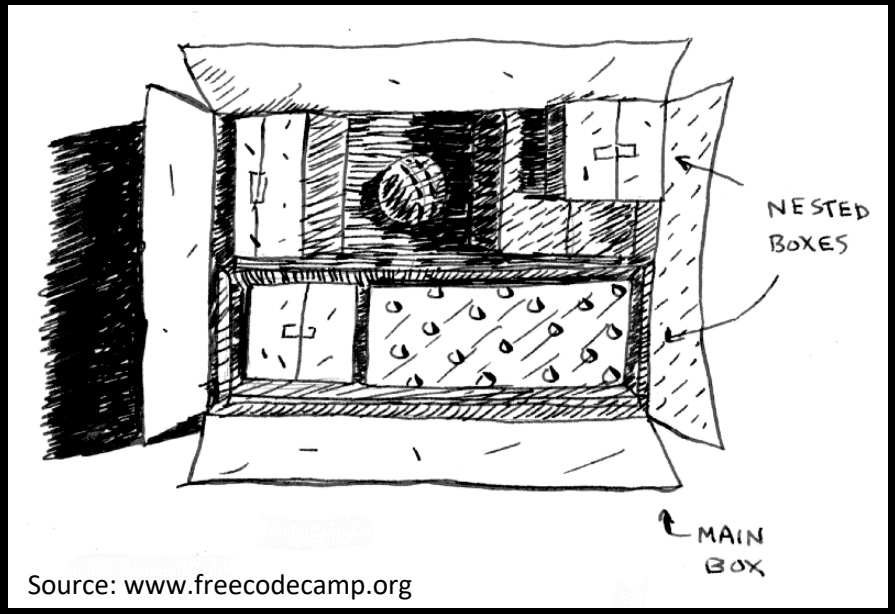
Intro to Computer Science
CS-UH 1001, Spring 2022

