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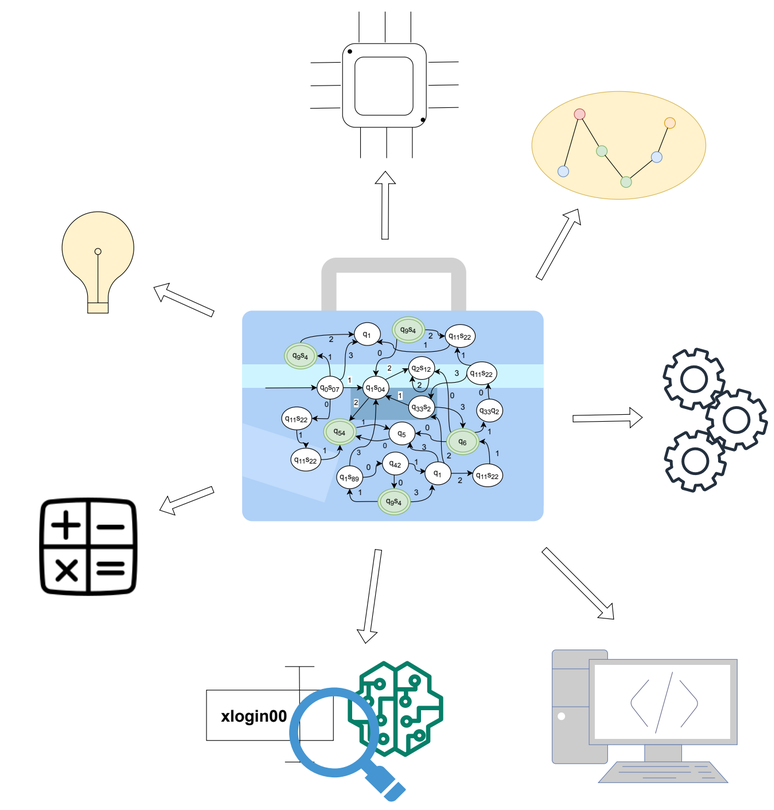
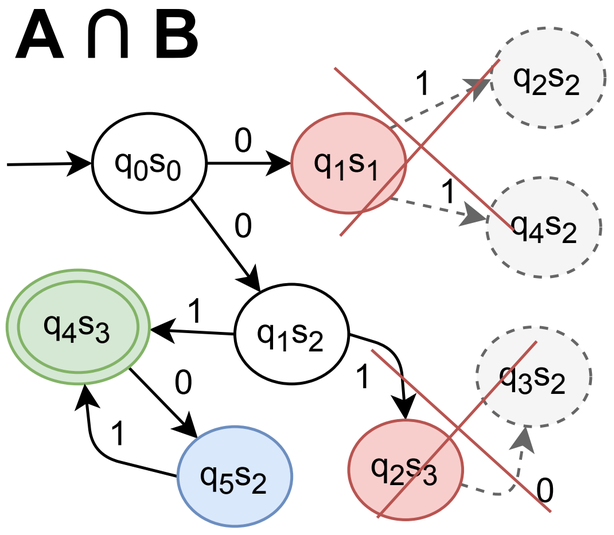
Abstraction of State Languages in Automata Algorithms
Abstrakce jazyků stavů v automatových algoritmech

