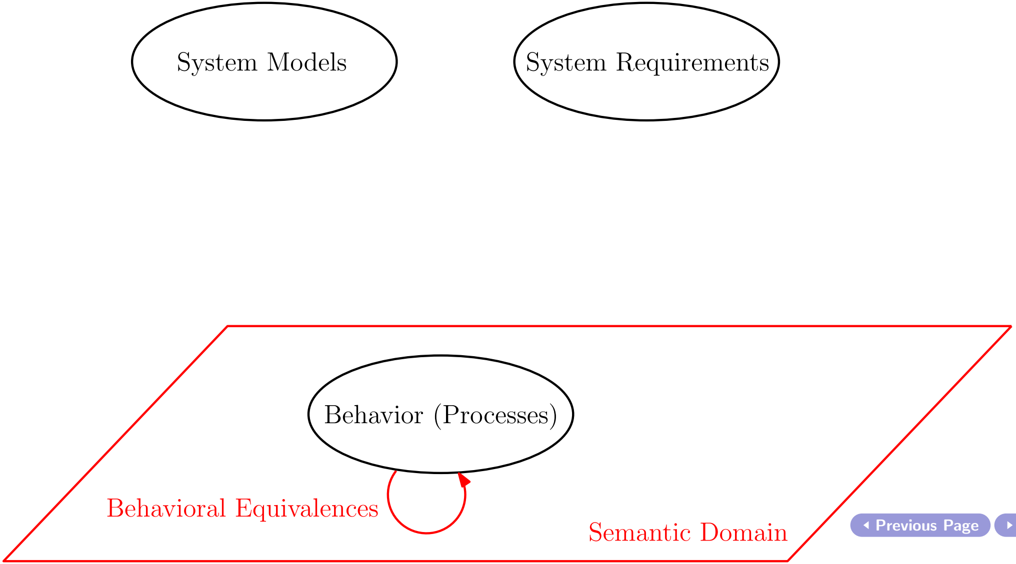
System Validation: Bisimulation

Mohammad Mousavi and Jeroen Keiren

General Overview



Bisimulation

$R \subseteq S \times S$ is strong bisimulation iff
for $s, t \in S$ s.t. $s\ R\ t$, and $a \in Act$:

- if $s \xrightarrow{a} s'$ then $\exists_{t' \in S}$ s.t. $t \xrightarrow{a} t'$ and $s'\ R\ t'$,
- if $t \xrightarrow{a} t'$ then $\exists_{s' \in S}$ s.t. $s \xrightarrow{a} s'$ and $s'\ R\ t'$,
- $s \in T$ iff $t \in T$.

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Bisimulation
Example

$\forall_{sRt}$

- $s \xrightarrow{a} s' \implies \exists_{t' \in S}\ t \xrightarrow{a} t'$ and $s'\ R\ t'$, and vice versa,
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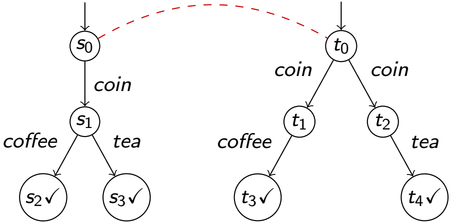

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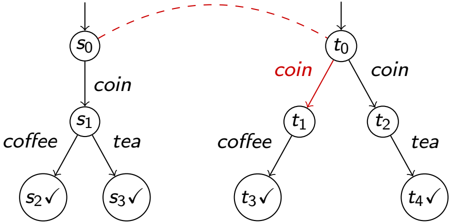

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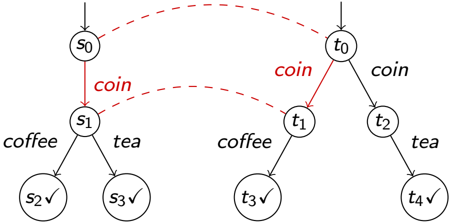

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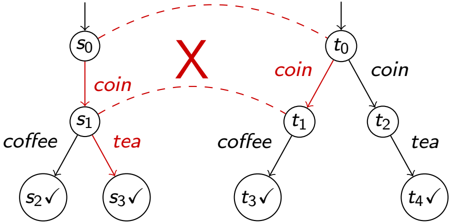

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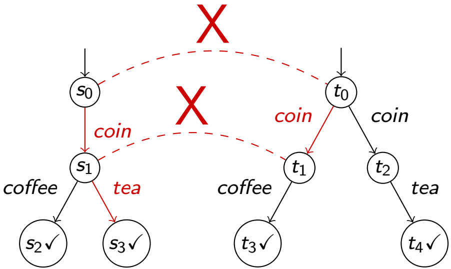
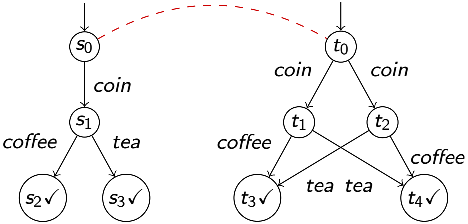


