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Fachrichtung 6.2 – Informatik
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9th Theoretical Assignment in
Artificial Intelligence (WS 2006/2007)

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Exercise 9.1 Consider the blocksworld with the operators **pickup, putdown, stack** and **unstack** defined in the lecture[1]. Assume that there are four blocks A,B,C and D, and a table. The start state is: *ON(A,B), ONTABLE(B), ONTABLE(D),ONTABLE(C),CLEAR(A), CLEAR(D),CLEAR(C),HANDEMPTY.*
The goal state is: *ON(C,A), ON(A,D).*

1. Find a plan that transforms the start state to the goal state according to the STRIPS algorithm presented in the lecture[2]. Hint: do not expand the whole search space – give one branch that leads to a plan! Indicate each step of the algorithm!
2. Explain what the Sussman-anomaly is. Can this effect occur in the above example?

Exercise 9.2 Assume that Pat got drunk last night and has to go the supermarket to buy groceries. Unfortunately, Pat got involved in an onion eating contest and a mud-wrestling match last night. Pat is currently sleeping and is hungry. One last thing that can be said about Pat is that he is lazy and does not like to do anything more than he has to. How should Pat get ready to go to the supermarket?

1. Define the problem by specifying the environment and operators. The environment should comprehend the states `HairMessy`, `Dressed`, `Clean`, `Hungry`, `Sleeping`.
2. Create a Minimal Partial Order Plan. How many Total Order Plans can be obtained from it?

Exercise 9.3 Consider (again) a blockworlds in which there is a *table*, and the blocks A, B, and C. Moreover, there are predicates $Clear(x)$ where x is a block and $On(x,y)$, where x is a block and y is a block or the table. Furthermore, consider the following operators:

> $Op(\text{Action:}Start,$
> $\text{Effect:}On(C,A) \wedge On(A,Table) \wedge Clear(C) \wedge On(B,Table) \wedge Clear(B))$
>
> $Op(\text{Action:}Finish,$
> $\text{Precond:}On(A,B) \wedge On(B,C) \wedge On(C,Table) \wedge Clear(A))$
>
> $Op(\text{Action:}Move(b,x,y),$
> $\text{Precond:}On(b,x) \wedge Clear(b) \wedge Clear(y)$
> $\text{Effect:}On(b,y) \wedge Clear(x) \wedge \neg On(b,x) \wedge \neg Clear(y))$
>
> $Op(\text{Action:}MoveToTable(b,x),$
> $\text{Precond:}On(b,x) \wedge Clear(b)$
> $\text{Effect:}On(b,Table) \wedge Clear(x) \wedge \neg On(b,x))$

Explain in detail how a *partial order planner (POP)* generates a plan for the Sussman anomaly. Give the different steps during the planning process as well as a diagram that shows the final plan with causal links including preconditions and ordering constraints.

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[1]Shown on slide 11, Chapter 4.
[2]Shown on slide 35, Chapter 4.