

CS303E: Elements of Computers and Programming

Lists of Lists

Mike Scott

Department of Computer Science
University of Texas at Austin

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Creating list of lists

Can create list of lists in Python

```
table = [[1, 2], [3, 6], [7,-3], [5, 6]]
```

- Access an element with 2 subscripts.
- By convention first subscript is row and the second is the column

	0	1	
0	1	2	index of column
1	3	6	
2	7	-3	
3	5	6	
			access element with 2 subscripts: table[2][0] -> 7

index of row

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List of Lists

Creating list of lists

Can also use list comprehension

```
table2 = [[0] * 12] * 10
```

A list of lists with 10 rows and 12 columns per row.

```
flips = [['H' if random.random() <= 0.5 else 'T'  
for x in range(12)] for x in range(10)]
```

A table with 10 rows and 12 columns per row.
Each elements is a random coin flip.

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List of Lists

List of Lists Problems

Write a function that returns the index of the row of a list of lists of ints has the largest sum. In the case of a tie return the index closest to 0.

Write a function that returns the index of the **column** of a list of lists of ints has the largest sum. In the case of a tie return the index closest to 0.

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List of Lists

Conway's Game of Life

- a cellular automaton designed by John Conway, a mathematician
- not really a game
- a simulation
- takes place on a 2d grid
- each element of the grid is occupied or empty by a simple organism, but not any known organism

<http://www.cuug.ab.ca/dewara/life/life.html>

- Select pattern from menu
- Select region in large area with mouse by pressing the control key and left click at the same time
- Select the paste button

Generation 0

	0	1	2	3	4	5
0	.	*	.	*	.	*
1	*	.	*	*	*	*
2	.	.	*	*	.	*
3	.	*	*	*	.	*

* indicates occupied, . indicates empty

Or

	0	1	2	3	4	5
0						
1						
2						
3						

Generation 1

	0	1	2	3	4	5
0	.	*	.	*	.	*
1	*
2	*
3	.	*	.	*	.	.

* indicates occupied, . indicates empty

Or, Generation 1

	0	1	2	3	4	5
0						
1						
2						
3						

Rules of the "Game"

If a cell is occupied in this generation.

- it survives if it has 2 or 3 neighbors in this generation
- it dies if it has 0 or 1 neighbors in this generation
- it dies if it has 4 or more neighbors in this generation

If a cell is unoccupied in this generation.

there is a birth if it has exactly 3 neighboring cells that are occupied in this generation

Neighboring cells are up, down, left, right, and diagonal. In general a cell has 8 neighboring cells

Case study

Design and implement a complete Python program to automate Conway's Game of Life

- text based
- user input for size of world
- wrapped or bounded?
- border or not?
- high level design first, **then** implement solution
- test, test, test, test

