

# Solving Proximity Constraints

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## 1 Introduction

## 2 System Model

## 3 Workflow

# Motivation

For proving theorems, a frequently occurring problem is to find common instances of formulae.

## Example 1

Let  $f$  be a function,  $a, b$  constants and  $x$  a variable. The two expressions

$$f(a, x) \quad \text{and} \quad f(a, b)$$

can be unified with  $\{x \mapsto b\}$ .

# Motivation

For proving theorems, a frequently occurring problem is to find common instances of formulae.

## Example 2

Let  $f, g$  be functions,  $a, b$  constants and  $x$  a variable. The two expressions

$$f(a, x) \quad \text{and} \quad g(a, b)$$

cannot be unified as  $f \neq g$ .

## Motivation

In 1965 Robinson presented his unification algorithm and solved this problem, his algorithm was improved for better(=faster) performance since.

If we consider now the unification problem

$$f(a, x) \simeq^? g(a, b)$$

again, we might wonder, if we could not ignore  $f \neq g$ , if they are “close” to each other, i.e. if they are equal in a fuzzy logic sense. Being close is represented as a proximity relation, which are symmetric and reflexive, but not necessarily transitive. C. Pau and T. Kutsia solved this problem, presenting an algorithm, which we implemented.

# Introduction

4 sets:

- $P$ : unification problem to be solved
- $C$ : neighborhood constraint
- $\sigma$ : set of pre-unifier
- $\Phi$ : name-class mapping

## Pre-Unification rules

$$\text{(Tri)} \{x \simeq^? x\} \uplus P; C; \sigma \Rightarrow P; C; \sigma$$

(Dec)

$$\{F(\overline{s_n}) \simeq^? G(\overline{t_n})\} \uplus P; C; \sigma \Rightarrow \{\overline{s_n \simeq^? t_n}\} \cup P; \{F \approx^? G\} \cup C; \sigma$$

$$\text{(VE)} \{x \simeq^? t\} \uplus P; C; \sigma \Rightarrow \{t' \simeq^? t\} \cup P; x \mapsto t'; C; \sigma \{x \mapsto t'\}$$

$$\text{(Ori)} \{t \simeq^? x\} \uplus P; C; \sigma \Rightarrow \{x \simeq^? t\} \cup P; C; \sigma$$

$$\text{(Cla)} \{F(\overline{s_n}) \simeq^? G(\overline{t_n})\} \uplus P; C; \sigma \Rightarrow \perp \text{ if } m \neq n$$

(Occ)

$$\{x \simeq^? t\} \uplus P; C; \sigma \Rightarrow \perp \text{ if there is an occurrence cycle of } x \text{ in } t$$

(VO)

$$\{x \simeq^? y, \overline{x_n \simeq^? y_n}\}; C; \sigma \Rightarrow \{\overline{x_n \simeq^? y_n}\} \{x \mapsto y\}; C; \sigma \{x \mapsto y\}$$

## Rules for Neighborhood Constraints

(FFS)  $\{f \approx^? g\} \uplus C; \Phi \Rightarrow C; \Phi$ ; if  $\mathcal{R}(f, g) \geq \lambda$

(NFS)  $\{N \approx^? g\} \uplus C; \Phi \Rightarrow C; \text{update}(\Phi, N \rightarrow \mathbf{pc}(g, \mathcal{R}, \lambda))$

(FSN)  $\{g \approx^? N\} \uplus C; \Phi \Rightarrow \{N \approx^? g\} \cup C; \Phi$

(NN1)

$\{N \approx^? M\} \uplus C; \Phi \Rightarrow C; \text{update}(\Phi, N \rightarrow f, M \rightarrow \mathbf{pc}(f, \mathcal{R}, \lambda))$ ,

where  $N \in \text{dom}(\Phi)$ ,  $f \in \Phi(N)$

(NN2)  $\{M \approx^? N\} \uplus C; \Phi \Rightarrow \{N \approx^? M\} \cup C; \Phi$ , where  
 $M \notin \text{dom}(\Phi)$ ,  $N \in \text{dom}(\Phi)$

(Fail1)  $\{f \approx^? g\} \uplus C; \Phi \Rightarrow \perp$ , if  $\mathcal{R}(f, g) < \lambda$

(Fail2)  $C; \Phi \Rightarrow \perp$ , if there exists  $N \in \text{dom}(\Phi)$  such that  $\Phi(N) = \emptyset$



## Simple example

Pre - fail:  $p(x, a) = ?q(f(a), g(b))$

### Test 4 in Test.java

Pre - ok, CS - fail: - des ging bei mir, i hätt 5 Schritte und 2 Branches, die aber failen-

$p(x, y, x) = ?q(f(a), g(b), y); R = \{(b, c), (c, d), (f, g), (p, q)\}$

### Test 3 in Test.java

Pre - ok, CS - ok: - des ging bei mir, i hätt 4 Schritte und 1 Branch-

$p(x, z) = ?q(f(b), f(x)); R = \{(a, a'), (a', b), (b, c'), (c', c), (p, q)\}$

Solution: ...

1 Introduction

2 System Model

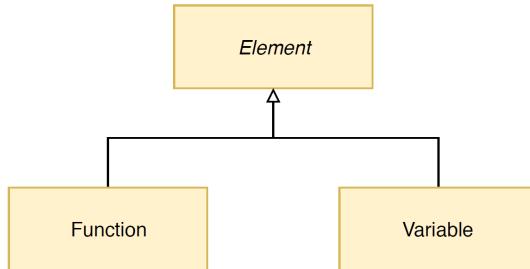
3 Workflow

# System Model

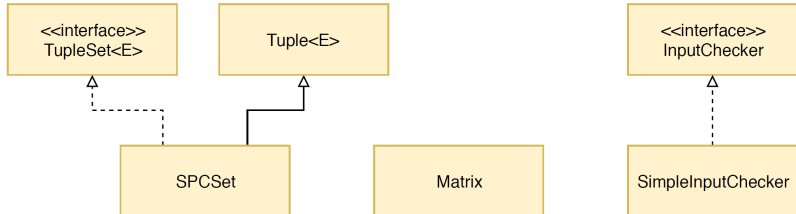
Project consists of 4 packages:

- elements : deals with elements
- tool : offers important tools (e.g. read input)
- unificationProblem : treats the unification problem
- userInterfaces : allow user interfaces

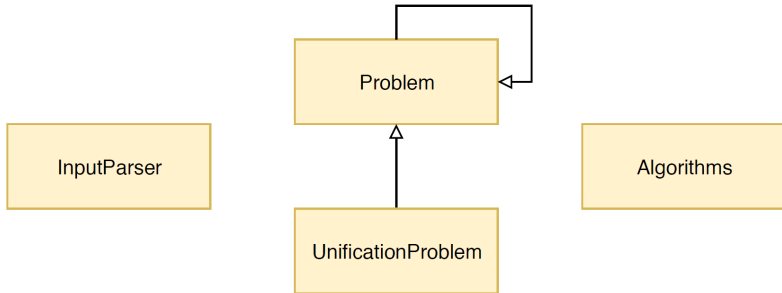
# Package elements



# Package tool



# Package unificationProblem



# Package userInterfaces

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# Workflow

