Project: Solving proximity constraints

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Version Number	Changes Summary	Author
0.1		Jan-Michael
0.2	added System Model	Jan-Michael
0.3	modified Parser, added Workflow	Jan-Michael

1 System Overview

We split the problem in 4 (5) smaller tasks:

1. Input Processing,
2. Pre-Unification,
3. Constraint Simplification,
4. Output.

O. Web-Integration.

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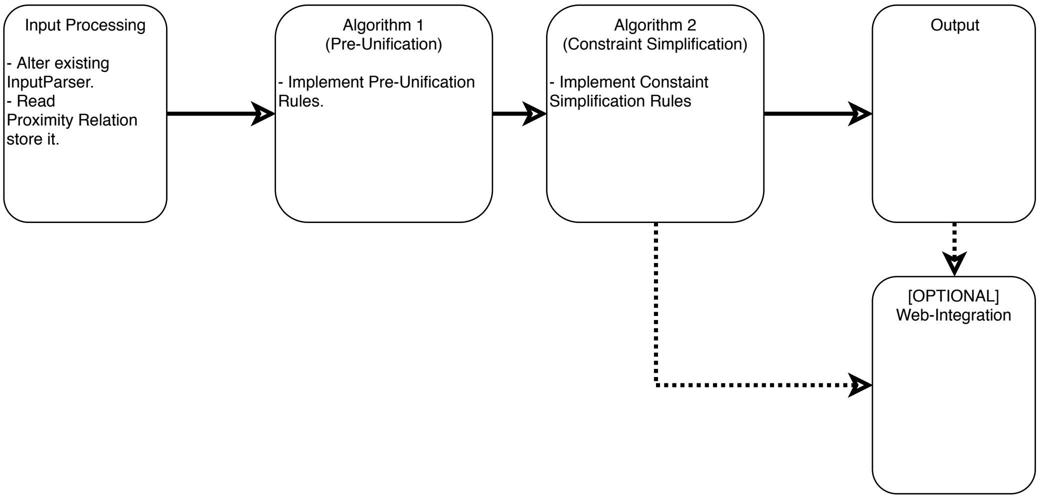

Input Processing
- Alter existing InputParser.
- Read Proximity Relation store it.
Algorithm 1
(Pre-Unification)
- Implement Pre-Unification Rules.
Algorithm 2
(Constraint Simplification)
- Implement Constaint Simplification Rules
Output
[OPTIONAL]
Web-Integration

1.1 Input Processing

The first idea here is to copy, alter and extend the existing code, in the class InputParser.

For the Proximity Relations $\mathcal{R}$ and the λ-*cut* we have the following idea:

1. We try to get the number of function symbols (n), constants are treated as 0-ary functions.
2. We let the user input the values to construct a symmetric matrix that consists of values in $[0, 1]$. This matrix must have a 1 in the main diagonal. All values below are 0. Therefore they will not be stored in the implementation.
3. We let the user (later) input $\lambda \in [0, 1]$ and calculate the set $\mathcal{R}_\lambda$.

1.2 Algorithms

We implement the Algorithms in an own class, that has two static functions, preUnification and Constraint-Solver.

1.2.1 Pre-Unification Algorithm

The preUnification method consists of a loop, that runs until either $\mathrm{P} = \emptyset$ or it is detected, that there is no solution to the problem.
Inside the loop body, the 7 pre-unification rules are iteratively applied to the first element (which gets popped by doing so).

The method changes the problems constraints and pre-unifier accordingly.

