem Specification
Constraints / Examples
Standard Semantics


Semantics-Guided Synthesis Problem
Language Syntax
Regular Tree Grammar
Language Semantics
Constrained Horn Clauses
Problem Specification
Constraints / Examples
Standard Semantics
Abstract Semantics
Bounded Loops
Define Custom Ops

Semantics-Guided Synthesis Problem

Syntax: Regular Tree Grammar	Semantics: Constrained Horn Clauses	Specification: Constraints / Examples

Paper Highlights

- Defining the Semgus Framework
- CHC-based solving for Semgus problems
- Alternative semantics in synthesis
- Unrealizability for imperative programs!

What's Next?

- More benchmarks for Semgus
- More Semgus solvers
- Practical issues: Efficiency, Scalability
- Theoretical questions: Can we further rely on semantics to guide synthesis?