Assignment Seven: Planning
Due: 11:59pm, Monday 12 March 2018.

Solution

This can be done in groups of size 1, 2 or 3. Working alone is not recommended. All members of the group need to be able to explain the group’s answer.
Submit your answers in individual files using Canvas. Use proper sentences in your answers.
Ask questions on Canvas discussion board. Feel free to answer them too.

Question One

Write a heuristic for the regression planner that works better than the provided heuristic(s) in the Python distribution. (You can use one of the problem variants from the last assignment, as long as you are clear what the problem this is for). You must provide evidence that this is better.


The way to get a good heuristic is to note that the goal keeps changing (and the state is fixed) during the search. So you should look through the subgoals to see of there is more information you could use. For example 'RHM' = True appears as a subgoal, so let’s construct a heuristic for that; the cost depends on whether the location is also in the goal. I did a couple of these and it improved the search space.

Question Two

Consider the CSP representation of the running planning problem we have been using. Either give the constraint in Python or just give a formula that represents the constraint.

(a) Specify the precondition constraint for the action pum.

Solution

\[
\begin{align*}
Rloc_i='mr' & \leftarrow \text{Action}_i='pum' \\
MW_i=\text{True} & \leftarrow \text{Action}_i='pum'
\end{align*}
\]

(b) Specify the effect constraint for the action pum.

Solution

\[
\begin{align*}
RHM_{i+1}=\text{True} & \leftarrow \text{Action}_i='pum' \\
MW_{i+1}=False & \leftarrow \text{Action}_i='pum'
\end{align*}
\]

(c) Specify the frame constraint for RHC.
**Solution**  For all values $V$:

$$RHC_{i+1}=V \iff RHC_{i+1}=V \land \text{Action}_i \notin \{puc, dc\}$$

(d) Suppose the problem has initial state \{`RLoc` : `lab`, `MW` : True, `SWC` : True, `RHC` : False, `RHM` : False\}, and goal \{`SWC` : False\} and a planning horizon of 3.

i) What is the initial state constraint?

**Solution**  $RLoc_0 = `lab` \land MW_0 = True \land SWC_0 = True \land RHC_0 = False \land RHM_0 = False$

ii) What is the goal constraint?

**Solution**  $SWC_3 = False$

iii) What is a solution found?

**Solution**  There is no solution with a horizon of 3.

(e) What is the smallest planning horizon for which the problem in part (d) has a solution?

**Solution**  5 is the smallest because it takes 5 actions to achieve the goal.

**Question Three**

For each question, specify how long you spend on it, and what you learned. How was the work in the team allocated? Was the question reasonable? (This questions is worth marks, so please do it!)

**Solution**  It should not have taken more than a few hours. Most of this should have been in understanding the material and playing, not in doing busy work. I hope it was reasonable, and you learned something.