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Fachrichtung 6.2 – Informatik
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8th Theoretical Assignment in Artificial Intelligence (SS 2005)

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Exercise 8.1: **10 P**

Use unification grammers to represent the sentence *John loves Mary* in a feature sentence.

Exercise 8.2: **20 P**

In the following example, we will show how the planning algorithm derives a solution to a problem that involves putting on a pair of shoes. In this problem scenario, Pat is walking around his house in his bare feet. He wants to put some shoes on to go outside. The actions are described in the following table. The following states are given `OnRightSock`, `OnLeftSock`, `OnBarefootLeft`, `OnBarefootRight`, `OnRightShoe` and `OnLeftShoe`. Assume, you have to wear socks in order to put on shoes!

	RightShoe	RightSock	LeftShoe	LeftSock
preconditions	OnRightSock	OnBarefootRight	OnLeftSock	OnBarefootLeft

- List all operators (inclusive *adds* and *deletes*). (5 P)
- Introduce two additional operators for putting a hat and a coat on, with the preconditions that the hat can only be put on if both pairs of shoes are on. There a no preconditions for putting on the coat. Add the adds and deletes of this two operators. (5 P)
- Give a partial-order plan that solves this shoe problem (use `STRIPS` without negation). How many feasible plans do exist? (10 P)

Exercise 8.3: **20 P**

Develop a functional version of the STRIPS algorithm presented in the lecture. This version should return a feasible plan if the problem is solvable. Use pseudocode (similar to the lecture slides) to present your algorithm and explain additionally your algorithm using natural language.

Exercise 8.4: **20 P**

Assume, Pat got drunk last night and has go to 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?

- Define the problem by specifying the environment and operators. The environment should comprehend the states `HairMessy`, `Dressed`, `Clean`, `Hungry`, `Sleeping`. (10 P)
- Create a Minimal Partial Order Plan. (10 P)

Exercise 8.5: **30 P**

Consider a blockworld 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:

$Op($ACTION:$Start$,
EFFECT:$On(C, A) \wedge On(A, Table) \wedge Clear(C) \wedge On(B, Table) \wedge Clear(B))$

$Op($ACTION:$Finish$,
PRECOND:$On(A, B) \wedge On(B, C) \wedge On(C, Table) \wedge Clear(A))$

$Op($ACTION:$Move(b, x, y)$,
PRECOND:$On(b, x) \wedge Clear(x) \wedge Clear(y)$
EFFECT:$On(b, y) \wedge Clear(x) \wedge \neg On(b, x) \wedge \neg Clear(y))$

$Op($ACTION:$MoveToTable(b, x)$,
PRECOND:$On(b, x) \wedge Clear(b)$
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.