Bisimulation Minimization and Symbolic Model Checking

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LY

The Lee-Yannakakis algorithm

LY - idea

- Stabilize only reachable blocks.
- Reachable block use a representative that has to bee reachable.
- The first state is the representative for the initial block.
- To find new reachable state, we look for transition from representative of reachable state to state from unreachable block.

LY - idea

Two loops :

- Search new reachable blocks
- Stabilize reachable but unstable blocks

LY - termination

With the exception of the initial block, all new blocks created by the algorithm have paths to the bad block.

LY - termination

Therefore, when a second block becomes reachable, the algorithm should raise a violation and terminate.

LY - new algorithm

Basic idea[1] :

- Search new reachable blocks.
- Stabilize reachable but unstable blocks.
- When a second block becomes reachable $\rightarrow$ raise a violation.

[1] Very similar to BR

LY - search

To search for new reachable block, the algorithm is searching from all the successor of the initial state if one of those is in a different block.

The algorithm also determine if the initial block has to be stabilize or not.

LY - search

- Let D be the set of all possible reachable state from the initial block B, $D := post(B)$.
- For each C which contains a state from $post(init)$
  - $B \neq C \rightarrow$ raise violation
  - $B \cap pre(C) \neq B \rightarrow B$ is not stable
  - $D := D - C$
- $D \neq \emptyset \rightarrow B$ is not stable

LY - stabilization

1: **while** B is not stable **do**
2: Mark B as stable
3: Create a new block with the states that reach outside of the current initial block
4: The remaining state are the new initial block
5: **end while**