EXERCISE 4

Science of Computational Logic

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Problem 4.1

We have three tiles, called a, b and c, placed in a squared ordered field that can contain exactly four tiles, as illustrated in the figure below. Tile X can be moved via the action $move(X)$ either horizontally or vertically to occupy the adjacent free portion of the field. It cannot be moved diagonally and it cannot overlap another tile.

state (A) state (B)

1. Formalize the actions $move(X)$ in fluent calculus.
2. Formalize the state (A).
3. Give a plan that transforms state (A) to state (B).

Problem 4.2

Consider the decision variant of the knapsack problem:

Given a set of items $\{i_1, \ldots, i_n\}$, each with a mass $m_i \in \mathbb{N}$ and a value $v_i \in \mathbb{N}$, can we include them in in a collection so that the total weight is less than m and the total value is more than v?

Specify a planning problem that has a solution if and only if the above problem can be answered with 'yes'.

Problem 4.3

Let $\mathcal{I}$ be an initial state containing, and $\mathcal{G}$ be a goal state and let $\mathcal{A}$ be the set of actions of Blocks World as specified in the lecture.

Specify a propositional formula F_n such that F is satisfiabile if and only if the planning problem has a solution of length n.