Identifiable Transitions in P Systems

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Problem & Context

Identifiable transitions (informal): any two distinct transitions emerging from the same state should produce distinct results;

Context: In testing based on Mealy machines or X-machines a similar concept is utilised.

Rationale: need to identify 'good' properties of a model (P system) similar to causality (N Busi, G Ciobanu), reverse computation (G Ciobanu) or formal verification of kP systems or stochastic systems.

Membrane Computing with One Compartment

A membrane system (or P system) is

$$P = (V, T, \mu, w_1, R_1, 1)$$

Identifiable rules: $r_1 : x_1 \to y_1$ and $r_2 : x_1 \to y_2$ identifiable iff whenever applied to a configuration they lead to distinct results.

Example: $r_1 : ab \to a'$ and $r_2 : bc \to b'$ applied to abc produces $a'c$ and ab', respectively. Hence, identifiable rules.

Why are these 'good' properties ?

New properties for P systems.

Provides suitable features for P systems when these are used as testing models – direct links with X-machines.

Some Results

Theorem 1. Any $r_1 : x_1 \to y_1$ and $r_2 : x_2 \to y_2$ are not identifiable iff $r_1 : uv_1 \to w_1$ and $r_2 : uv_2 \to wv_2$ and v_1, v_2 are disjoint.

Theorem 2. The multisets of rules $M_1 = M_1' \cup M, M_2 = M_2' \cup M$, such that $M_1' \cap M_2' = \emptyset$, are identifiable iff $r_{M_1'} : uv_1 \to wy_1$ and $r_{M_2'} : uv_2 \to wy_2$ such that $v_1 \neq y_1$ or $v_2 \neq y_2$.

Theorem 3. If $r_1 : x_1 \to y_1$ and $r_2 : x_2 \to y_2$ are identifiable then $r_1^n, r_2^n, n \geq 1$ are identifiable.

Theorem 4. For any P system working in maximal parallel or sequential modes there is a P system working in the same mode with any two multisets of rules identifiable.

Further Work

Multi-compartment P systems + new features.

Power of these systems.

New and better properties.

End

Thanks!

Questions?