

Automata, Games & Verification

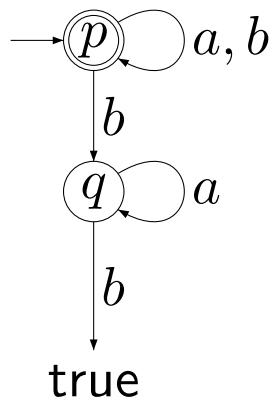
Summary #9

Today at 2:15pm in SR 016

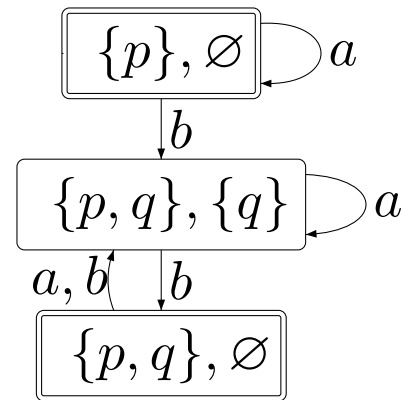
Seminar “Games, Synthesis, and Robotics”

Planning Graph Heuristics for Belief Space Search

Theorem 1. [Miyano and Hayashi, 1984] *For every alternating Büchi automaton \mathcal{A} , there exists a nondeterministic Büchi automaton \mathcal{A}' with $\mathcal{L}(\mathcal{A}) = \mathcal{L}(\mathcal{A}')$.*



universal
automaton



nondeterministic
automaton

Definition 1. Two nodes $x_1, x_2 \in T$ in a run tree (T, r) are *similar* if $|x_1| = |x_2|$ and $r(x_1) = r(x_2)$.

Definition 2. A run tree (T, r) is *memoryless* if for all similar nodes x_1 and x_2 and for all $y \in D^*$ we have that $(x_1 \cdot y \in T \text{ iff } x_2 \cdot y \in T)$ and $r(x_1 \cdot y) = r(x_2 \cdot y)$.

Theorem 2. If an alternating Büchi Automaton \mathcal{A} accepts a word α , then there exists a memoryless accepting run of \mathcal{A} on α .

Acceptance of a word α by an alternating Büchi automaton can also be characterized by a **game**:

- Positions of Player 0: $V_0 = S \times \omega$;
- Positions of Player 1: $V_1 = 2^S \times \omega$;
- Edges: $\{((s, i), (X, i)) \mid X \models \delta(s, \alpha(i))\}$
 $\cup \{((X, i), (s, i + 1)) \mid s \in X\}$

Player 0 wins a play iff $F \times \omega$ is visited infinitely often.

The word α is accepted iff Player 0 has a strategy to win the game from position $(s_0, 0)$.