STRIPS ⟶ assum each action cost 1

$P = \langle F, O, I, G \rangle$

operators
- Pre : P_1, P_2 ← must satisfy this to perform the action
- Add : P_3
- del : P_2

$F = \{at(x,y), visited(x,y) \mid x,y \in \{0,\dots m-1\}\}$

$I = \{at(0,0), visited(0,0)\}$ → one state

$G = \{visited(x,y) \mid (x,y) \in V\}$ → more than one state

AI Planning for Autonomy

Problem Set III: Choosing Heuristics

1. Reformulate the state-model from Q2 as a STRIPS problem $P = \langle F, O, I, G \rangle$.

2. Consider a $m \times m$ manhattan grid, and a set of coordinates V to visit in any order, and a set of inaccessible coordinates (walls) W.

   Using the state space below:

$O = \{ move(x,y,x',y')$ { Pre $at(x,y)$, add $at(x',y')$, $visited(x',y')$, del $at(x,y)$

$$
\begin{aligned}
S &= \{\langle x, y, V' \rangle \mid x, y \in \{0, \dots, m-1\} \wedge V' \subseteq V\} \\
S_0 &= \langle 0, 0, V \rangle \\
A(\langle x, y, V' \rangle) &= \{\langle dx, dy \rangle \mid dx, dy \in \{-1, 0, 1\} \\
&\qquad \wedge\ |dx| + |dy| = 1 \\
&\qquad \wedge\ \langle x + dx, y + dy \rangle \notin W\} \\
T(\langle dx, dy \rangle, \langle x, y, V' \rangle) &= \langle x + dx, y + dy, \\
&\qquad v - \{\langle x + dx, y + dy \rangle\} \rangle \\
c(a, s) &= 1 \\
G &= \{\langle x, y, V' \rangle \mid x, y \in \{0, \dots, m-1\} \wedge V' = \emptyset\}
\end{aligned}
$$

- Explain the meaning of x, y and V' in each state $s \in S$
- Define 3 different heuristics for this problem.
- Which of your heuristics is admissible? consistent? dominates the others?
- Estimate the complexity of calculating each of your heuristics.
- Which would you use in A*? Why?

minimum spanning tree → improvement → Steiner Tree

delete-relaxation