COMP90054 Workshop 3

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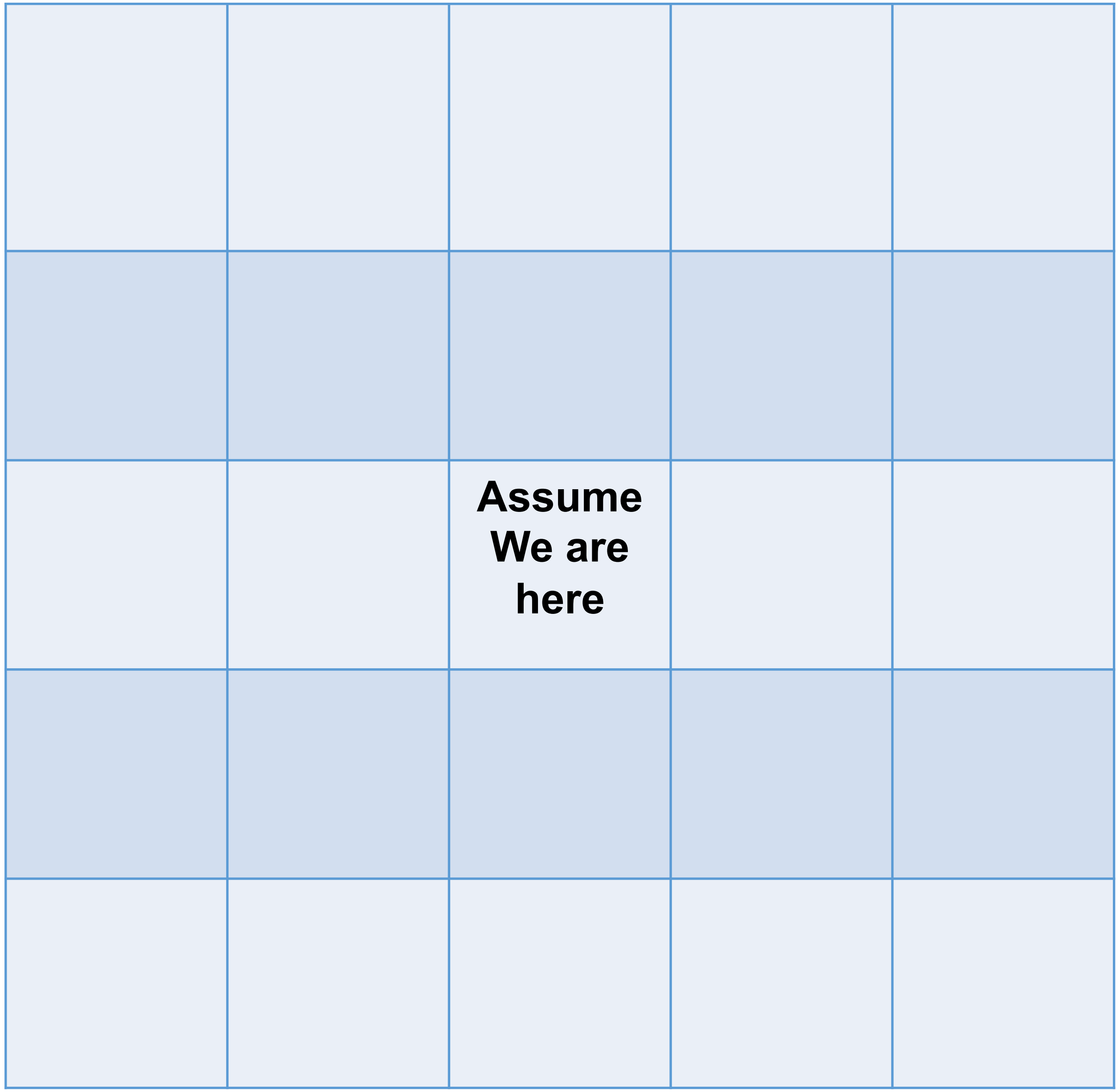
Recap: Manhattan Problem

- Consider an $m \times m$ **Manhattan Grid**, and a set of coordinates G to visit in any order.
- **Hint**: Consider a set of coordinates V' remaining to be visited, or a set of coordinates V already visited. What's the difference between them
- Formulate a state-based search problem to find a tour of all the desired points (i.e. define a state space, applicable actions, transition and cost functions).

