

AI2 Module 4
Tutorial 4: Notes on Solutions

Alan Bundy
and
Jürgen Zimmer
School of Informatics

1 STRIPS Planning in the Blocks World

(a) The operator Unstack:

act:	Unstack(x,y)
pre:	On(x,y),Clear(x),Handempty
add:	Holding(x),Clear(y)
del:	On(x,y),Clear(x),Handempty

(b)

- Unstack(C,A)
- Putdown(C)
- Pickup(A)
- Stack(A,B)

(c)

- Pickup(B)
- Stack(B,C)

(d) This illustrates the problem of interacting goals and the Sussman Anomaly¹.

- Unstack(C,A)
- Putdown(C)
- Pickup(B)
- Stack(B,C)
- Pickup(A)
- Stack(A,B)

Note that this plan interleaves the plans for (b) and (c). STRIPS is unable to find such interleaved plans. Examples like this led to the partial-order planners, discussed in the lectures, which can deal with such interleaving.

¹See also <http://www.cs.cf.ac.uk/Dave/AI2/node122.html>.

2 Planning in the Wumpus World

(a)

act:	Shoot
pre:	At(sq1),Heading(dir),Next(sq1,dir,sq2),Wumpus(sq2)
add:	
del:	Wumpus(sq2)

(b)

- Right
- Forward
- Shoot

(c)

- (i) First use resolution to try to prove the goal $\neg Wumpus(\langle 1, 3 \rangle)$ in the initial state. This fails.
- (ii) Then match the negated goal against the delete lists of the operators. This succeeds only with the operator **Shoot**. The partially instantiated preconditions of the operator, $At(sq1)$, $Heading(dir)$, $Next(sq1, dir, \langle 1, 3 \rangle)$, $Wumpus(\langle 1, 3 \rangle)$, become the new subgoals.
- (iii) Try to prove the new subgoals in the initial state. This partially succeeds with the substitution $\{dir = North, sq1 = \langle 1, 2 \rangle\}$, leaving the residue $At(\langle 1, 2 \rangle), Heading(North)$.
- (iv) Match the first subgoal against the subgoals of the available operators. This succeeds with the operator **Forward**. The partially instantiated preconditions of this operator, $At(sq1')$, $Heading(dir')$, $Next(sq1', dir', \langle 1, 2 \rangle)$, $OK(\langle 1, 2 \rangle)$, become the new subgoals.
- (v) Try to prove the new subgoals in the initial state. This partially succeeds with the substitution $\{dir' = North, sq1' = \langle 1, 1 \rangle\}$, leaving the residue $Heading(North)$ which is identical with the second subgoal of (iii).
- (vi) Match this subgoal with the add-list of the operators. This succeeds with the operator **Right**. The instantiated preconditions of the operator, $Heading(dir'')$, $Ninety(dir'', North)$, become the new subgoals.
- (vii) Proving the new subgoals in the initial state succeeds with the substitution $\{dir'' = West\}$.
- (viii) Return the plan: Right, Forward, Shoot.

3 Qualification and Ramification

Open ended discussion question. Some possible answers are:

- (a) train is in working order, track is in working order, no strike, no accident, ...
- (b) other passengers move too, track/train is worn, train gets dirty, ...