Foundations of Artificial Intelligence

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Exercise Sheet 7

Due: Friday, June 18, 2021

Exercise 7.1 (Planning)

Consider the following STRIPS-Task $\Pi = \langle \mathcal{S}, O, I, G \rangle$:

- $\mathcal{S}$: {X, Y, Z, G}
- $O : \{A, B, C, D, E, F\}$ where

$$
\begin{aligned}
A:&\ \mathit{pre}(A) = \{X\}, && \mathit{eff}(A) = \{Y, Z\}\\
B:&\ \mathit{pre}(B) = \{X\}, && \mathit{eff}(B) = \{\neg X, Z\}\\
C:&\ \mathit{pre}(C) = \{\neg Y\}, && \mathit{eff}(C) = \{Z\}\\
D:&\ \mathit{pre}(D) = \{\neg Z\}, && \mathit{eff}(D) = \{Y\}\\
E:&\ \mathit{pre}(E) = \{\neg X, Y\}, && \mathit{eff}(E) = \{\neg Y, G\}\\
F:&\ \mathit{pre}(F) = \{Z\}, && \mathit{eff}(F) = \{\neg Z, G\}
\end{aligned}
$$

- I: {X, Y}
- G: {G}

(a) State for each operator from O if it is applicable in I or not. For each applicable operator also give the resulting state after applying that operator in I.

(b) Give an applicable plan π that leads from I to G.

Exercise 7.2 (Bayes' Rule)

In Freiburg 80% of all cars are red. You see a car at night that does *not* appear red to you. You know that you can correctly identify a red car only in 70% of the cases when the given car is red. And you can identify a non-red car correctly in 90% of the cases when the given car is non-red.

(a) List all conditional and non-conditional probabilities that you can determine directly from the task description. Note: Differentiate between the statement that a car *is red* and the statement that you have *seen a red car*.

(b) Compute the probability that the car is actually red, when you perceive a car as red in Freiburg at night.

Exercise 7.3 (Independence and Joint and Conditional Probabilities)

(a) A 6-sided die is rolled once. Which of the following events are independent? Show the probability values and reasoning.

- E : An even number is rolled
- O : An odd number is rolled
- T : A number ≥ 3 is rolled

(b) Make the joint probability distribution table for the events E and T.

(c) Calculate the conditional probability $P(\neg e \mid t)$.

Note: The exercise sheets may be worked on in groups of up to three students.