Authors:
Erick Rosete Beas — er165@uni-freiburg.de
Jessica Lizeth Borja Diaz — jb986@uni-freiburg.de

Principles of AI Planning

Exercise Sheet 7

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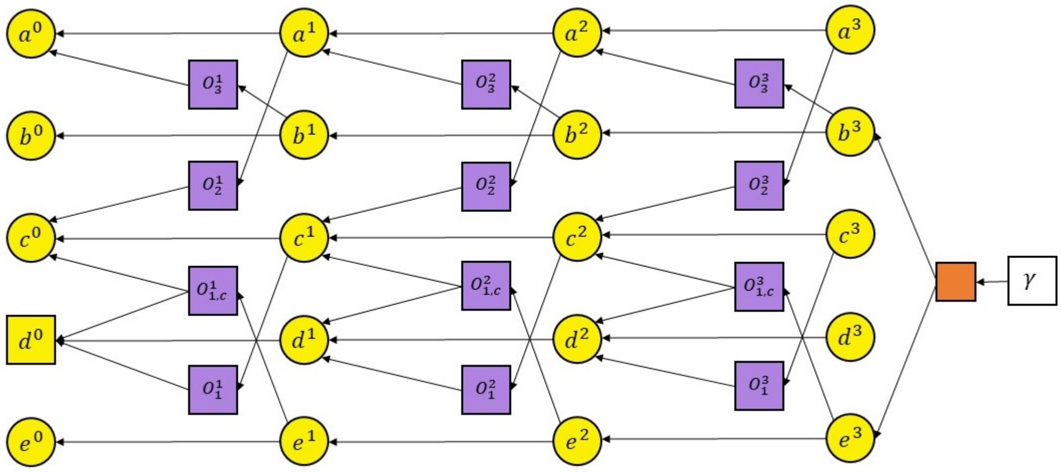
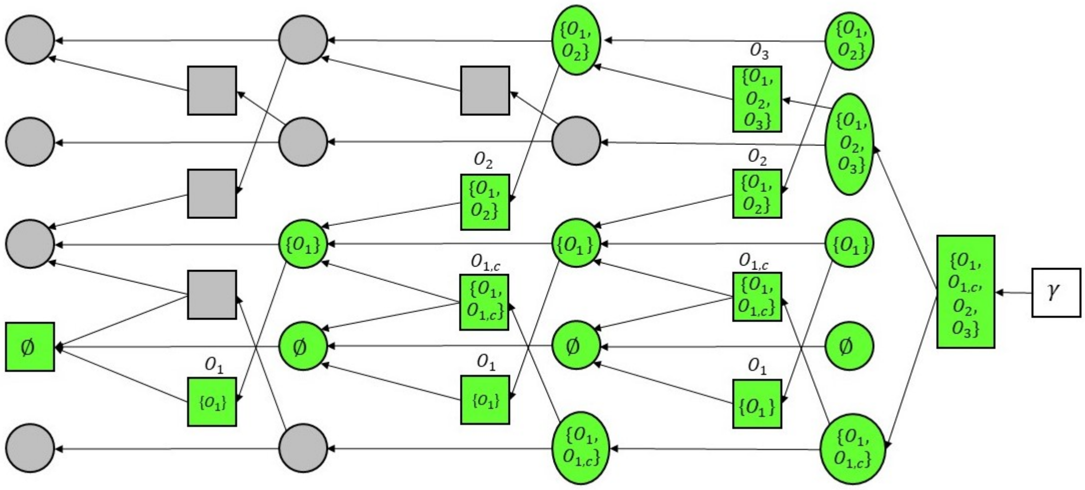
Exercise 8.1 - Relaxed planning graph and heuristics