Konečné automaty jako toolbox pro řešení problémů



Optimalizace operací nad konečnými automaty

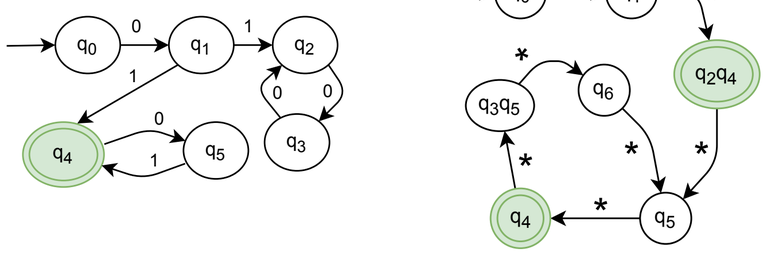


Algoritmizace

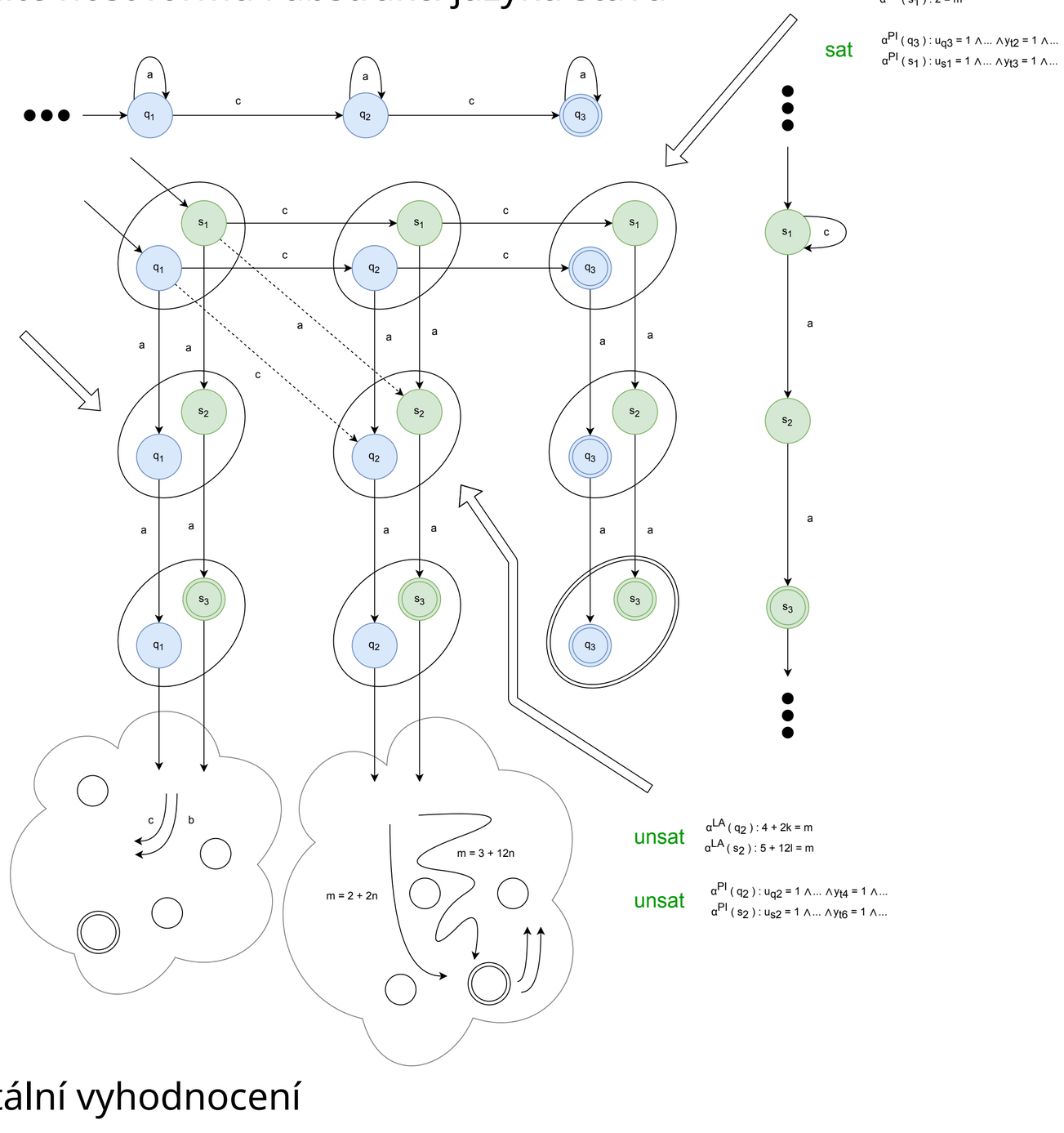
Input : NFA $A_1 = (Q_1, \Sigma, \delta_1, I_1, F_1)$,
NFA $A_2 = (Q_2, \Sigma, \delta_2, I_2, F_2)$
Output: NFA $P = (A_1 \cap A_2) = (Q, \Sigma, \delta, I, F)$ with $L(A_1 \cap A_2) = L(A_1) \cap L(A_2)$

```
1  Q, δ, F ← ∅
2  I ← I1 × I2
3  W ← I
4  res ← False
5  solved ← ∅
6  addPersistentClauses()
7  while W ≠ ∅ do
8      picklast [q1, q2] from W
9      add [q1, q2] to solved
10     if not isSkippable([q1, q2]) then
11         if α^LA(q1) ∧ α^LA(q2) is unsat then
12             res ← False
13         else
14             smtSolverPush()
15             addStateSpecificClauses([q1, q2])
16             res ← α^PI(q1) ∧ α^PI(q2) is sat
17             smtSolverPop()
18             if res = Unknown then
19                 res ← True
20     else
21         res ← True
22     if res = True then
23         add [q1, q2] to Q
24         if q1 ∈ F1 and q2 ∈ F2 then
25             add [q1, q2] to F
26         forall a ∈ Σ do
27             forall q1' ∈ δ1(q1, a), q2' ∈ δ2(q2, a) do
28                 if [q1', q2'] ∉ solved and [q1', q2'] ∉ W then
29                     add [q1', q2'] to W
30                 add [q1', q2'] to δ([q1, q2], a)
```

