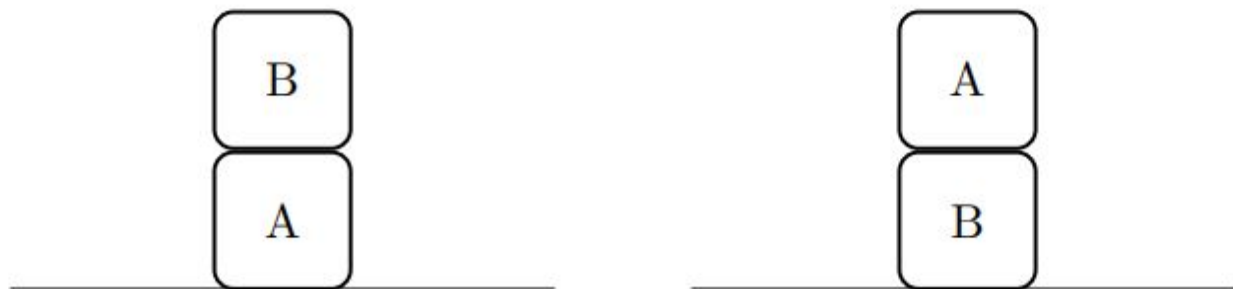# Foundations of Artificial Intelligence

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Exercise Session
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Exercise 7.1

Consider the problem of using a robotic arm with gripper to move two blocks, A and B, from the initial state shown below on the left to the final one shown on the right:

This problem is modeled as the following STRIPS planning problem:

Solve the planning problem using forward search in the state space (using breadth-first search without elimination of repeated states), drawing the search tree and showing the solution.

Planning (8 points). Consider the problem of making tea. You have:
- some amount of water that can be either hot or cold, and can be in a bottle, in a kettle or in a cup,
- a kettle that can be empty or not empty,
- a cup that can be empty or not empty,
- a bottle that can be empty or not empty,
- a teabag that can be either in the cup or not in the cup.
The property of a container of being empty or not empty only refers to water.

Question 1: Represent the above setting in PDDL. Your model must be general and allow for the possible presence of other amounts of water, kettles, cups, bottles, and teabags. Report the constants and the predicates, distinguishing between predicates that represent time-independent properties and predicates that represent time-dependent properties (fluents). Do not define redundant predicates (e.g., something cold is not hot and vice versa).

Question 2: Represent the goal: having a cup full of hot water with a teabag in it.
Question 3: Define the following 3 action schemas:
- Pour: move all the water from one container to another empty container (the action schema must work for *any* container of water)
- AddTeaBag: place a teabag into a cup (and only in a cup),
- BoilWaterInKettle: use the kettle to boil the water it contains.