

## Assignment Five: Planning

Due: 11:59pm, Monday 26 October 2020.

Solving following problems requires the Python code at

[http://aipython.org/aipython\\_322\\_as5.zip](http://aipython.org/aipython_322_as5.zip) (including planning with STRIPS representation).

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 a pdf file using Canvas. Use proper sentences in your answers.

Ask questions on Canvas discussion board. Feel free to answer them too.

**Question One**

- (a) Change the representation of the delivery robot world [Example 6.1 of the textbook, and `delivery_domain` in `stripsProblem.py` in AIPython] so that the robot cannot carry both mail and coffee at the same time. Test it on an planning problem that gives a different solution than the original representation. Report on both the path found and the size of the space searched (the number of paths expanded and the number of paths remaining on the frontier) for a forward planner for both the original and the modified version for your problem.
- (b) Suppose the robot cannot carry both mail and coffee at the same time, but the robot can carry a box in which it can place objects (so it can carry the box and the box can hold the mail and coffee). Suppose boxes can be picked up and dropped off at any location, but the robot can only pick up a box if it is not carry anything. Give the STRIPS representations for the actions. Test it at least on the problem of starting from the lab with mail waiting, the robot must deliver coffee and the mail to Sam's office.

**Question Two**

In this question, we will investigate heuristics for the forward planner.

- (a) Consider question 1, part (a).
  - i) Are the heuristics provided in the Python code for the original searcher still admissible? Explain why or why not.
  - ii) Define an admissible heuristic function for the modified problem in 1(a) that is an improvement over the provided heuristics. You must give evidence that supports it being an improvement. (Be explicit about what it means to be an improvement.)
  - iii) Is your heuristic for part (ii) admissible for the original problem?
- (b) Consider question 1, part (b).
  - i) Are the heuristics provided in the Python code for the original searcher still admissible? Explain why or why not.
  - ii) Define an admissible heuristic function for the modified problem in 1(b) that is an improvement over the provided heuristics. You must give evidence that supports it being an improvement. (Be explicit about what it means to be an improvement.)
  - iii) Is your heuristic for part (ii) admissible for the original problem?

### **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?