Exercise 2.1 (Logic-Based and Reactive Architectures (2 Points))

(a) Consider the vacuum cleaner example in the lecture. How many rules in total would have to be written for the 3 × 3 Grid world? How does this change for a 10 × 10 world? (0.5)

(b) Describe a subsumption architecture solving this same problem. Assume the following definitions:

\[ A = \{\text{Suck, Forward, Turn}\} \]

Full Observability, i.e.: Dirt = 0, 1, \( X = 0, \ldots, n \), \( Y = 0, \ldots, n \), \( \Theta = \{\text{North, South, East, West}\} \) and

\[ P = \text{Dirt} \times X \times Y \times \Theta \]

Give sensible definitions for the behaviors \( b(c, a) \), especially the sets \( c \) and define the inhibition relation. (1.5)

Exercise 2.2 (Behavior networks (1 Point))

Draw a simple behavior network for the vacuum cleaner world as in the CS:Freiburg case study.

The graph should include:

(a) The competence modules

(b) Propositions in the world

(c) The goals

(d) pre-and postconditions connected via edges You can derive propositions, e.g. location\_dirty, informally from the definitions in the previous exercise (i.e. it is ok to describe them in words, if it is clear, that they can be derived).

Exercise 2.3 (Subsumption architecture (2pt, written))

Consider the following grid world.
A robot $S$ need to go to $G$. The black cells are blocked. There are two behaviors.

(a) $B_1$: If forward is blocked, turn left.

(b) $B_2$: Go along the direction toward $G$.

$B_1 \prec B_2$, please draw the trajectory of $S$.

This exercise should be submitted during the lecture on Monday (Nov. 9th)