m x m Grid



P = {S, s0, SG, A, T, C}

- a set of coordinates G to visit in any order

- Using a set of coordinates V' remaining to be visited,

Recap: Manhattan Problem

- a set of coordinates G to visit in any order
- Using a set of coordinates V' remaining to be visited

- $S = \{\langle x, y, V' \rangle \mid x, y \in \{0, \ldots, m-1\} \wedge V' \subseteq G\}$
- $s_0 = \langle (0,0), G \setminus \{(0,0)\} \rangle$
- $S_G = \{\langle (x,y), \{\} \rangle \mid x, y \in \{0, \ldots, m-1\}\}$
- $A(\langle x, y, V' \rangle) = \{(dx, dy) \mid$
  - $dx, dy \in \{-1, 0, 1\}$
  - $\wedge\ |dx| + |dy| = 1$
  - $\wedge\ x + dx, y + dy \in \{0, \ldots, m-1\}$
  - $(x + dx, y + dy) \notin W\ \}$
- $T(\langle x, y, V' \rangle, (dx, dy)) = \langle x + dx, y + dy, V' \setminus \{(x + dx, y + dy)\} \rangle$
- $c(a, s) = 1$

Problem 1

Reformulate the state-space model from *Review and Recap* as a STRIPS problem $P = \langle F, O, I, G \rangle$

STRIPS Model

- A **problem** in STRIPS is a tuple $P = \langle F, O, I, G \rangle$:
  - F stands for set of all atoms (boolean vars)
  - O stands for set of all operators (actions)
  - $I \subseteq F$ stands for initial situation
  - $G \subseteq F$ stands for goal situation

STRIPS Model

- Operators $o \in O$ **represented** by
  - the Add list $Add(o) \subseteq F$
  - the Delete list $Del(o) \subseteq F$
  - the Precondition list $Pre(o) \subseteq F$

Recap: Manhattan Problem

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  - $T(\langle x, y, V' \rangle, (dx, dy)) = \langle x + dx, y + dy, V' \setminus \{(x + dx, y + dy)\} \rangle$
  - $c(a, s) = 1$

Problem 1

$F_1 = \{ \underline{x(i)}, \underline{y(i)} \mid i \in \{0 \dots m-1\} \}$

- $F = \{at(x,y), visited(x,y) \mid x, y \in \{0, \dots, m-1\}\}$
- $O = \{move(x,y,x',y')$:
  - Prec:
  - Add:
  - Del:
- $I = \{at(0,0), visited(0,0)\}$
- $G = \{visited(x,y) \mid (x,y) \in G'\}$

Problem 1

- $F = \{at(x, y), visited(x, y) \mid x, y \in \{0, \ldots, m-1\}\}$
- $O = \{move(x, y, x', y')$:
  - Prec: $at(x, y)$
  - Add: $at(x', y'), visited(x', y')$
  - Del: $at(x, y)$

  | for each adjacent (x, y), (x', y'), and $(x', y') \notin W$ }

$x, y, x', y' \in \{0 \ldots m-1\}$

$|x-x'|+|y-y'|=1$

- $I = \{at(0, 0), visited(0, 0)\}$
- $G = \{visited(x, y) \mid (x, y) \in G'\}$

Problem 1

notWall(x,y)

- $F = \{at(x,y), visited(x,y) \mid x, y \in \{0, \ldots, m-1\}\}$
- $O = \{move(x,y,x',y')$:
  - Prec: $at(x,y)$ **notWall(x,y), notWall(x‘, y’)**
  - Add: $at(x',y'), visited(x',y')$
  - Del: $at(x,y)$

  $\mid$ for each adjacent $(x,y), (x',y')$
- $I = \{at(0,0), visited(0,0)\}$
- $G = \{visited(x,y) \mid (x,y) \in G'\}$

Problem 2

G1						G2
	Wall	Wall	Starting point			

Problem 2

- Goal-counting
- Manhattan distance to the closest goal(position) heuristic
- Manhattan distance to the furthest goal(position) heuristic
- Your own heuristic…

Recap: Dominant Relation

- If heuristic h1 dominates heuristic h2:
- Then we will have h1(s) >= h2(s), for all s belongs to state space S
- And both h1 and h2 need to be admissible