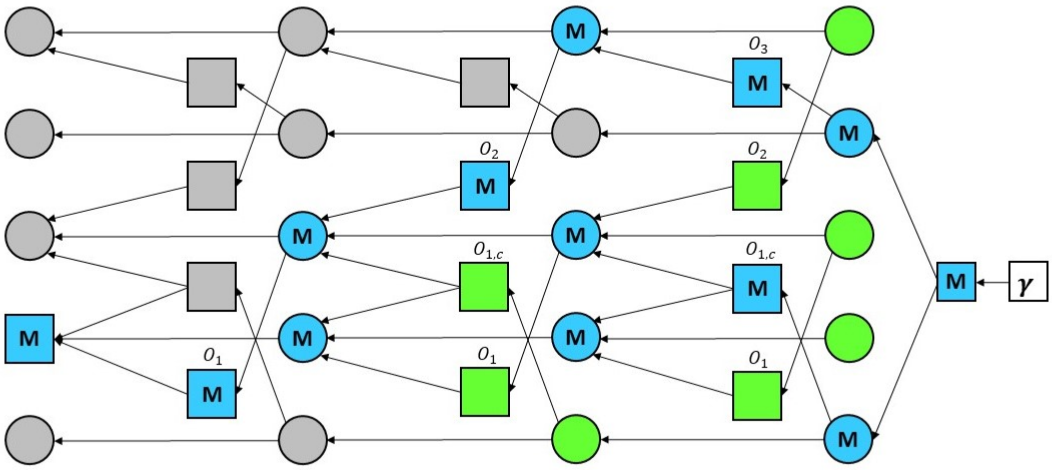
Consider the relaxed planning task Π^+ with variables $A = \{a, b, c, d, e\}$, operators $O = \{o_1, o_2, o_3\}$, $o_1 = \langle d, c \wedge (c \rhd e)\rangle$, $o_2 = \langle c, a\rangle$, $o_3 = \langle a, b\rangle$, goal $\gamma = b \wedge e$ and initial states $s = \{a \mapsto 0, b \mapsto 0, c \mapsto 0, d \mapsto 1, e \mapsto 0\}$. Solve the following by drawing the relaxed planning graph for the lowest depth k that is necessary to extract a solution



(a) **Calculate $h_{sa}(s)$ for Π^+**
The heuristic value for the initial state is 4.



(b) **Calculate $h_{FF}(s)$ for Π^+**
The heuristic value for the initial state is 4.



Exercise 8.1 - Finite domain representation

FDR planning task $\Pi' = \langle V, I, O, \gamma \rangle$

$$V = \{above - a, above - b, above - c, below - a, below - b, below - c\}$$

$$\mathcal{D}_{above\text{-}a} = \{b, c, nothing\}$$

$$\mathcal{D}_{above\text{-}b} = \{a, c, nothing\}$$

$$\mathcal{D}_{above\text{-}c} = \{a, b, nothing\}$$

$$\mathcal{D}_{below\text{-}a} = \{b, c, table\}$$

$$\mathcal{D}_{below\text{-}b} = \{a, c, table\}$$

$$\mathcal{D}_{below\text{-}c} = \{a, b, table\}$$

$$I = \{above\text{-}a \mapsto nothing, above\text{-}b \mapsto a, above\text{-}c \mapsto nothing,$$
$$below\text{-}a \mapsto b, below\text{-}b \mapsto table, below\text{-}c \mapsto table\}$$

$$O = move\text{-}x\text{-}y\text{-}z, move\text{-}x\text{-}table\text{-}z, move\text{-}x\text{-}y\text{-}table$$

$$move\text{-}x\text{-}y\text{-}z = \langle above\text{-}y = x \wedge above\text{-}x = nothing \wedge above\text{-}z = nothing,$$
$$below\text{-}x := z \wedge above\text{-}y := nothing \wedge above\text{-}z := x\rangle$$

$$move\text{-}x\text{-}table\text{-}z = \langle above\text{-}x = nothing \wedge below\text{-}x = table \wedge above\text{-}z = nothing,$$
$$below\text{-}x := z \wedge above\text{-}z := x\rangle$$

$$move\text{-}x\text{-}y\text{-}table = \langle above\text{-}y = x \wedge above\text{-}x = nothing,$$
$$below\text{-}x := table \wedge above\text{-}y := nothing\rangle$$

for pair-wise distinct $x, y, z \in a, b, c$

$$\gamma = above\text{-}c = b \wedge above\text{-}a = c$$