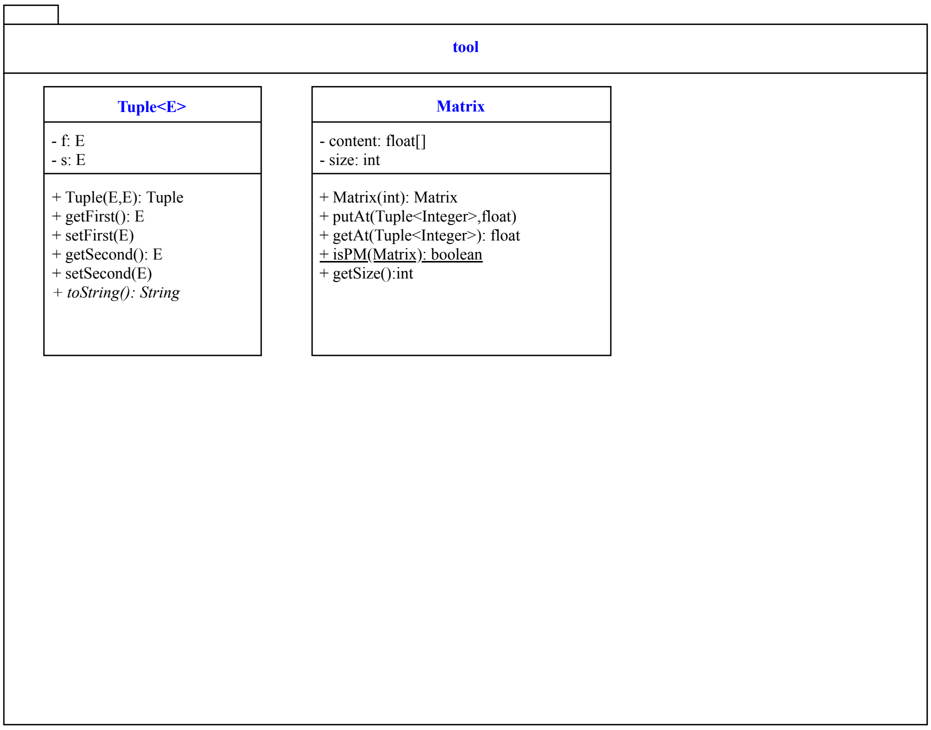
1.2.2 Constraint Simplification Algorithm