Délková abstrakce: Laso automaty



Splnitelnost formulí abstrakcí jazyků stavů



Parikovské obrazy: Formule pro stavy

$$u_q + \sum_{t \in \Delta_q^+} y_t - \sum_{t \in \Delta_q^-} y_t = 0$$

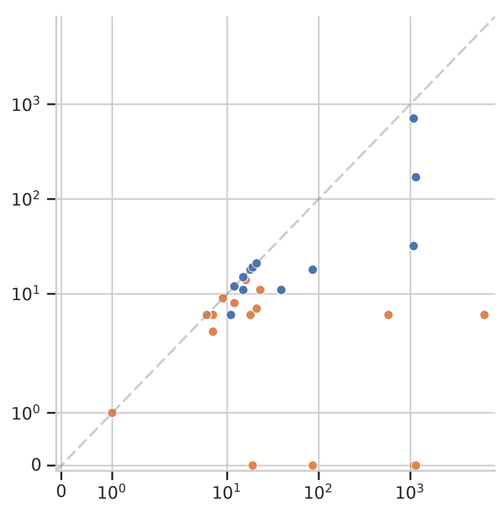
$$\alpha^{PI} : \exists u_{q_1}, \ldots, u_{q_n}, z_{q_1}, \ldots, z_{q_n}, y_{t_1}, \ldots, y_{t_m} : \varphi$$

$$\alpha^{PI}(q_1) \wedge \alpha^{PI}(q_2) \textbf{ is } sat$$

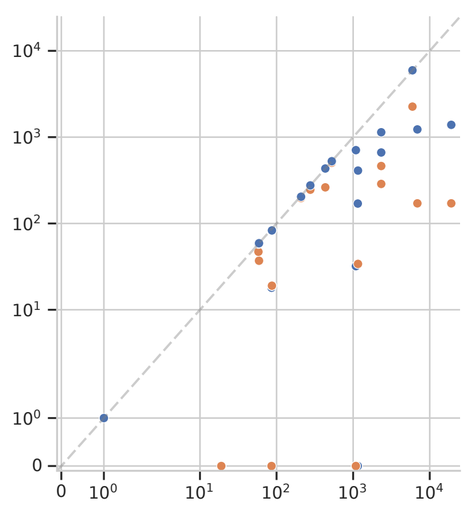
Mintermizace

Experimentální vyhodnocení

Test prázdnosti



Celý produkt



SMT solver: Inkrementální SMT solving