Reducing model-checking artefacts

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Context
Model checking

Traditional

true/false
Context
Model checking

Traditional

true/ false
Context
Model checking

Traditional

Symbolic

true/false

true/false
Context
Model checking

Traditional

Symbolic

true/false

true/false

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Context
Model checking

Traditional

Symbolic
Parity games

A set of vertices.
An edge relation.
A priority mapping.
A player mapping.

\( V \)
\( \rightarrow \subseteq V \times V \)
\( \Omega : V \rightarrow \mathbb{N} \)
\( P : V \rightarrow \{\Diamond, \Box\} \)

\( \Diamond = \text{even} \)
\( \Box = \text{odd} \)
Parity games

$V$  
$\to \subseteq V \times V$  
$\Omega : V \to \mathbb{N}$  
$\mathcal{P} : V \to \{\Diamond, \square\}$  

A set of vertices.
An edge relation.
A priority mapping.
A player mapping.

$\Diamond = \text{even}$
$\square = \text{odd}$
Parity games

\[ V \rightarrow \subseteq V \times V \mapsto \text{A set of vertices.} \]
\[ \Omega : V \rightarrow \mathbb{N} \mapsto \text{An edge relation.} \]
\[ \mathcal{P} : V \rightarrow \{\lozenge, \square\} \mapsto \text{A priority mapping.} \]
\[ \mathcal{P} : V \rightarrow \{\lozenge, \square\} \mapsto \text{A player mapping.} \]
Parity games

\[ V \] A set of vertices.

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Parity games

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Parity games

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Parity games

- $V$: A set of vertices.
- $\rightarrow \subseteq V \times V$: An edge relation.
- $\Omega: V \rightarrow \mathbb{N}$: A priority mapping.
- $\mathcal{P}: V \rightarrow \{\diamond, \square\}$: A player mapping.

\[\begin{align*}
\diamond &= \text{even} \\
\square &= \text{odd}
\end{align*}\]
Parity games

- $V$: A set of vertices.
- $\rightarrow \subseteq V \times V$: An edge relation.
- $\Omega : V \rightarrow \mathbb{N}$: A priority mapping.
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Parity games

$V$ A set of vertices.
$\rightarrow \subseteq V \times V$ An edge relation.
$\Omega : V \rightarrow \mathbb{N}$ A priority mapping.
$\mathcal{P} : V \rightarrow \{\Diamond, \Box\}$ A player mapping.

$\Diamond = \text{even}$
$\Box = \text{odd}$
Equivalences

Example

\[0 \rightarrow 1 \rightarrow 1 \rightarrow 0 \rightarrow 0\]

\(\Diamond = \text{even}\)

\(\square = \text{odd}\)
Equivalences

Strong bisimilarity [KW11]

Example

$\diamond = \text{even}$

$\Box = \text{odd}$
Equivalences

Governed bisimilarity [KW11]

Example

\[\begin{array}{c}
\text{\textbullet} = \text{even} \\
\text{\textsquare} = \text{odd}
\end{array}\]
Stuttering bisimilarity [CKW11]

Example
Stuttering bisimilarity [CKW11]
Governed stuttering bisimilarity [CKW12]
Equivalences

Governed stuttering bisimilarity [CKW12]

Example

0 → 1 → 1 → 0 → 0

□ = even

□ = odd
Governed stuttering bisimilarity [CKW12]
Equivalences

Governed stuttering bisimilarity [CKW12]

Example

\[\begin{array}{c}
0 \\
1 \\
1 \\
o \\
o \\
\end{array}\]

\[\begin{array}{c}
\Box=\text{even} \\
\square=\text{odd} \\
\end{array}\]
Governed stuttering bisimilarity [CKW12]
Results
Size reduction governed stuttering (w.r.t. original)

- modelchecking
- games
- equivalence
- pgsolver

Reduction (%)
Results
Time reduction (w.r.t. original)