

Foundations of Agent Programming

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Exercise 9.1

Reconsider the SPARK encoding of the Gold Mining Domain from Exercise 8.2. Find a complete derivation starting from $(\mathcal{B}, \mathcal{D}, \mathcal{I}, \text{Select})$, where

$$\begin{aligned}\mathcal{B} &= \{At(\text{Agent}, A), At(\text{Gold}, A), At(\text{Depot}, B), Adjacent(A, B)\} \\ \mathcal{D} &= \{+At(\text{Gold}, A)\} \\ \mathcal{I} &= \{\}\end{aligned}$$

Exercise 9.2 Repetition

The *8-puzzle* consists of a 3×3 grid and 8 randomly distributed tiles numbered from 1 to 8. A square which is horizontally or vertically adjacent to the empty position *Blank* can be moved to this position. The goal is to order the pieces according to some specification. We use the following fluent and action, where the *Blank* is considered to be moved:

$$\begin{aligned}Cell(x, y, tile) &\hat{=} \text{tile } tile \in \{1, \dots, 8, Blank\} \text{ is at position } (x, y) \\ Move(x, y) &\hat{=} \text{the } Blank \text{ is moved to position } (x, y) \text{ which is horizontally or vertically} \\ &\quad \text{adjacent to its current position}\end{aligned}$$

Considering the given domain, solve the following tasks:

- a) Define a Precondition Axiom and an Effect Axiom in the *General Action Calculus*.
(Chapter 2: "Procedural Action Programs")
- b) Define a Precondition Axiom and Effect Axioms (along with Frame Axioms) in the *Game Description Language*.
(Chapter 2: "Procedural Action Programs")
- c) Define a Precondition Axiom and a Successor State Axiom in the *Situation Calculus*.
(Chapter 2: "Procedural Action Programs")
- d) Define a Precondition Axiom and a State Update Axiom in the *Fluent Calculus*.
(Chapter 4: "Declarative Action Programs")
- e) Define a Precondition Axiom and State Update Axioms in the *Event Calculus*.
(Chapter 5: "Commonsense Reasoning for Agents")