Bisimulation
An Exercise



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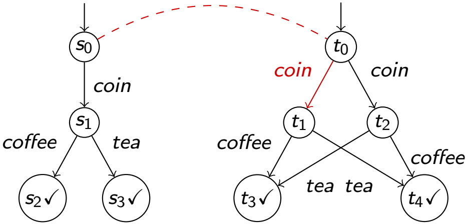
Bisimulation
An Exercise



Bisimulation
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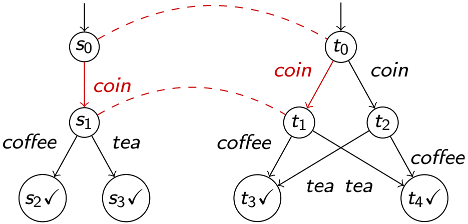

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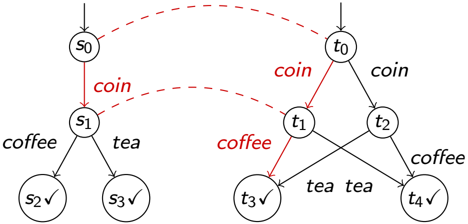

Bisimulation
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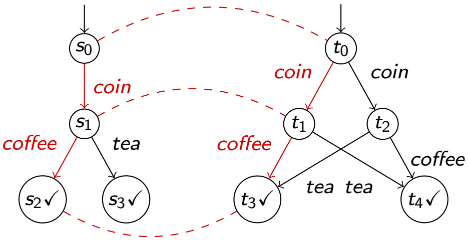

Bisimulation
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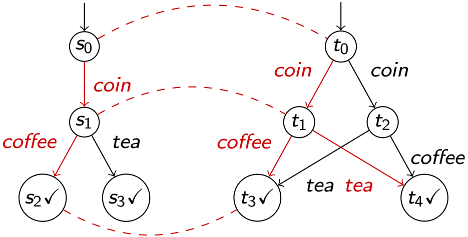

Bisimulation

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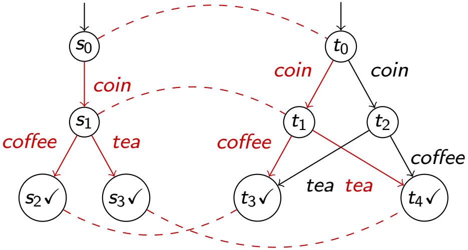

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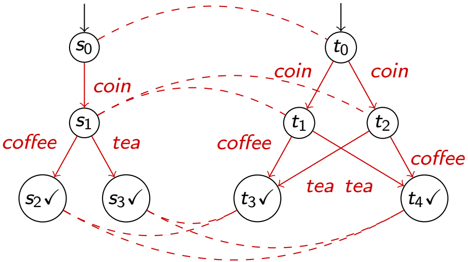
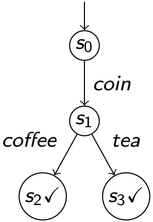


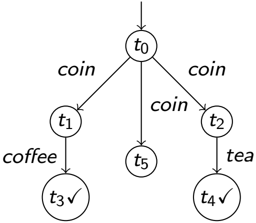
Intermezzo

Specifying LTSs in mCRL2



mCRL2 specification:

```
act coin, coffee, tea;

proc s0 = coin . s1;
s1 = coffee + tea;

init s0;
```



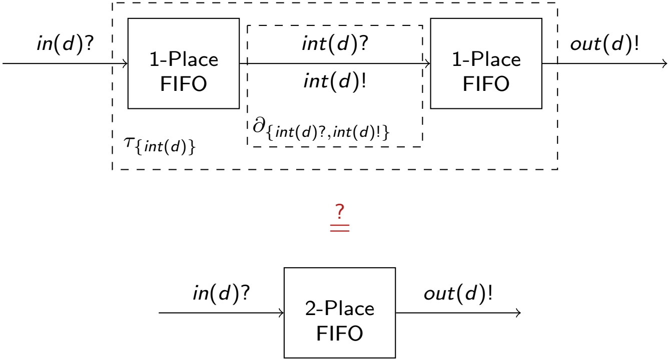
mCRL2 specification:

```
act coin, coffee, tea;

proc t0 = coin . t1 +
          coin . t2 +
          coin . delta;
     t1 = coffee;
     t2 = tea;

init t0;
```

Comparing LTSs in mCRL2
Example

mcrl22lps	Transformation into linear process form
lps2lts	Transformation into labeled transition systems
ltsgraph	Draw the LTS (suitable for small)
ltscompare	Checking for behavioral equivalences

Motivation
Verifying two-place buffer



Thank you very much.