Lecture 21: Recursion Lab

Key in a Box Example



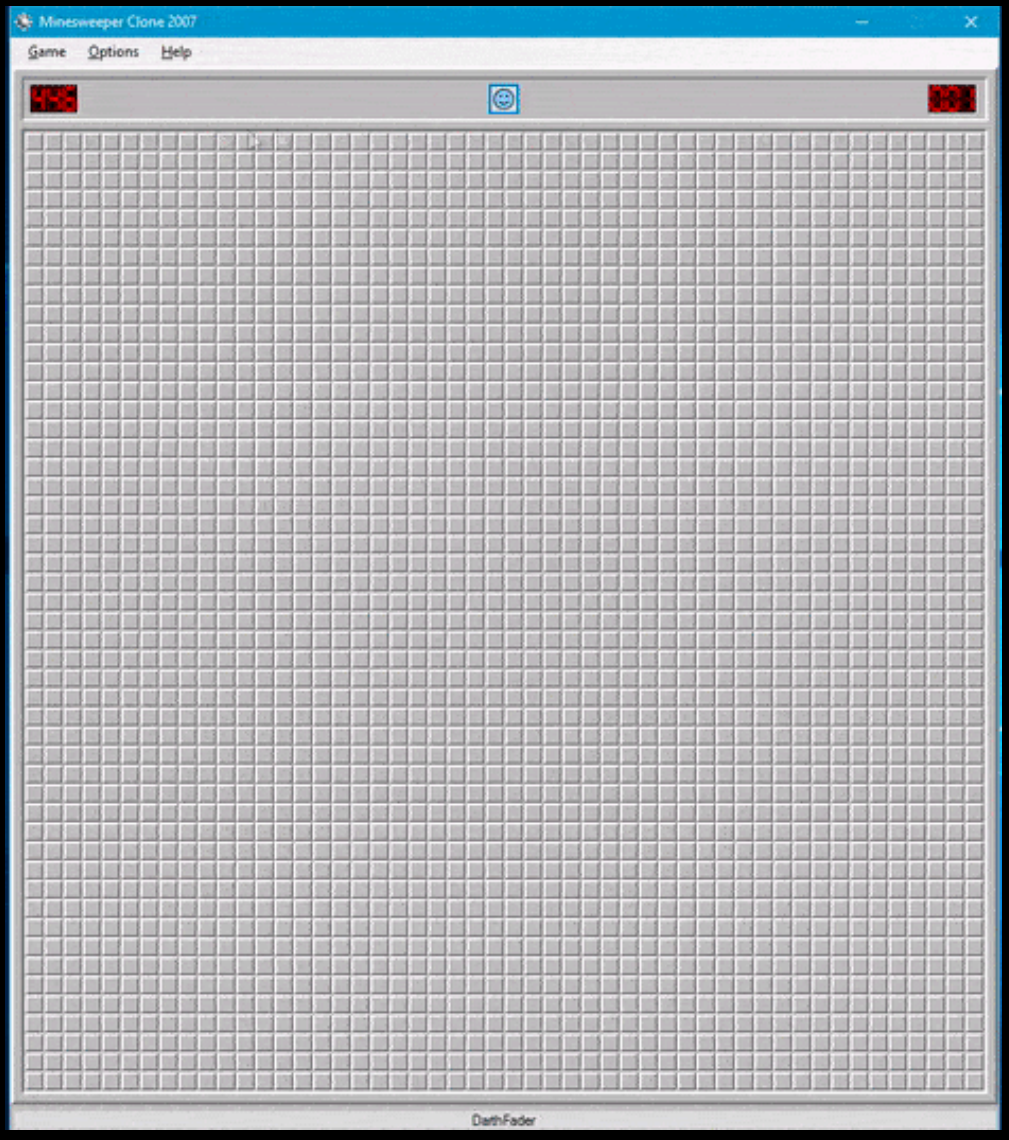
Source: www.freecodecamp.org

- To find the key, you have to make a series of decisions, among various choices, where
  - you don't have enough information to know what to choose
  - each decision leads to a new set of choices
  - some sequence of choices may be the solution – some may not

Recursive Backtracking

- Backtracking is
  - a methodical way of trying out various sequences of decisions, until a solution is found
  - often used to solve problems that require trying out multiple paths
  - examines partial solutions, abandoning unsuitable ones and returning to consider other candidates

- Often used for
  - combinatorial optimization problems
  - solving puzzles, e.g. crossword, sudoku, etc


Minesweeper Clone 2007
Game
Options
Help
DarthFader

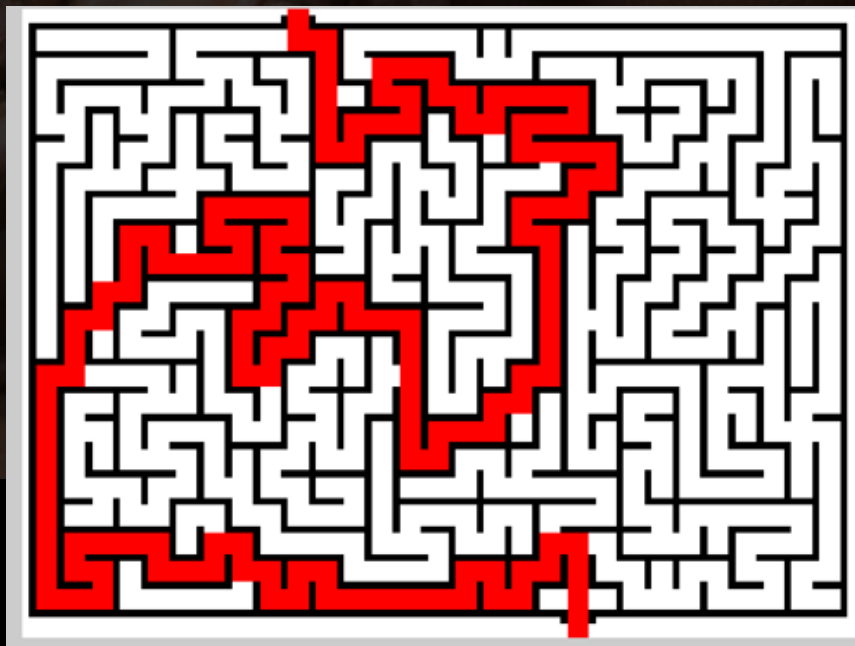
Lab I:
Solving a maze using recursion

Maze (ex_21.1.py)

Create a program that solves mazes through recursion

Use ex_21.1.py from Brightspace

- Find path through maze:
  - Start at beginning of maze
  - If exit is reached, return True
  - Otherwise, explore all neighbors of current location



Lab II:
Solving Sudoku Puzzle using Recursion

Sudoku (ex_21.2.py)

Assume we have the following Sudoku board. Try to solve it recursively

- Use ex_21.2.py from Brightspace

- Solve sudoku recursively:
  - For all open cells, place a number (1-9) and check if is legal
  - If so, move on to the next open cell and place a number
  - If not, try next number

1					7		9	
	3			2				8
		9	6			5		
		5	3			9		
	1			8				2
6					4			
3							1	
	4							7
		7				3		

Solving Sudoku - Brute Force

- A brute force algorithm is a simple and generally inefficient approach
- Trying out all combinations until you find one that works
- Brute force isn't efficient, but computers are fast

When Should Recursion be Used?

- Use recursion if
  - the problem has a tree-like structure
  - the problem requires backtracking
  - solutions/algorithms for a recursive by nature