

Exercise 1

The owl Steffi wants to deliver a letter containing the result of the student council elections from the CS student council to the AStA building. After delivering the results, she wants to go back to her nest in the student council. Steffi is currently located at the Mensa building. She can fly between any two locations.

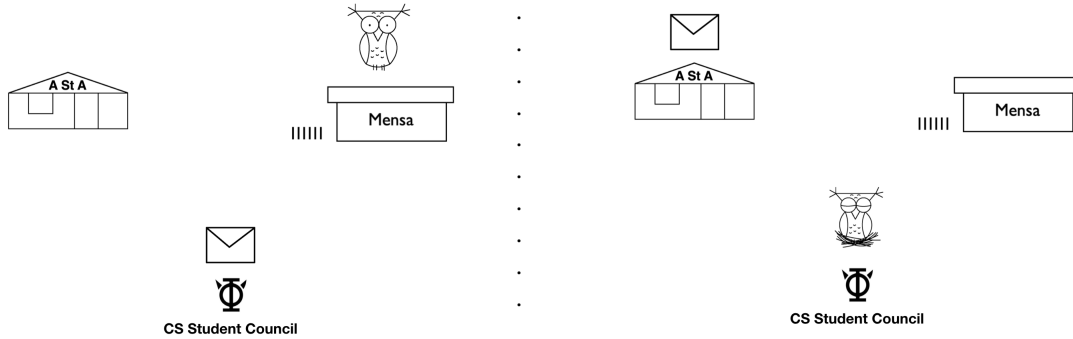
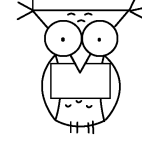


Figure 1: Initial state (left) and goal (right) of the planning task

Complete the formalization of the planning task. “Empty” stands for Steffi not carrying anything. Fill in all gaps indicated by a question mark (?). You may introduce new predicates if necessary.

$$\begin{aligned}
 P &= \{at(Steffi, x), at(Letter, x), carrying(Letter), empty\} \\
 &\quad \text{for } x \in \{Mensa, AStA, Council\} \\
 I &= \{at(Steffi, Mensa), at(Letter, Council), empty\} \\
 G &= \{?\} \\
 A &= \{fly(x, y) \mid (x, y) \in \{?\}\} \\
 &\quad \cup \{pickup(i, x) \mid x \in \{?\}, i \in \{?\}\} \\
 &\quad \cup \{drop(i, x) \mid x \in \{?\}, i \in \{?\}\}
 \end{aligned}$$

- $fly(x, y) : \text{pre: } \{?\}, \text{add: } \{?\}, \text{del: } \{?\}$
- $pickup(i, x) : \text{pre: } \{?\}, \text{add: } \{?\}, \text{del: } \{?\}$
- $drop(i, x) : \text{pre: } \{?\}, \text{add: } \{?\}, \text{del: } \{?\}$

Exercise 2

This year the AStA decided to no longer believe the student councils and wants Steffi to bring all voting slips to the AStA building. In total, there are 20 voting slips. Unfortunately Steffi can only carry up to 2 letters at a time. Formalize the new initial and goal state and the new actions. You can add more parameters to the existing predicates/actions or add new predicates (but no new actions) if needed.