Authors:
Erick Rosete Beas — er165@uni-freiburg.de
Jessica Lizeth Borja Diaz — jb986@uni-freiburg.de

Principles of AI Planning

Exercise Sheet 1

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Exercise 1.2 - State Space Size

The goal is to measure the time required to generate the whole state space if every state generation if generating one state take $1x10^{-6}s$.

Lets summarize the important data and variables:

- Five robotic vacuum cleaner.
- 10x10 discrete cells.
- Each robot is in exactly one cell and several robots can be in the same cell at the same time.
- Each cell is either clean or dirty.
- Each robot has a battery with 20 charge levels

The whole state space will be of the following size:

$$\underbrace{(100^5)}_{\text{robot positions}} * \underbrace{(20^5)}_{\text{charging states}} * \underbrace{(2^{100})}_{\text{cell state (clean or dirty)}} = 4.056 * 10^{46}$$

Creating the whole state space will take

$$4.056 * 10^{46} * 10^{-6}s = 4.056 * 10^{40}s = 1.286 * 10^{33}years$$

Which is far bigger than the age of the universe.

Exercise 1.3 - Planning literature

The questions that we will like to discuss during the course of the lecture are the following:

1. How can we generate an heuristic function of a planning task?

2. During the article it was mentioned that the current model-based approaches like SAT may spend a lot of time solving problems with a big state space size. How does the recent development **SAT-based planning** overcomes this issue? Will this type of planner be included in the lecture?

3. Is there any other model-based approach besides SAT that combined with heuristic functions performs equal or better than SAT-based planning?

4. If not, why is SAT combined with heuristics instead of other model-based approaches?

5. Additionally from Torchlight, has there been any new advances on the field of automatically generating an optimal heuristic function?

6. Is LM-cut heuristic still the state of the art in planners? Will this topic be covered in the course?