

Principles of AI Planning

Prof. Dr. B. Nebel, R. Mattmüller
N. Mayer
Winter Semester 2012/2013

University of Freiburg
Department of Computer Science

Exercise Sheet 6

Due: December 7th, 2012

Exercise 6.1 (Stability of h_{sa} , 4 points)

Show that it is important to test for stability when computing h_{sa} by giving an example where you get an unnecessarily high overestimation when not performing this test.

Show by giving a relaxed planning graph in which the goal node has cardinality v in some layer k , but a strictly smaller cardinality $v' < v$ in the *next* layer $k + 1$.

Exercise 6.2 (Relaxed planning graph and heuristics, 1.5+1.5+1.5+1.5 points)

Once again, consider the (now relaxed) planning task $\Pi^+ = \langle A, I, O, \gamma \rangle$:

$$\begin{aligned} A &= \{\widehat{\text{visible}}, \widehat{\text{visible}}, \widehat{\text{at-party}}, \widehat{\text{at-party}}, \widehat{\text{guests-angry}}, \widehat{\text{guests-angry}}\}, \\ I &= \{\widehat{\text{visible}} \mapsto 1, \widehat{\text{at-party}} \mapsto 1, \widehat{\text{guests-angry}} \mapsto 0 \\ &\quad \widehat{\text{visible}} \mapsto 0, \widehat{\text{at-party}} \mapsto 0, \widehat{\text{guests-angry}} \mapsto 1\} \\ O &= \{\text{toggle-ring}, \text{leave-party}\}, \\ \text{toggle-ring} &= \langle \top, (\widehat{\text{visible}} \triangleright \widehat{\text{visible}}) \wedge (\widehat{\text{visible}} \triangleright \widehat{\text{visible}}) \rangle, \\ \text{leave-party} &= \langle \widehat{\text{at-party}}, \widehat{\text{at-party}} \wedge (\widehat{\text{visible}} \triangleright \widehat{\text{guests-angry}}) \rangle \\ \gamma &= \widehat{\text{at-party}} \wedge \widehat{\text{guests-angry}}. \end{aligned}$$

Solve the following exercises by drawing the relaxed planning graph(s) for the lowest depth k that is necessary to extract a solution. Remember to draw additional layers for **stability checking** where applicable!

- (a) Calculate $h_{\max}(I)$ for Π^+ .
- (b) Calculate $h_{\text{add}}(I)$ for Π^+ .
- (c) Calculate $h_{sa}(I)$ for Π^+ .
- (d) Calculate $h_{FF}(I)$ for Π^+ .

NOTE: You may hand in analog hand-drawn graphs or any reasonable digital variant (PSTricks, PGF, TikZ, {Open, Libre}Office etc) as long as the result a) is PDF and b) doesn't cause spontaneous self-combustion of eyeballs. Please keep it legible and DO NOT SCAN: If you draw on paper, submit on paper.

Note: The exercise sheets may and should be worked on in groups of two students. Please state both names on your solution (this also holds for submissions by e-mail).