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Principles of AI Planning

Exercise Sheet 13

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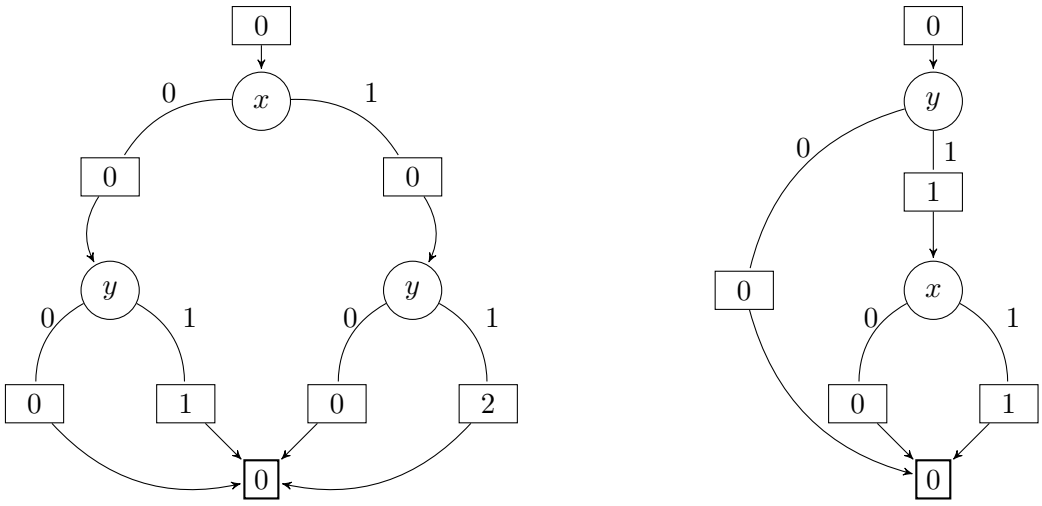
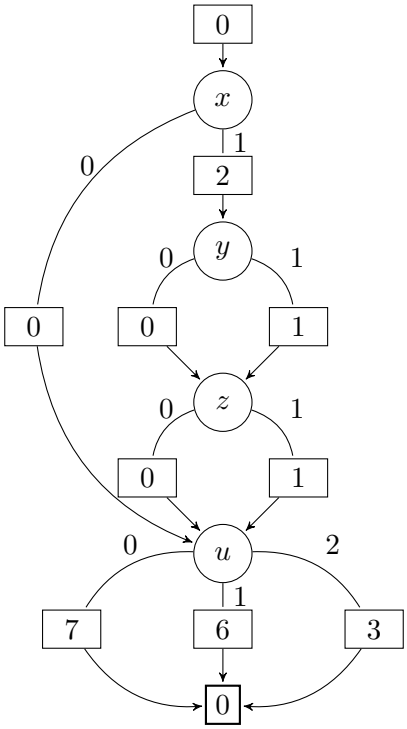
Exercise 13.1 - EVMDDs

(a)

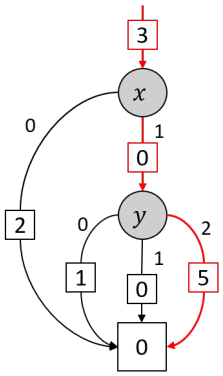


(b)



Exercise 13.3 - EVMDD sizes and variable orders

Consider a cost function represented by the EVMDD on the right.
Let s be a state with $s(x) = 1$ and $s(y) = 2$. To which value does the EVMDD evaluate for state s?
$cost(s) = 3 + 0 + 5 = 8$



Exercise 13.4 - EVMDD-based action compilation

Consider again the EVMDD from Exercise 13.3. Assume it encodes the cost c_{o_1} of operator $o_1 = \langle z = 1 \wedge u = 1, x := 0 \rangle$.