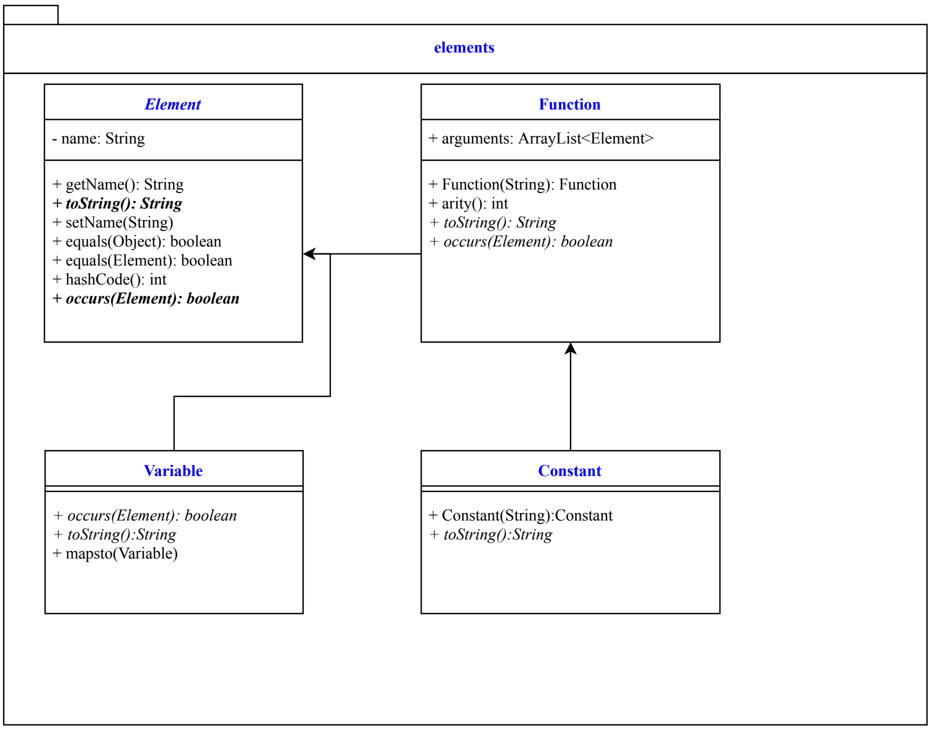
1.3 Output

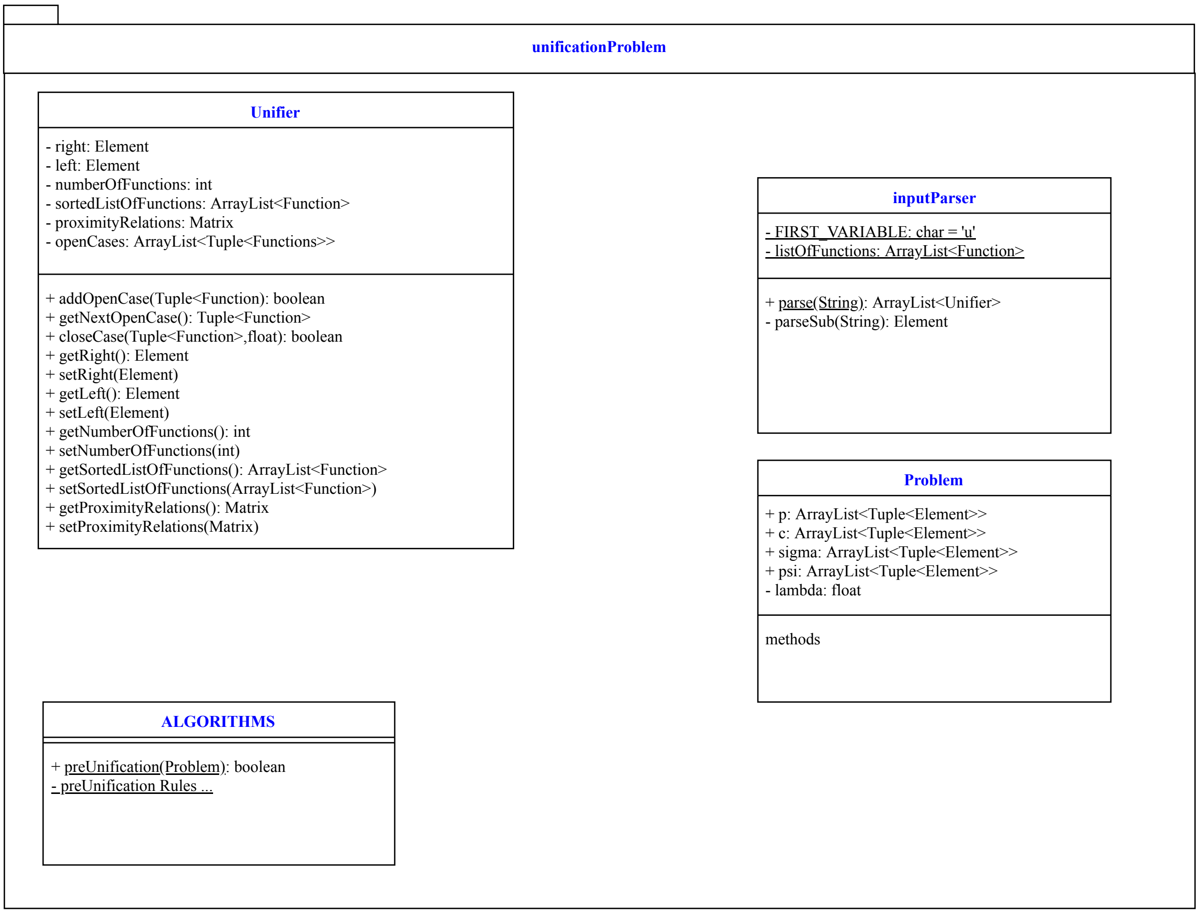
2 System Model

The program consists of 3 packages,

- tool
- elements
- unificationProblem


tool
Tuple<E>
- f: E
- s: E
+ Tuple(E,E): Tuple
+ getFirst(): E
+ setFirst(E)
+ getSecond(): E
+ setSecond(E)
+ *toString(): String*
Matrix
- content: float[]
- size: int
+ Matrix(int): Matrix
+ putAt(Tuple<Integer>,float)
+ getAt(Tuple<Integer>): float
+ isPM(Matrix): boolean
+ getSize():int

elements
Element
- name: String
+ getName(): String
+ toString(): String
+ setName(String)
+ equals(Object): boolean
+ equals(Element): boolean
+ hashCode(): int
+ occurs(Element): boolean
Function
+ arguments: ArrayList<Element>
+ Function(String): Function
+ arity(): int
+ *toString(): String*
+ *occurs(Element): boolean*
Variable
+ *occurs(Element): boolean*
+ *toString():String*
+ mapsto(Variable)
Constant
+ Constant(String):Constant
+ *toString():String*



unificationProblem

Unifier

- right: Element
- left: Element
- numberOfFunctions: int
- sortedListOfFunctions: ArrayList<Function>
- proximityRelations: Matrix
- openCases: ArrayList<Tuple<Functions>>

```
+ addOpenCase(Tuple<Function>): boolean
+ getNextOpenCase(): Tuple<Function>
+ closeCase(Tuple<Function>,float): boolean
+ getRight(): Element
+ setRight(Element)
+ getLeft(): Element
+ setLeft(Element)
+ getNumberOfFunctions(): int
+ setNumberOfFunctions(int)
+ getSortedListOfFunctions(): ArrayList<Function>
+ setSortedListOfFunctions(ArrayList<Function>)
+ getProximityRelations(): Matrix
+ setProximityRelations(Matrix)
```

inputParser

```
- FIRST_VARIABLE: char = 'u'
- listOfFunctions: ArrayList<Function>
```

```
+ parse(String): ArrayList<Unifier>
- parseSub(String): Element
```

