

AI Planning for Autonomy

## Problem Set III: Choosing Heuristics

1. 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:

$$\begin{aligned}
 S &= \{\langle x, y, v \rangle \mid x, y \in [0..m] \wedge v \subseteq V\} \\
 S_0 &= \langle 0, 0, V \rangle \\
 A(\langle x, y, v \rangle) &= \{\langle dx, dy \rangle \mid dx, dy \in \{-1, 0, 1\} \\
 &\quad \wedge |dx| + |dy| = 1 \\
 &\quad \wedge \langle x + dx, y + dy \rangle \notin W\} \\
 t(\langle dx, dy \rangle, \langle x, y, v \rangle) &= \langle x + dx, y + dy, \\
 &\quad v - \{\langle x + dx, y + dy \rangle\} \rangle \\
 c(a, s) &= 1 \\
 G &= \{\langle x, y, v \rangle \mid \langle x, y, v \rangle \in S \wedge v = \emptyset\}
 \end{aligned}$$

- 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?
2. Reformulate the state-model from Q1 as a STRIPS problem  $P = \langle F, O, I, G \rangle$ .
  3. Write pseudo code for the following search algorithms:  
 Feel free to implement these in python in the appropriate places in search.py for assignment 1.
    - Breadth First
    - Depth First
    - A Star
    - Uniform Cost