# Foundations of Artificial Intelligence

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# Some Comments on the Exercises

**Exercise 7.1**

Clear(y) is needed because otherwise we cannot specify the Precond of action Stack(x,y). Indeed, we should require that ∀x ¬Clear(x,y) that is not allowed in precondition since it is a negated condition.

**Exercise 7.2**

*Isn't Empty equivalent to ¬Carry? If this is the case, why don't we just represent a state in which the robot is not carrying the ball by simply omitting the predicate Carry?*

Answer: Yes, Empty is logically equivalent to ¬Carry. Empty is necessary otherwise we cannot specify the Precond of action PickRa as we cannot use negation of conditions in preconditions.

**In general, if you realize that you need a condition for a precondition that is a negation of an existing condition you need to add a new condition!**

# Exercise 7.3 Variation

Consider the Hanoi tower problem. This puzzle has $n$ discs, $D_1,...,D_n$, with holes in their centers, and three pegs, A, B, C, on which the discs can be placed. Disc $D_{i+1}$ is larger than disc $D_i$. Initially, all the discs are on peg A. We want them on peg C in the same configuration.

The following rules apply:

- only the top disc on a peg can be moved;
- a disc cannot be placed on top of a smaller one.

# Exercise 7.3 Variation

1. Model the general problem for n disks as a STRIPS planning problem;
2. For n = 2, solve the problem with forward planning in the state space with greedy best-first with elimination of repeated states (as heuristics, use the number of unsatisfied goal conditions; break ties using a FIFO strategy). Report the search tree, the repeated nodes that are not expanded, and the solution found. **[During the exercise session, I mentioned to use BFS. You can try both!]**