Problem

```
+ p: ArrayList<Tuple<Element>>
+ c: ArrayList<Tuple<Element>>
+ sigma: ArrayList<Tuple<Element>>
+ psi: ArrayList<Tuple<Element>>
- lambda: float
```

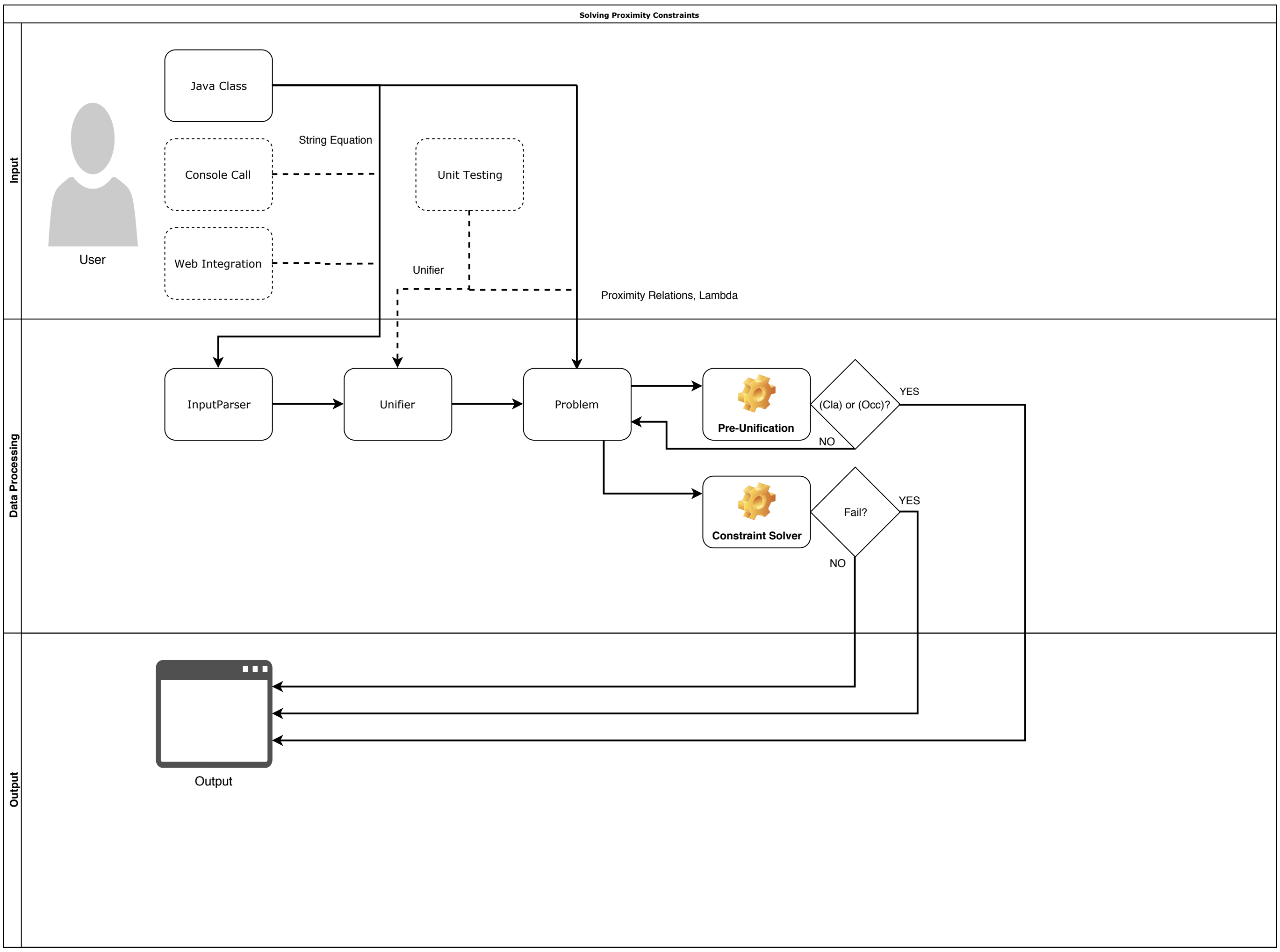
methods

ALGORITHMS

```
+ preUnification(Problem): boolean
- preUnification Rules ...
```

3 Work Flow

The typical workflow looks like this:


Solving Proximity Constraints
Input
Data Processing
Output
User
Java Class
Console Call
Web Integration
String Equation
Unit Testing
Unifier
Proximity Relations, Lambda
InputParser
Unifier
Problem
Pre-Unification
(Cla) or (Occ)?
YES
NO
Constraint Solver
Fail?
YES
NO
Output