

Foundations of Artificial Intelligence

Exercise Sheet 9

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June 25, 2021

Exercise 9.1

(a)

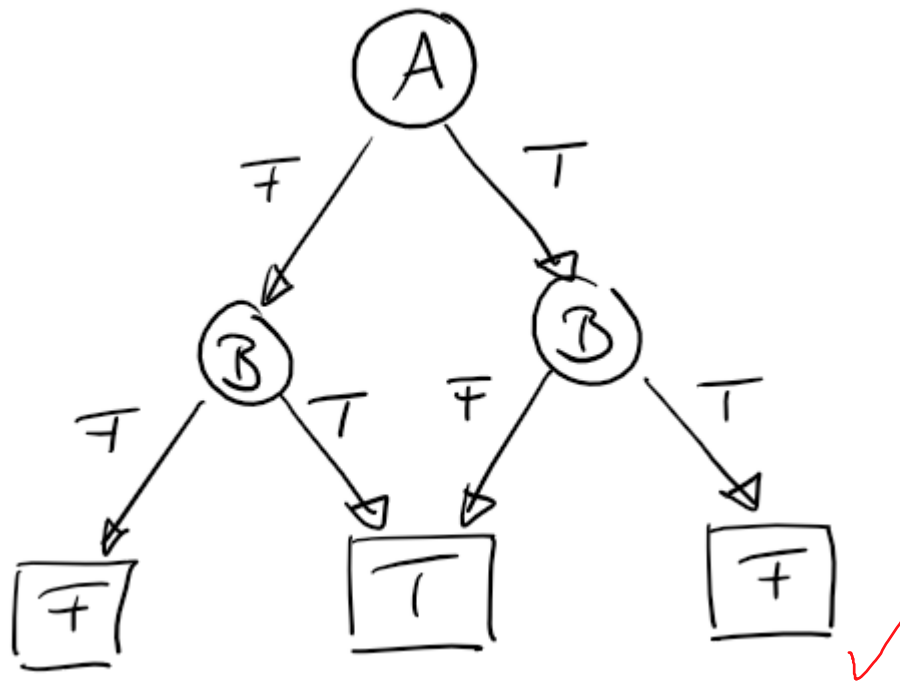
$$\begin{aligned}\pi_{t+1}(s) &= \operatorname{argmax}_a \sum_{s'} P(s'|s, a) U_t(s') \\ \pi_1(s) &= \operatorname{argmax}_a \{0.8 \cdot u(0, 2) + 0.1 \cdot u(0, 1) + 0.1 \cdot u(1, 1), \\ &\quad 0.8 \cdot u(1, 1) + 0.1 \cdot u(2, 0) + 0.1 \cdot u(0, 0), \\ &\quad 0.8 \cdot u(0, 0) + 0.1 \cdot u(1, 1) + 0.1 \cdot u(0, 1), \\ &\quad 0.8 \cdot u(0, 1) + 0.1 \cdot u(0, 0) + 0.1 \cdot u(0, 2)\} \\ &= \operatorname{argmax}_a \{0, \\ &\quad -1, \\ &\quad -8, \\ &\quad -1\} \\ &= N \quad \checkmark\end{aligned}$$

(b)

$$\begin{aligned}U'(s) &= -1 + 0.5 \cdot \max_a \{0.8 \cdot u(4, 4) + 0.1 \cdot u(4, 3) + 0.1 \cdot u(3, 3), \\ &\quad 0.8 \cdot u(4, 3) + 0.1 \cdot u(4, 2) + 0.1 \cdot u(4, 4), \\ &\quad 0.8 \cdot u(4, 2) + 0.1 \cdot u(4, 3) + 0.1 \cdot u(3, 3), \\ &\quad 0.8 \cdot u(3, 3) + 0.1 \cdot u(4, 2) + 0.1 \cdot u(4, 4)\} \\ &= -1 + 0.5 \cdot \max_a \{-0.1, \\ &\quad -0.8 + 1, \\ &\quad 8 - 0.1, \\ &\quad 1\} \\ &= 2.95\end{aligned}$$

Exercise 9.2

(a)



(b)

