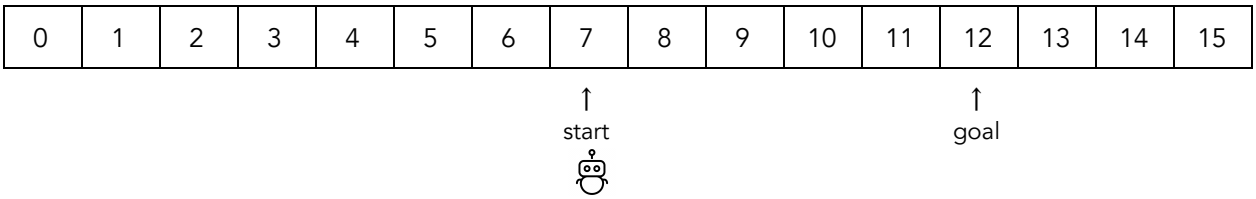
Assignment 5 - Synthesis II

Submission details: Please submit a .py file. Submit via GradeScope. If you have questions on this process, get in touch via the Slack or via email.
Due: 10/5/20

For this assignment, you'll develop a synthesizer in Z3.

In class on Thursday 10/1, we played around with a Z3 program for synthesizing sequences of simple robot motion planning primitives in a 1D environment. Example:



Our in-class robot could move left or right.

Task 1

For this assignment, extend the in-class synthesizer so that the robot has a 2D environment and can move left, right, up, or down. How will you represent the environment?

Examples:

0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

3,0	3,1	3,2	3,3
2,0	2,1	2,2	2,3
1,0	1,1	1,2	1,3
0,0	1,0	2,0	3,0

Task 2

Implement iterative deepening. Your program should first try searching for instruction sequences of length 1, then length 2, and so on.

Task 3

Add obstacles to your environment. When the robot runs an instruction that would move it into a square with an obstacle, it should stay in its original position instead. How will you represent obstacles?

Hint: Remember to build up the constraints on the robot's movements using Z3 constraints instead of normal Python. E.g., You'll want to use `And(x,y)` instead of `x and y`. You'll want to use a bunch of Ands instead of if val in list.

Some Useful Resources
https://ericpony.github.io/z3py-tutorial/guide-examples.htm
https://z3prover.github.io/api/html/namespacez3py.html
Some Fun Resources
https://www.cs.cornell.edu/~asampson/blog/minisynth.html
https://www.mattkeeter.com/projects/synthesis/