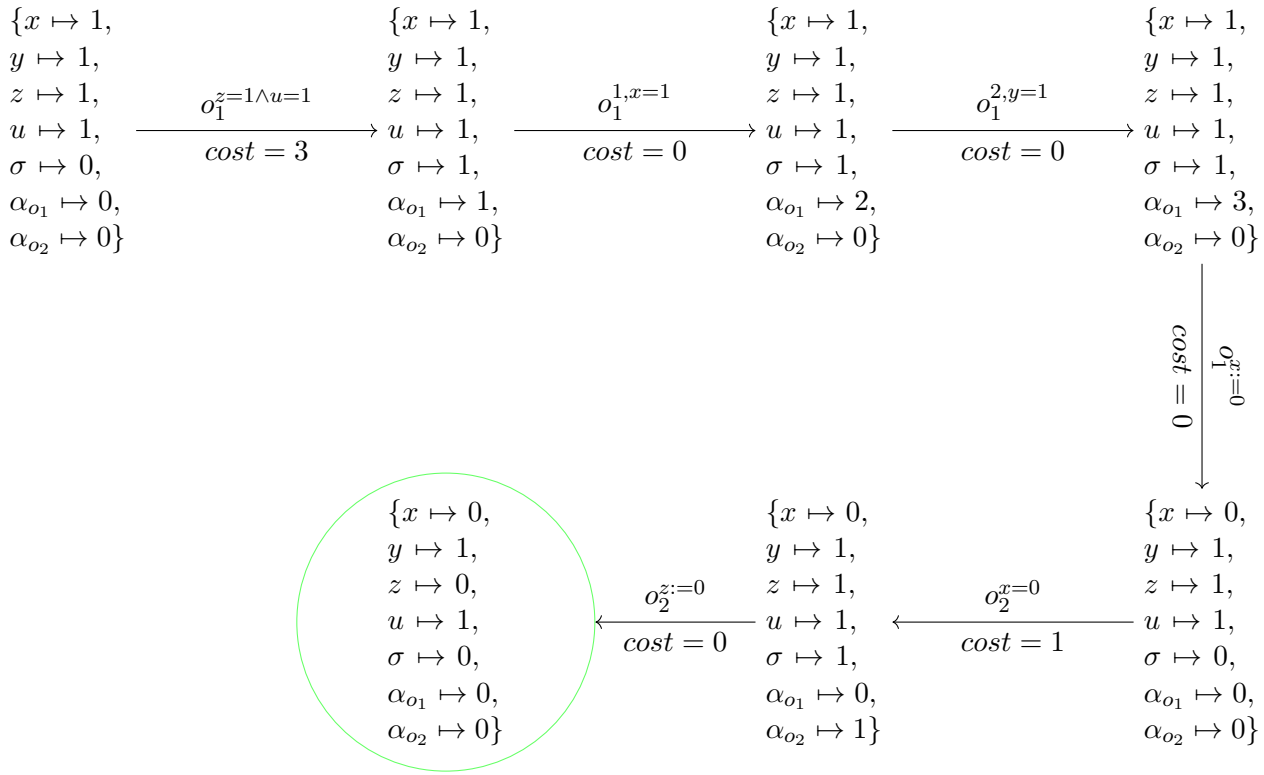
a) Give the EVMDD-based action compilation of o_1 using this EVMDD.

$$O_1^{z=1 \wedge u=1} = \langle z = 1 \wedge u = 1 \wedge \sigma = 0 \wedge \alpha_{o_1} = 0, \sigma := 1 \wedge \alpha_{o_1} := 1 \rangle \qquad cost = 3$$
$$O_1^{1,x=0} = \langle \alpha_{o_1} = 1 \wedge x = 0, \alpha_{o_1} := 3 \rangle \qquad cost = 2$$
$$O_1^{1,x=1} = \langle \alpha_{o_1} = 1 \wedge x = 1, \alpha_{o_1} := 2 \rangle \qquad cost = 0$$
$$O_1^{2,y=0} = \langle \alpha_{o_1} = 2 \wedge y = 0, \alpha_{o_1} := 3 \rangle \qquad cost = 1$$
$$O_1^{2,y=1} = \langle \alpha_{o_1} = 2 \wedge y = 1, \alpha_{o_1} := 3 \rangle \qquad cost = 0$$
$$O_1^{2,y=2} = \langle \alpha_{o_1} = 2 \wedge y = 2, \alpha_{o_1} := 3 \rangle \qquad cost = 5$$
$$O_1^{x:=0} = \langle \alpha_{o_1} = 3, x := 0 \wedge \sigma := 0 \wedge \alpha_{o_1} := 0 \rangle \qquad cost = 0$$

b) Let $\Pi = \langle V, I, O, \gamma, (c_o)_{o \in O} \rangle$ with $V = \{x, y, z, u\}$, $\mathcal{D}_x = \mathcal{D}_z = \mathcal{D}_u = \{0, 1\}$ and $\mathcal{D}_y = \{0, 1, 2\}$, initial state I with $I(x) = I(y) = I(z) = I(u) = 1$, operators $O = \{o_1, o_2\}$ with o_1 as above and $o_2 = \langle x = 0, z := 0 \rangle$ with cost function $c_{o_2} = 1$ and goal formula $\gamma = (z = 0)$. Give an optimal plan π for Π and an optimal plan π for the EVMDD-based action compilation of Π and their respective costs.
Optimal plan π for Π

$$\{x \mapsto 1, y \mapsto 1, z \mapsto 1, u \mapsto 1\} \xrightarrow[cost = 3]{o_1} \{x \mapsto 0, y \mapsto 1, z \mapsto 1, u \mapsto 1\} \xrightarrow[cost = 1]{o_2} \{x \mapsto 0, y \mapsto 1, z \mapsto 0, u \mapsto 1\}$$

Optimal plan π for $\Pi' = EAC(\Pi)$



We can notice the cost of both plans is the same, 3.