# LECTURE 12

#### **RECURSION WITH BACKTRACKING**

MCS 275 Spring 2023 Emily Dumas

#### **LECTURE 12: RECURSION WITH BACKTRACKING**

Reminders and announcements:

- Project 1 due 6pm today.
- Project 2 description will be posted by Monday.
- Project 2 due 6pm on Fri Feb 24.

# PLAN

- Recall backtracking algorithm to solve a maze
- Implement the maze solver
- Experiment with it

#### Algorithm depth\_first\_maze\_solution:

- Input: a maze and a path under consideration (partial progress toward solution).
- 1. If the path is a solution, just return it.
- 2. Otherwise, enumerate possible next steps that don't go backwards.
- 3. For each of the possible next steps:
  - Make a new path by adding this next step to the current one.
  - Make a recursive call to attempt to complete this path to a solution.
  - If recursive call returns a solution, we're **done**. Return it immediately.
  - (If recursive call returns None, continue the loop.)
- 4. If we get to this point, every continuation of the path is a dead end. Return None.

## LET'S WRITE THIS IN PYTHON

depth\_first\_maze\_solution(M,path=None):
Arguments:

- M a Maze object to be solved (read only)
- path a list of Point2 objects

**Returns: Either** 

- List of Point2 objects (solution extending path), or
- None (if no solution exists that extends path)

#### **MAZE COORDINATES**

(0,0)	(1,0)	(2,0)	(3,0)	(4,0)	(5,0)	(6,0)
(0,1)	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)
(0,2)	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)
(0,3)	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)
(0,4)	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)
(0,5)	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)
(0,6)	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)

#### **MAZE COORDINATES**



## **IMAGE SUPPORT**

Class Maze can save an instance as SVG
(.save\_svg(fn)) or PNG(.save\_png(fn)).

The latter requires a module called Pillow we'll discuss later. Can install with:

python3 -m pip install pillow



Same suggested references as Lecture 10.

#### **REVISION HISTORY**

- 2022-02-14 Last year's lecture on this topic finalized
- 2023-02-10 Updated for 2023