計算理論研究室

Theory of Computation Group

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テーマ例：理論探査 (Theory Exploration)

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x_1	x_2	x_3
x_4	x_5	x_6
x_7	x_8	x_9

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e.g.

2	9	4
7	5	3
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rules of puzzle → **Theory Explorer** → $\left\{ x_5 = \right.$

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x_4	x_5	x_6
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6	1	8

rules of puzzle → **Theory Explorer** → $x_5 = 5$

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rules of puzzle → **Theory Explorer** → $\begin{cases} x_5 = \mathbf{5} \\ x_1 + x_9 = \end{cases}$

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rules of puzzle → **Theory Explorer** → $\begin{cases} x_5 = \mathbf{5} \\ x_1 + x_9 = \mathbf{10} \end{cases}$

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rules of puzzle → **Theory Explorer** →

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rules of puzzle → **Theory Explorer** →

$$\begin{cases} x_5 = \mathbf{5} \\ x_1 + x_9 = \mathbf{10} \\ x_6 + x_8 = \mathbf{2}x_1 \end{cases} \quad (!!!)$$

テーマ例：理論探査 (Theory Exploration)

```
def sum(x):
    y = 0
    while x > 0:
        y = x + y
        x = x − 1
    return y
```

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$\mathsf{sum}(x) = \mathsf{f}_1(x, 0)$

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$$\mathsf{f}_1(x, y) = \begin{cases} \mathsf{f}_2(x, y) & \text{if } x > 0 \\ \mathsf{f}_4(x, y) & \text{otherwise} \end{cases}$$

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program → **Theory Explorer** → $\mathsf{sum}(n) = \boldsymbol{\frac{n(n+1)}{2}}$

テーマ例：単一化 (Unification)

```
      def sum(x):
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$\mathsf{sum}(\boldsymbol{n}) = \mathbf{10}$ → **Unification Tool** →

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$\mathsf{sum}(\boldsymbol{n}) = \mathbf{10}$ → **Unification Tool** → $\boldsymbol{n} = 4$

テーマ例：単一化 (Unification)

$$\mathsf{qsort}([\,]) = ys$$
$$\mathsf{qsort}(x : xs) = \mathsf{qsort}([y \mid y \in xs, y \leqslant x]) +\!\!+ [x] +\!\!+ \mathsf{qsort}([y \mid y \in xs, x < y])$$

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$\mathsf{qsort}([\mathbf{3}, \boldsymbol{x}, \mathbf{2}]) = [\mathbf{1}, \mathbf{2}, \boldsymbol{y}]$ → **Unification Tool** →

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$\mathsf{qsort}([\mathbf{3}, \boldsymbol{x}, \mathbf{2}]) = [\mathbf{1}, \mathbf{2}, \boldsymbol{y}]$ → **Unification Tool** → $\begin{cases} \boldsymbol{x} = \mathbf{1} \\ \boldsymbol{y} = \end{cases}$

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$\mathsf{qsort}([\mathbf{3}, \boldsymbol{x}, \mathbf{2}]) = [\mathbf{1}, \mathbf{2}, \boldsymbol{y}]$ → **Unification Tool** → $\begin{cases} \boldsymbol{x} = \mathbf{1} \\ \boldsymbol{y} = \mathbf{3} \end{cases}$

テーマ例: 計算量解析 (Complexity Analysis)

$$\mathsf{qsort}([\,]) = ys$$
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配属後は数独から (Starting with Sudoku)

5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8		?	7	9

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contact: 廣川 (https://www.jaist.ac.jp/~hirokawa/)

theme: 計算と演繹 (computation and deduction)

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room: **I-54**

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以下に興味のある人は楽しく研究できると思います

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- プログラミング言語理論 (programming language theory)

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- プログラミング言語理論 (programming language theory)
- 定理証明 (theorem proving)

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- プログラミング言語理論 (programming language theory)
- 定理証明 (theorem proving)
- 論理推論 (logical reasoning)