Principles of AI Planning

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Exercise Sheet 11

Due: January 31th, 2012

Exercise 11.1 (Dynamic programming – 4 points)

Consider the propositional nondeterministic planning task $\Pi = \langle A, I, O, \gamma \rangle$, with

- the set of variables $A = \{a, b, c\}$,
- initial state $I = \{a \mapsto 0, b \mapsto 0, c \mapsto 1\}$,
- set of operators $O = \langle o_1, o_2, o_3 \rangle$, where
  - $o_1 = \langle a, \{b \wedge c, b \wedge \neg c\} \rangle$,
  - $o_2 = \langle \neg a \wedge b, \{a \wedge \neg b, a\} \rangle$,
  - $o_3 = \langle \neg b, \{\neg a \wedge b\} \rangle$
- and goal $\gamma = a \wedge b$

Determine a strong plan for Π by computing backward distances with the dynamic programming algorithm.

Exercise 11.2 (Symbolic regression search with boolean function operations – 3 points)

Consider the planning task Π from exercise 11.1. Perform a regression search with boolean function operations and simplify all formulas as much as possible. It is sufficient to calculate $\mathit{spreimg}_o(\alpha)$, where o is the operator from the strong plan of exercise 11.1 that is applied in a state described by $\mathit{spreimg}_o(\alpha)$ and results in a state described by α.

Exercise 11.3 (Nondeterministic progression search – 1.5+1.5 points)

(a) Model the game *Tic-Tac-Toe* as a nondeterministic planning task for a grid of size 2×2 with the goal to get two markers in a row, column or diagonally. Formalize the game from the first player's perspective. See `http://de.wikipedia.org/wiki/Tic_Tac_Toe` if rule questions arise.

(b) Determine a strong plan for the planning task of exercise 11.3a as a graph by providing a solution graph generated by progression search.

Note: The exercise sheets may and should be worked on in groups of two students. Please state both names on your solution (this also holds for submissions by e-mail).